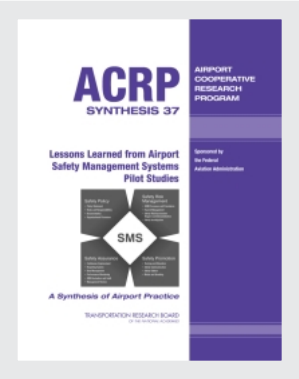

Lessons Learned from Airport Safety Management Systems Pilot Studies

DETAILS

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AUTHORS

Landry, Joanne; Dave Fleet Consulting, LLC; and Hybrid-3 Inc.

AIRPORT COOPERATIVE RESEARCH PROGRAM

ACRP SYNTHESIS 37

Lessons Learned from Airport Safety Management Systems Pilot Studies

A Synthesis of Airport Practice

CONSULTANTS
Joanne Landry
Landry Consultants, LLC
Seattle, Washington

Dave Fleet Consulting, LLC
Indianapolis, Indiana

and

Hybrid-3 Inc.
Indianapolis, Indiana

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AIRPORT COOPERATIVE RESEARCH PROGRAM

Airports are vital national resources. They serve a key role in transportation of people and goods and in regional, national, and international commerce. They are where the nation's aviation system connects with other modes of transportation and where federal responsibility for managing and regulating air traffic operations intersects with the role of state and local governments that own and operate most airports. Research is necessary to solve common operating problems, to adapt appropriate new technologies from other industries, and to introduce innovations into the airport industry. The Airport Cooperative Research Program (ACRP) serves as one of the principal means by which the airport industry can develop innovative near-term solutions to meet demands placed on it.

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The ACRP was authorized in December 2003 as part of the Vision 100-Century of Aviation Reauthorization Act. The primary participants in the ACRP are (1) an independent governing board, the ACRP Oversight Committee (AOC), appointed by the Secretary of the U.S. Department of Transportation with representation from airport operating agencies, other stakeholders, and relevant industry organizations such as the Airports Council International-North America (ACI-NA), the American Association of Airport Executives (AAAE), the National Association of State Aviation Officials (NASAO), Airlines for America (A4A), and the Airport Consultants Council (ACC) as vital links to the airport community; (2) the TRB as program manager and secretariat for the governing board; and (3) the FAA as program sponsor. In October 2005, the FAA executed a contract with the National Academies formally initiating the program.

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Cover figure: The four SMS components, Safety Policy, Safety Risk Management, Safety Assurance, and Safety Promotion. Joanne M. Landry, developed by GSS Creative, Chicago, Illinois

FOREWORD

Airport administrators, engineers, and researchers often face problems for which information already exists, either in documented form or as undocumented experience and practice. This information may be fragmented, scattered, and unevaluated. As a consequence, full knowledge of what has been learned about a problem may not be brought to bear on its solution. Costly research findings may go unused, valuable experience may be overlooked, and due consideration may not be given to recommended practices for solving or alleviating the problem.

There is information on nearly every subject of concern to the airport industry. Much of it derives from research or from the work of practitioners faced with problems in their day-to-day work. To provide a systematic means for assembling and evaluating such useful information and to make it available to the entire airport community, the Airport Cooperative Research Program authorized the Transportation Research Board to undertake a continuing project. This project, ACRP Project 11-03, "Synthesis of Information Related to Airport Practices," searches out and synthesizes useful knowledge from all available sources and prepares concise, documented reports on specific topics. Reports from this endeavor constitute an ACRP report series, *Synthesis of Airport Practice*.

This synthesis series reports on current knowledge and practice, in a compact format, without the detailed directions usually found in handbooks or design manuals. Each report in the series provides a compendium of the best knowledge available on those measures found to be the most successful in resolving specific problems.

PREFACE

By Gail R. Staba
Senior Program Officer
Transportation Research Board

This synthesis study is intended to provide airport operators with data and experience from SMS pilot study airports through survey results, lessons learned, and general findings and trends. The proposed audience is U.S. Part 139 certificated airport operators; however, although intended for Part 139 airports, the results gathered in this synthesis of practice may be helpful to all airports.

The study approach focused on completing a literature review of current SMS industry documentation and conducting interviews with SMS pilot study airport representatives and consultants. Of the 31 participating SMS pilot study airports, 26 airport operators provided information through in-person and telephone interviews.

Joanne Landry, Landry Consultants LLC, Seattle, Washington, collected and synthesized the information and wrote the report. The members of the topic panel are acknowledged on the preceding page. This synthesis is an immediately useful document that records the practices that were acceptable within the limitations of the knowledge available at the time of its preparation. As progress in research and practice continues, new knowledge will be added to that now at hand.

CONTENTS

Note: Many of the photographs, figures, and tables in this report have been converted from color to grayscale for printing. The electronic version of the report (posted on the Web at www.trb.org) retains the color versions.

LESSONS LEARNED FROM AIRPORT SAFETY MANAGEMENT SYSTEMS PILOT STUDIES

SUMMARY

In 2001, the International Civil Aviation Organization (ICAO), an agency of the United Nations with international aviation oversight, adopted a new standard in Annexes 6 (Operation of Aircraft), 11 (Air Traffic Services), and 14 (Aerodromes), requiring that all 192 contracting states establish safety management system (SMS) requirements. According to ICAO, "safety is increasingly viewed as the outcome of the management of certain organizational processes, which have the objective of keeping the safety risks of the consequences of hazards in operational contexts under organizational control. Thus . . . safety is considered to have the following meaning: The state in which the possibility of harm to persons or of property damage is reduced to, and maintained at or below, an acceptable level through a continuing process of hazard identification and safety risk management."

ICAO further clarifies the function of a SMS by stating that "the difference between traditional system safety and present-day safety management is that, because of its engineering roots, system safety focused mostly on the safety implications of technical aspects and components of the system under consideration, somewhat at the expense of the human component. Safety management, on the other hand, builds upon the dogma of system safety (hazard identification and safety risk management), and expands the field of perspective to include Human Factors and human performance as key safety issues during system design and operation." In simple terms, SMS is a proactive business approach to managing and mitigating potential hazards within the organization to improve safety performance.

SMS is comprised of four components (or pillars), including safety policy, safety risk management, safety assurance, and safety promotion. The FAA defines each component as follows:

- **Safety Policy.** Safety policy provides the foundation or framework for the SMS. It outlines the methods and tools for achieving desired safety outcomes. Safety policy also details management's responsibility and accountability for safety.
- **Safety Risk Management.** As a core activity of SMS, safety risk management uses a set of standard processes to proactively identify hazards, analyze and assess potential risks, and design appropriate risk mitigation strategies.
- **Safety Assurance.** Safety assurance is a set of processes that monitor the organization's performance in meeting its current safety standards and objectives as well as contribute to continuous safety improvement. Safety assurance processes include information acquisition, analysis, system assessment, and development of preventive or corrective actions for nonconformance.
- **Safety Promotion.** Safety promotion includes processes and procedures used to create an environment in which safety objectives can be achieved. Safety promotion is essential to create an organization's positive safety culture. Safety culture is characterized by knowledge and understanding of an organization's SMS, effective communications, competency in job responsibilities, ongoing training, and information sharing. Safety promotion elements include training programs, communication of critical safety issues, and confidential reporting systems.

FAA, as one of the 192 ICAO contracting states, indicates in the October 7, 2010, *Notice of Proposed Rulemaking Safety Management Systems for Certificated Airports,* that it "supports conformity of U.S. aviation safety regulations with ICAO standards and recommended practices and intends to meet the intent of the ICAO standard in a way that complements existing airport safety regulations in 14 CFR Part 139." This notice also states: "This action would require each certificate holder to establish a SMS for its entire airfield environment (including movement and non-movement areas) to improve safety at airports hosting air carrier operations." FAA defines SMS as, "a formalized approach to managing safety by developing an organization-wide safety policy, developing formal methods of identifying hazards, analyzing and mitigating risk, developing methods for ensuring continuous safety improvement, and creating organization-wide safety promotion strategies. When systematically applied in a SMS, these activities provide a set of decision-making tools that airport management can use to improve safety."

FAA's approach to assessing the impact of SMS on 14 Code of Federal Regulations Part 139 certificated airports included "developing advisory guidance, researching airport SMS recommended practices, and conducting airport pilot studies." Beginning in April 2007 and concluding in early 2012, FAA provided opportunities for U.S. airports to gain knowledge from and provide information and feedback to FAA by conducting SMS airport pilot studies. To date, 31 airports of various sizes, operations, and regions have participated in four SMS airport pilot studies, including the following:

1. FAA SMS Pilot Study 1—Gap Analysis and SMS Manual and Program Plan Development for Class I, II, III, and IV Airports;
2. FAA SMS Pilot Study 2—Gap Analysis and SMS Manual and Program Plan Development Limited to Class II, III, and IV Airports;
3. FAA SMS Pilot Study 3—SMS Follow-on/Proof-of-Concept Study; and
4. FAA SMS Pilot Study 4—SMS Implementation Study.

This Synthesis study's objective is to provide airport operators with data and experience from SMS pilot study airports through survey results, lessons learned, and general findings and trends. The proposed audience is U.S. Part 139 certificated airport operators; however, while intended for Part 139 airports, the results gathered in this Synthesis of Practice may be helpful to all airports.

The study approach focused on completing a literature review of current SMS industry documentation and conducting interviews with SMS pilot study airport representatives and consultants. Sources for the literature review included FAA, ICAO, the Government Accountability Office, various ACRP resources, Transport Canada, the Australian Government's Civil Aviation Safety Authority, and academic and industry references relating to SMS. The SMS pilot study interviews consisted of on-site or telephone discussions ranging from 30 to 90 min using a 36-question survey tool to address all aspects of the four SMS pilot studies, including program logistics, planning, staffing, and SMS integration and implementation. Of the 31 participating SMS pilot study airports, 26 airport operators responded—an 84% response rate. Airports participants were represented from each of the four studies and from Class I, II, and IV airports (no Class III airports participated in the survey). Throughout this Synthesis study report, de-identified data and findings are presented by airport class to address differences in operational scale and staffing. Definitions of class size are presented in the Glossary of Terms and Acronyms.

A summary of findings and lessons learned from a survey of pilot study airport operators for this Synthesis study are presented here:

- **SMS Pilot Study Program Management.** Program management is the set of structures, tools, activities, and personnel that is employed by airports to realize a fully functional and operational SMS, including a program gap analysis, program plan, and schedule. All airports participating in Pilot Studies 1 and 2 conducted a program gap

analysis to compare their existing Part 139 operations and the four SMS components. Airports used a variety of checklists and templates to determine program gaps. Draft SMS manuals and program plans were then developed as a result of the gap analysis. SMS manuals developed in the first two pilot studies were nearly all revised by airports participating in the following pilot studies (Studies 3 and 4). Modifications were a reflection of the implementation program's use of a theoretical document developed in the first studies. Many airports reduced the initial SMS manual content to align with staff needs and ease of use and others increased the content to include standard operating procedures and detailed processes and procedures.

Key lessons learned relating to SMS pilot study program management include the following:

- Clearly defining the SMS project development documents, such as a program plan and schedule, assists with the airport's ability to design, plan, and deploy the SMS.
- Ensuring adequate or flexible SMS program timelines to conduct a gap analysis (or other business analysis efforts) assists airports in developing program plans.
- Allowing adequate time to design, develop, test, and deploy the SMS manual through the life of the program implementation improves the quality of the manual and associated processes.
- Developing program plans to be flexible supports the airport's SMS implementation timelines and staffing constraints.
- Local airport and U.S. Part 139 experience is a valuable SMS consultant skill in consultant selection in addition to SMS development and deployment expertise.
- Formal SMS guidance, documentation, and information-sharing opportunities support the SMS design and development.
- Collateral duties are the reported norm for current and future SMS staff responsibilities; budget constraints and delayed hiring decisions based on forthcoming FAA rulemaking are cited as the primary reasons new hires are not planned.
- Data collection, analysis, and trending are core functions of SMS and require early planning for adequate budgets to procure or build technological solutions.
- The method to develop and deploy a safety policy statement requires various approval processes depending on the airport management structure. Airport safety policy development includes investigating the proper route and approval function early in the SMS program to ensure adequate time is allocated.

- **SMS Components Design, Development, and Deployment.** As airports developed the four components of the SMS program (safety policy, safety risk management, safety assurance, and safety promotion), a number of references and resources were used. The majority of airports ensured a thorough review of FAA's Advisory Circular (AC) 150/5200-37 regarding SMS implementation for Part 139 airports. The AC, authored in 2007, offered at the time of the initial studies (2007 and 2008) the only formal guidance published by FAA. Airports also reported reviewing the ICAO *Safety Management Manual* as the second most used document to develop the SMS manual and program. All airports surveyed, except one, hired consultants to assist with elements of the SMS studies. Management of the airport staff and the study consultants was most often assigned to a staff member from the airport operations department. All airports reported that the assigned SMS pilot study program manager took on the project management duties as a collateral assignment. Few airports reported hiring new staff to represent the safety (SMS) manager; most airports, again, assigned staff with additional or shared duties to support the SMS program.

  A series of lessons learned for SMS implementation, including aspects of each component, is presented here:

  - Deployment of the safety policy is unique to each airport's internal and external communication paths. Some airports develop a communication plan to roll out the safety policy statement in conjunction with the SMS program.
  - Linking safety policy objectives to measurable goals and metrics provides management the ability to report on SMS program activities and progress.

- Safety risk management is facilitated by the development of various topic-related safety risk assessments (SRAs).
- Airports are conducting SRAs outside the specific context of SMS pilot studies. SRAs are developed and managed by a broad range of personnel with subject matter expertise.
- Expansion of the SMS program to the terminal and landside operations might be considered in addition to the movement and nonmovement areas as the SMS program is being designed and developed.
- Conducting a program audit in Year 1 can be challenging. Performing a program evaluation where incremental milestones have been achieved may be of greater use to management, especially with regard to assessing SMS policy objectives and goals.
- Data collection and use as part of the safety assurance component of the airport SMS is being addressed by airports using fit-for-purpose solutions, such as commercial off-the-shelf software, custom application development, and paper-based systems. Data collection at some airports currently includes, or is planned to include, the landside and terminal areas for continuity of management and reporting.
- Data collection and trending are at the core of safety assurance and data collection solutions vary depending on airport size and SMS program scope.
- Training programs are scalable to each airport and operation, including staff skills development, based on positions and additional duties assigned.
- Staff buy-in and reluctance to change can affect implementation of a SMS; early activities, such as direct communication and training, are documented means to promote SMS.

• **SMS Challenges and Benefits.** Airports participating in the FAA pilot studies found that there were challenges to SMS implementation as well as many benefits. Twenty-four of the 26 airports participating in the Synthesis survey reported they would continue to pursue SMS implementation. Some airports indicated they were waiting for regulatory requirements to start implementation and to assign staff and budgets, but others, especially the 14 airports participating in the final SMS implementation study (Study 4), noted that they were underway and would continue to refine the SMS program in the upcoming year. Many airports also stated that they were allowing for additional time and effort to possibly revise the current SMS program at the time the FAA Rule is finalized.

  Airports reported benefits and challenges including the following lessons learned:

- Airports are awaiting additional resources and forthcoming SMS guidance from FAA.
- Improved communication, increased safety awareness, integration of disparate departments and staff through collective assessment of risk and budgets, and data collection and trending analysis to provide a higher level of awareness are reported as benefits of the SMS pilot studies.

CHAPTER ONE

INTRODUCTION

According to the FAA 2010 *Annual Runway Safety Report,* "the FAA is responsible for the oversight and regulation of the world's most advanced and safest aviation system" and "the FAA is responsible for the largest and most complex National Airspace System in the world" (FAA 2010). FAA cites strong aviation partnerships and collaboration as a foundation on which safety is maintained. A variety of initiatives including advanced technologies, training, human factors, and nonpunitive reporting are currently underway within the United States to improve aviation safety.

The International Civil Aviation Organization (ICAO) Council (of which the United States is a member) adopts standards and provides direction and recommendations for air transportation worldwide. In 2001, ICAO introduced *Standards and Recommended Practices for Aerodrome Safety Management,* and in November 2005, ICAO amended Annex 14, Volume I (*Aerodrome Design and Operations*) to require contracting states to establish a safety management system (SMS). According to FAA's Notice of Proposed Rulemaking (NPRM), [it] "supports conformity of U.S. aviation safety regulations with ICAO standards and recommended practices. The agency intends to meet the intent of the ICAO standard in a way that complements existing airport safety regulations in 14 CFR Part 139" (FAA 2010).

Consequently, the United States, as a contracting state within ICAO, initiated SMS rulemaking efforts for certificated airports under 14 CFR Part 139. In September 2008, FAA mandated SMS development within its own lines of business, including the Air Traffic Organization, Office of Aviation Safety, and Office of Airports through FAA Order 8000.369, *Safety Management System Guidance.*

SAFETY MANAGEMENT SYSTEM DEFINED

As described in the Advisory Circular (AC) 150/5200-37, SMS is the formal, top-down business-like approach to managing safety risk (FAA 2007). It includes systematic procedures, practices, and policies for the management of safety (including safety policy, safety risk management, safety assurance, and safety promotion). More specifically, a SMS program is a systematic, comprehensive process for managing safety risks. The SMS sets goals, implements policies, develops processes, and tracks and measures performance. It concerns itself with organizational safety rather than strictly conventional health and safety issues at work. SMS defines how an airport intends to manage safety as an integral part of its business management activities. The functional result of a SMS is to proactively manage risk, detect and correct safety problems before those problems result in an accident or incident, and reduce the impact and cost of incidents (FAA 2007).

According to ICAO,

> an SMS can be likened to a toolbox that contains the tools that an aviation organization needs in order to be able to control the safety risks of the consequences of the hazards it must face during the delivery of the services for which the organization is in business. It is important to acknowledge that an SMS itself is neither a tool nor a process. An SMS is the toolbox, where the actual tools employed to conduct the two basic safety management processes (hazard identification and Safety Risk Management) are contained and protected. What an SMS does for an organization is to provide a toolbox that is appropriate, in size and complexity, to the size and complexity of the organization (ICAO 2009).

ICAO further explains that

> an SMS aims to make continuous improvements to the overall level of safety of an organization. An SMS is a constant, never-ending operation that aims at maintaining and, if possible, improving safety levels that are commensurate with the organization's strategic objectives and supporting core business functions. In this sense, an SMS is profoundly different from the traditional notion of accident investigation, which waited for an accident to occur, then extracted and distributed as many safety lessons as possible learned from the investigation in order to prevent similar accidents. An SMS actively looks for hazards, continuously assesses safety risks, to contain them before they result in an accident (ICAO 2009).

SMS is comprised of four key components (described as pillars in ICAO documentation): safety policy, safety risk management, safety assurance, and safety promotion. A brief overview of the four SMS components is presented here.

Safety Policy

FAA states in the 2010 NPRM that "Safety Policy provides the foundation or framework for the SMS. It outlines the methods and tools for achieving desired safety outcomes. Safety Policy also details management's responsibility and accountability for safety" (FAA 2010). Fundamentally the safety policy serves as the overarching guide to the SMS and

includes the development of the oversight and objectives of the SMS program, including top management's commitment to safety for staff. Policy also includes roles and responsibilities for the safety manager and accountable executive and other collateral duties performed by staff, as well as a definition of duties for safety committees and their participants.

Safety Risk Management

FAA defines safety risk management (SRM) as "a core activity of SMS. SRM uses a set of standard processes to proactively identify hazards, analyze and assess potential risks, and design appropriate risk mitigation strategies" (FAA 2010). At the core of a SMS is the ability to collect information on hazards, identify and quantify the associated risks through severity and likelihood, and determine the corrective action (if any). Risk analysis may be conducted by a variety of subject matter experts who weigh in on the potential risk scenarios, typically using an organizationally developed risk matrix. Either individually or as a group, risks are ranked and recorded for resolution, monitoring, and reporting.

Safety Assurance

FAA defines safety assurance as "a set of processes that monitor the organization's performance in meeting its current safety standards and objectives as well as contribute to continuous safety improvement. Safety assurance processes include information acquisition, analysis, system assessment, and development of preventive or corrective actions for nonconformance" (FAA 2010). Safety assurance essentially serves as a checks-and-balances system to ensure that SMS processes and procedures and risk mitigation strategies are having their intended effect.

Safety Promotion

According to FAA, "safety promotion includes processes and procedures used to create an environment where safety objectives can be achieved. Safety promotion is essential to create an organization's positive safety culture. Safety culture is characterized by knowledge and understanding of an organization's SMS, effective communications, competency in job responsibilities, ongoing training, and information sharing" (FAA 2010). A successful SMS includes a structured method to communicate safety-related information to staff and tenants. This communication can take on multiple forms, such as posters, meetings, alerts, safety fairs, safety exhibits, and so forth.

According to ICAO, the two SMS core components of safety risk and safely assurance

> take place under the umbrella provided by Safety Policy and objectives and are supported by safety promotion. These two components [Safety Risk and Safely Assurance] of an SMS encompass the necessary organizational arrangements without which hazard identification and Safety Risk Management would be impossible, or seriously flawed. It can therefore be considered that Safety Risk Management and Safety Assurance are the actual "doing" of SMS; they are the operational activities underlying a performing SMS. Safety policies and objectives and safety promotion, on the other hand, provide the frame of reference as well as the support that allow the operational activities underlying Safety Risk Management and Safety Assurance to be effectively conducted (ICAO 2009).

RULEMAKING AND SAFETY MANAGEMENT SYSTEM PILOT STUDY ACTIVITIES

In February of 2007, FAA initiated a rulemaking action to consider an amendment to Part 139, Certification of Airports, as well as AC 150/5200-37 entitled *Introduction to Safety Management Systems for Airport Operators*. The proposed rulemaking requires certificated airports to implement a SMS consistent with the ICAO Annex 14 requirement. The NPRM further states that

> In a new §139.402, the FAA would require each airport SMS to include the four SMS components: Safety Policy, SRM, Safety Assurance, and Safety Promotion. To support each of these components, the FAA proposes a certificate holder implement a number of elements. Together the components and elements provide the general framework for an organization-wide safety management approach to airport operations. To make these components and elements effective, a certificate holder would develop processes and procedures appropriate to the airport's operating environment. The FAA understands that a certificate holder could comply with these requirements through a variety of means (FAA 2010).

To gain specific insight and information relating to the integration of SMS into the broad range of Part 139 certificated airports throughout the United States., FAA launched a series of SMS pilot studies commencing in 2007 and concluding in early 2012. A total of 31 airports of varying size, location, and operations participated in four individual SMS pilot studies since 2007 (see Table 2 for details regarding airport participation). The FAA initiated the first SMS pilot study in 2007, which focused on (*a*) conducting a gap analysis to assess SMS integration into the airport's Part 139 operations and (*b*) developing a draft and final SMS manual and SMS program plan. Grant funds were made available to 20 airports and 22 airports participated in the study. The first SMS pilot study was completed in 2008. FAA noted that this initial SMS pilot study was dominated by Class I airports, and in mid-2008 a second SMS pilot study was launched and limited to Class II, III, and IV airports; a total of nine airports participated. The second SMS pilot study was completed in 2010. In addition to the second round of SMS pilot studies, FAA invited three airports to conduct a follow-on/proof-of-concept study to "prove out" a series of tasks and SMS projects to gain a better understanding of the complexities and interoperability of the SMS program and Part 139 airports. The follow-on SMS study, including three airport participants, was completed in early

2010. Finally, FAA offered a SMS implementation study in later 2010 to airports who participated in any of the prior SMS pilot studies. A total of 14 airports participated in the SMS implementation study and all programs were scheduled to be completed in early 2012. Detailed information for each of the studies is presented in Appendix C.

SAFETY MANAGEMENT SYSTEM PILOT STUDY FINDINGS AND DOCUMENTATION

To date, limited documentation of specific, compiled, or trended results associated with the SMS pilot studies is available. In October 2008, a presentation by FAA was delivered at the AAAE/MITRE/ACI-NA Safety Management Systems for Airports Conference in Baltimore, Maryland. The presentation provided a summary of findings from the first SMS pilot study; however, no formal data analysis was conducted and the report focused on key trends collected from the participating airports. In May 2011, the FAA released the *Technical Report on Airport Safety Management Systems* (*SMS*) *Pilot Studies* (FAA 2011), which included a compiled summary of written surveys and interviews with 25 of the SMS pilot study airports. The document provided few summaries or trends and focused on compiling interview responses from airport representatives. In early June 2011, FAA posted a number of SMS pilot study airport documents to the Federal Docket Management System (Docket) and subsequently to the FAA's SMS for implementations website. The documents included gap analyses and checklists, SMS manuals, and other relevant resources considered useful to airport operators as a reference library.

On October 7, 2010, FAA released the NPRM Safety Management System for Certificated Airports (75 FR 62008) and, as such, requested comments from industry and airport operators through the Federal Docket Management System. Comments were initially due on or before January 5, 2011. The date was revised first to March 7, 2011, and extended a second time to July 5, 2011. In addition to NPRM comments, FAA requested formal submittal of clarifying questions to be delivered to the Docket by April 6, 2011.

Responses to the clarifying questions were published on May 21, 2011. The timeline presented in Figure 1 provides a summary of key dates and SMS pilot study durations. The timeline end date coincides with the end of FAA's SMS implementation study in early 2012.

SYNTHESIS STUDY APPROACH AND OBJECTIVES

The objective of this ACRP Synthesis study is to provide a structured report of findings from the 31 airports that participated in the FAA's SMS pilot studies (SMS studies) to present airports' experiences and lessons learned. Although intended for certificated (Part 139) airports, the results may be helpful to all airports.

This report is comprised of eight chapters:

Chapter One—Introduction,
Chapter Two—Safety Management System Pilot Study Program Management,
Chapter Three—Safety Management System and Safety Policy,
Chapter Four—Safety Management System and Safety Risk Management,
Chapter Five—Safety Management System and Safety Assurance,
Chapter Six—Safety Management System and Safety Promotion,
Chapter Seven—Safety Management System Challenges and Benefits, and
Chapter Eight—Conclusions.

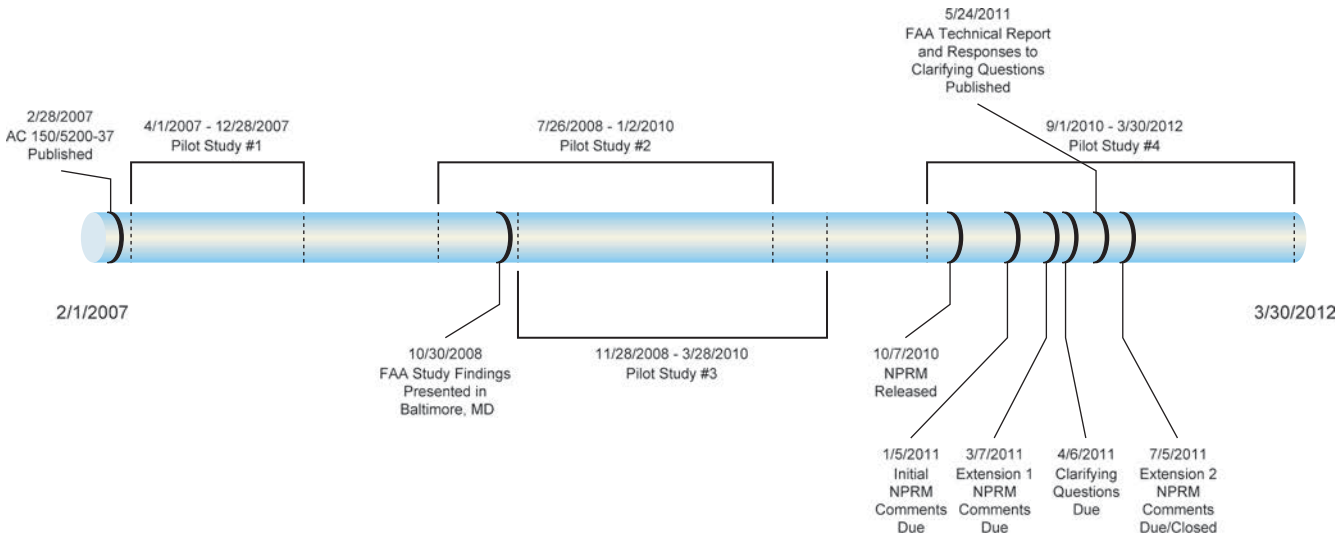

FIGURE 1 SMS pilot study timeline.

The approach to data collection included development of an interview preparation document including a description of the synthesis objectives and a questionnaire comprised of 36 questions (see Appendix B). It was concluded that using an online or written survey instrument for the study would limit the project findings and constrain the ability to ask for clarification or discuss specific aspects of the responses. The preparation document was sent to all 31 SMS pilot study implementations by e-mail and included a schedule of available interview times and dates. Airport representatives confirmed availability and sessions were scheduled accordingly. All interviews were conducted by a minimum of two study members to facilitate the interview process; one posed the questions and the other captured interview notes electronically. All notes were consolidated into a master database, standardized, de-identified, sorted, and trended and are presented in this document. Of the total 31 airports in the survey group, 26 were interviewed either by phone or in person, resulting in an 84% response rate. Table 1 provides a summary of Synthesis surveys and interviews by each SMS pilot study airport representative and by class size.

Table 2 provides a detailed list of airports that participated in the FAA SMS studies, including a cross-referenced indication of which airports were interviewed as part of the Synthesis study. To support the interviews conducted, a focused literature search was performed using various industry, Internet, and publication resources. Source documents focused largely on U.S. resources to ensure that a Part 139 perspective and relevance were maintained. The literature search included a review of implementation SMS-related documents available on the FAA's public website.

Although not a part of the FAA studies, three Canadian airports were interviewed (all Class I equivalents) using the same set of questions to guide the discussion. The Canadian airports were selected based on size, location, and SMS implementation status. In 2005, Transport Canada, which certifies and regulates all airports in Canada, initiated an aviation-wide SMS program. Certain airports (with a certificate issued under Section 302.03) began implementation in 2008 and are in the final phases of SMS implementation. Because U.S. airports are in the early stages of implementation, the Canadian airport perspective (albeit a small survey group) was considered useful to provide a more thorough analysis of later stages within the implementation process. A summary of findings from Canadian interviews is presented in Appendix A. Canadian survey results are not included in the U.S. airport findings to ensure that an accurate reflection of SMS pilot study airport responses is presented.

LITERATURE AND DATA SEARCH

In the early stages of the SMS pilot study programs, few SMS resources were available to U.S. implementations; however, in the past 4 years a number of key documents have been authored, updated, and published to assist airports in developing a SMS program. As part of the Synthesis study interviews, airports were asked to provide a list of documents used to develop their SMS. The list of documents and links are presented in Table 3 and sorted alphabetically by organization or agency. Additional industry resources were included to supplement the surveyed list of references. Additional information regarding an airport's reported most useful document is located in chapter two and a formal bibliography and list of references are provided.

An additional set of resources available to airports developing their SMS program includes a series of documents provided by SMS pilot study implementations to the FAA as part of their SMS pilot study deliverables. The types of documents submitted

TABLE 1
SMS PILOT STUDY AIRPORTS PARTICIPATING IN SYNTHESIS STUDY SURVEYS

Description—Airports Surveyed by SMS Pilot Study		Percentage Surveyed	Yes	No	Total in Study
Surveys	Study 1 Airports Surveyed	90	20	2	22
	Study 2 Airports Surveyed	66	6	3	9
	Study 3 Airports Surveyed	100	3	0	3
	Study 4 Airports Surveyed	100	14	0	14
	Total of Study Airports Surveyed	84	26	5	31
Description—Airports Surveyed by Class Size		Percentage Surveyed	Yes	No	Total in Study
Surveys	Class I Airports Surveyed	90	18	2	20
	Class II Airports Surveyed	100	3	0	3
	Class III Airports Surveyed	0	0	2	2
	Class IV Airports Surveyed	83	5	1	6
	Total of Class Size Airports Surveyed	84	26	5	31

TABLE 2
AIRPORT SMS PILOT STUDY LIST OF AIRPORTS AND INTERVIEW STATUS

No.	Airports in Pilot Studies	Airport ID	Service Level	Class	State	Study 1	Study 2	Study 3 Follow on	Study 4 Implementation	Interviewed
1.	Atlanta—Hartsfield Atlanta International	ATL	Large Hub	Class I	GA	X			X	Yes
2.	Austin–Bergstrom International	AUS	Medium Hub	Class I	TX	X				No
3.	Baltimore–Washington International	BWI	Large Hub	Class I	MD	X				Yes
4.	Boeing Field	BFI	Non-Hub	Class II	WA		X			Yes
5.	Cheyenne Regional	CYS	Non-Hub	Class II	WY		X		X	Yes
6.	Concord Regional	JQF	Reliever	Class IV	NC	X		X		Yes
7.	Dallas/Fort Worth International	DFW	Large Hub	Class I	TX	X			X	Yes
8.	Daytona Beach	DAB	Non-Hub	Class I	FL	X				Yes
9.	Detroit Metro–Wayne County	DET	Large Hub	Class I	MI	X				Yes
10.	Dubuque Regional	DBQ	Non-Hub	Class I	IA	X			X	Yes
11.	Fort Worth Alliance	AFW	Reliever	Class IV	TX		X			Yes
12.	Indianapolis International	IND	Medium Hub	Class I	IN	X			X	Yes
13.	Jackson Municipal	JAN	Small Hub	Class I	MS	X				Yes
14.	Jacksonville International	JAX	Medium Hub	Class I	FL	X			X	Yes
15.	Kona International at Keahole	KOA	Small Hub	Class I	HI	X				Yes
16.	Lexington—Blue Grass	LEX	Small Hub	Class I	KY	X				Yes
17.	North Las Vegas	VGT	Non-Hub	Class III	NV		X			No
18.	Ohio State University	OSU	Reliever	Class IV	OH		X		X	Yes
19.	Pittsburgh–Allegheny County	PIT	Medium Hub	Class I	PA	X			X	Yes
20.	Sacramento International	SAC	Medium Hub	Class I	CA	X				Yes
21.	San Antonio International	SAT	Medium Hub	Class I	TX	X			X	Yes
22.	Santa Maria Public	SMX	Non-Hub	Class I	CA	X				No
23.	Seattle–Tacoma International	SEA	Large Hub	Class I	WA	X		X	X	Yes
24.	Show Low Regional	SOW	Non-Primary	Class III	AZ		X			No
25.	Sloulin Field	ISN	Non-Hub	Class II	ND		X			Yes
26.	South Bend Regional	SBN	Non-Hub	Class I	IN	X		X	X	Yes
27.	Southern Illinois–Carbondale	MDH	GA	Class IV	IL	X			X	Yes

(*continued on next page*)

TABLE 2
(*continued*)

No.	Airports in Pilot Studies	Airport ID	Service Level	Class	State	Study 1	Study 2	Study 3 Follow on	Study 4 Implementation	Interviewed
28.	*Talladega Municipal	ASN	GA	NA	AL		X			Yes
29.	Tallahassee Regional	TLH	Small	Class I	FL	X			X	Yes
30.	Teterboro	TEB	Reliever	Class IV	NY		X			No
31.	Toledo Express	TOL	Non-Hub	Class I	OH	X			X	Yes
	Total Airport Count (By Study)					22	9	3	14	

*Note: Talladega Municipal is no longer a Part 139 Class IV Certificated Airport; however, Synthesis study survey results are compiled with other Class IV airports.

SMS Pilot Study Key	
Study 1—All Class Size Gap, Program Plan, and SMS Manual	Study 3—Follow-on/Proof of Concept
Study 2—Limited to Class II, III, and IV Gap, Program Plan, and SMS Manual	Study 4—Implementation

TABLE 3
SMS RESOURCES

No.	SMS Documents/Resources/References	Organization/Agency	Link or ISBN
1.	SMS Webinar, Presentations, Meetings	Airport Consultants Council	http://www.acconline.org
2.	Report 1, Safety Management Systems for Airports	ACRP	http://www.trb.org/Publications/Blurbs/159030.aspx
3.	Report 1, Safety Management Systems for Airports, Volume 2: Guidebook	ACRP	http://www.trb.org/Publications/Blurbs/162491.aspx
4.	Various Meetings, Presentations, Seminars, Webinars, Papers regarding SMS	Airports Council International–North America	http://aci-na.org/
5.	Various Meetings, Presentations, Seminars, Webinars, Papers regarding SMS	American Association of Airport Executives	http://www.aaae.org/
6.	Safety Management Systems Website (Various Resources)	Australian Civil Aviation Safety Authority	http://www.casa.gov.au/scripts/nc.dll?WCMS:STANDARD::pc=PC_91430
7.	Bangalore SMS Manual	Bangalore International Airport	http://fsfi.avia.ru/sem/subp/A.2.9BIALSMSManualEngl.pdf
8.	Implementing Safety Management Systems in Aviation	Burlington, VT: Ashgate. Stolzer, A.J., Halford, C.D., and Goglia, J.J. (2011)	ISBN: 978-1-4094-0165-0
9.	Safety Management Systems in Aviation	Burlington, VT: Ashgate. Stolzer, A.J., Halford, C.D., and Goglia, J.J. (2008)	ISBN: 978-0-7546-7304-0
10.	Documents from Multiple Canadian Airports	Canadian Airport Council	http://www.cacairports.ca/english/
11.	AC 150/5200-37, Introduction to Safety Management Systems for Airport Operators	FAA	http://www.faa.gov/airports/resources/advisory_circulars/index.cfm/go/document.current/documentNumber/150_5200-37
12.	FAA Order 5200.11, FAA Airports (ARP) Safety Management System	FAA	http://www.faa.gov/regulations_policies/orders_notices/index.cfm/go/document.current/documentNumber/5200.11
13.	FAA Order 8000.369, Safety Management System Guidance	FAA	http://www.faa.gov/regulations_policies/orders_notices/index.cfm/go/document.current/documentNumber/8000.369
14.	FAA SMS Website (Various Resources)	FAA	http://www.faa.gov/airports/airport_safety/safety_management_systems/

TABLE 3
(*continued*)

No.	SMS Documents/Resources/References	Organization/Agency	Link or ISBN
15.	FAA Notice of Proposed Rulemaking, 14 CFR Parts 139 Safety Management Systems for Certificated Airports	FAA	http://www.gpo.gov/fdsys/pkg/FR-2010-10-07/pdf/2010-25338.pdf
16.	AC No 120-92 Introduction to Safety Management Systems for Air Operators	FAA	http://rgl.faa.gov/Regulatory_and_Guidance_Library/rgAdvisoryCircular.nsf/0/6485143d5ec81aae8625719b0055c9e5/$FILE/AC%20120-92.pdf
17.	Digest November-December 2005 Unlocking the Potential of a Safety Management System	Flight Safety Foundation	http://flightsafety.org/fsd/fsd_nov-dec05.pdf
18.	International Air Transportation Association (IATA) Safety Training Courses	IATA	http://www.iata.org/training/pages/safety.aspx
19.	Safety Management Manual (SMM) Document 9859	ICAO	http://www.icao.int/anb/safetymanagement/Documents.html
20.	Managing the Risks of Organizational Accidents Human Error	James Reason	Various book vendors
21.	Corporate Safety Plan	Nav Canada	http://www.navcanada.ca/ContentDefinitionFiles/Publications/CorpPublications/AdditionalPublications/SafetyPlan2010_2011_en.pdf
22.	Fault Tree Handbook (NUREG-0492) (Chapter 1)	Nuclear Regulatory Agency's	http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr0492/
23.	Voluntary Protection Program (VPP)	Occupational Safety & Health Administration	http://www.osha.gov/dcsp/vpp/
24.	SMS for Airports Web Site	Transport Canada	http://www.tc.gc.ca/eng/civilaviation/standards/sms-menu-618.htm
25.	The Army Safety Program—Regulation 385–10	U.S. Department of the Army	http://www.apd.army.mil/pdffiles/r385_10.pdf
26.	SMS Training Courses and Associated Manual	University of Southern California Viterbi School of Engineering	http://viterbi.usc.edu/aviation/courses/sms-mgr.htm

are presented in Table 3 and are available on the FAA's SMS for implementations website at the following address: http://www.faa.gov/airports/airport_safety/safety_management_systems/external/pilot_studies/documentation/.

The collected documents include SMS manuals, program plans, risk definitions and matrices, gap and audit checklists, safety policies, staff roles and responsibilities, data collection strategies, legal references, and other relevant information developed from various airports. These shared resources provide SMS or program managers with samples of existing document formats, contents, and approaches. Table 4 includes service level and airport operating certificate class information for added reference and scalability of SMS program information collected.

Of the 26 airports interviewed, three distinct groups were identified through interviews and analysis:

1. Airports that participated in the first, second, or third SMS pilot study and are implementing SMS within the SMS implementation study (14 airports);
2. Airports that participated in the first, second, or third SMS pilot study and are implementing SMS outside of the SMS implementation study (five airports); and
3. Airports that participated in the first, second, or third SMS pilot studies and are not implementing SMS (seven airports).

Groups 1 and 2 are collectively referred to as "implementation airports" and Group 3 is presented throughout this document as "nonimplementation airports."

All implementation SMS pilot study participants (with the exception of one nonfunded airport that had a preexisting SMS program in place) conducted a gap analysis and developed a SMS manual; therefore, the questions relating to the gap analysis and SMS manual and program plan development reflect both the implementation and nonimplementation airport responses. Because the Synthesis study questions focused on implementation efforts, nonimplementation airports (seven) were unable to provide responses. In these cases, the Synthesis survey results focus solely on implementation airports as defined previously.

TABLE 4
AIRPORTS' CONTRIBUTION OF SMS DOCUMENTATION TO FAA

Airport	State	Service Level	Class	Study	Documents Provided by Airport
Austin–Bergstrom International	TX	Medium Hub	Class I	Study 1	▪ SMS Statement of Work ▪ Gap Analysis ▪ Draft SMS Manual ▪ SMS Manual ▪ Safety Risk Management Training Presentation ▪ Safety Risk Management Decision report template
Baltimore–Washington International	MD	Large Hub	Class I	Study 1	▪ SMS Manual
Boeing Field	WA	Non-Hub	Class II	Study 2	▪ SMS Manual
Cheyenne Regional	WY	Non-Hub	Class II	Study 2 Study 4	▪ Draft Risk Matrix Definition ▪ Draft Risk Analysis and Assessment Guidance ▪ Safety Risk Management Process
Concord Regional	NC	Reliever	Class IV	Study 1 Study 3	▪ SMS Implementation Plan ▪ Gap Analysis ▪ Draft SMS Manual ▪ SMS Manual ▪ Management Commitment (Safety Policy)
Dallas/Fort Worth International	TX	Large Hub	Class I	Study 1 Study 4	▪ SMS Statement of Work
Detroit Metro–Wayne County	MI	Large Hub	Class I	Study 1	▪ Gap Analysis ▪ SMS Manual
Dubuque Regional	IA	Non-Hub	Class I	Study 1 Study 4	▪ SMS Manual Volume 1 ▪ SMS Manual Volume 2
Fort Worth Alliance	TX	Reliever	Class IV	Study 2	▪ SMS Gap Analysis
Jacksonville International	FL	Medium Hub	Class I	Study 1 Study 4	▪ Gap Analysis ▪ SMS Implementation Study ▪ SMS Manual
Kona International at Keahole	HI	Small Hub	Class I	Study 1	▪ Gap Analysis ▪ SMS Management Plan ▪ SMS Manual
Sacramento International	CA	Medium Hub	Class I	Study 1	▪ Gap Analysis ▪ Gap Analysis Matrix ▪ Injury and Illness Prevention Plan
San Antonio International	TX	Medium Hub	Class I	Study 1 Study 4	▪ Draft SMS Manual
Santa Maria Public	CA	Non-Hub	Class I	Study 1	▪ Gap Analysis ▪ SMS Draft Management Plan ▪ SMS Manual
Seattle–Tacoma International	WA	Large Hub	Class I	Study 1 Study 3 Study 4	▪ SMS Assurance Plan ▪ SMS Data Collection and System Review ▪ SMS Minimum Standards ▪ Nonpunitive Program and Legal Authority ▪ SMS Roles and Responsibilities ▪ Safety Policy Guide ▪ SMS Self-Inspection Program ▪ SMS Training and Orientation
South Bend Regional	IN	Non-Hub	Class I	Study 1 Study 3 Study 4	▪ SMS Monthly Progress Reports ▪ Safety Risk Assessment Report ▪ Safety Risk Assessment Documentation
Southern Illinois	IL	General Aviation	Class IV	Study 1 Study 4	▪ Gap Analysis ▪ SMS Risk Matrix ▪ SMS Manual ▪ Safety Risk Assessment
Talladega Municipal	AL	General Aviation	NA	Study 2	▪ Gap Analysis ▪ SMS Manual

Source:
http://www.faa.gov/airports/airport_safety/safety_management_systems/external/pilot_studies/documentation/, Extracted 04-01-2012.

SMS Pilot Study Key	
Study 1—All Class Size Gap, Program Plan, and SMS Manual	Study 3—Follow-on/Proof-of-Concept
Study 2—Limited to Class II, III, and IV Gap, Program Plan, and SMS Manual	Study 4—Implementation

CHAPTER TWO

SAFETY MANAGEMENT SYSTEM PILOT STUDY PROGRAM MANAGEMENT

BACKGROUND

Once fully implemented, SMS is an operational system. However, there is a significant amount of planning and activity required to bring SMS from inception to normal operations. Program management is the set of structures, tools, activities, and personnel that is employed by airports to realize a fully functional and operational SMS.

The program plan documents all aspects required to implement and operate a SMS. The plan incorporates overall scope, tasks, and dependencies and creates a basis for schedule, staffing, and budget. The program plan may be effectively used to set and manage stakeholder expectations. ICAO refers to the program plan as an implementation plan.

The program schedule uses the information defined in the program plan to set specific and traceable deadlines, milestones, dependencies, and completion dates for SMS tasks. The budget defines cost estimates for SMS implementation and operations and the mechanisms by which those costs will be supported.

Organizational structures, staffing, and program management are developed in conjunction with the program plan and can define team members and the roles and responsibilities, including the use of consultants, that will be necessary to implement and operate a SMS, including that of the SMS program manager, who is responsible for the coordination and completion of all SMS implementation activities and who may or may not be the airport's assigned safety manager. In this context, the safety manager was regarded as specific to SMS. There may be multiple airport safety managers at airports who are not involved in SMS but, rather, supervise and manage other, non-airside safety activities such as Occupational Safety and Health Administration compliance.

FAA SMS Pilot Studies 1 and 2 required participating airports to develop a program plan, Study 3 required airports to revise program plans accordingly, and Study 4 required airports to create a study plan. All such deliverables will be collectively referred to as program plans for the remainder of the report. Other program management elements such as status reporting were required from participating SMS pilot study airports through a series of FAA-defined deliverables.

CHAPTER CONTENTS

This chapter presents interview respondent findings, analysis, and lessons learned relating to the SMS program management, analysis, design, and development aspects of the airport's efforts including:

- Gap analysis process and report,
- SMS manual development,
- Program plan and schedule development,
- Consultant services,
- Reference documents,
- Organizational structures and program management, and
- Budget.

FINDINGS AND ANALYSIS

Gap Analysis Process and Report

As described in chapter one, Study 1 was conducted between 2007 and 2008 (Study 1 included all class types of airports) and Study 2 spanned from 2008 to early 2010 (Study 2 was limited to Class II, III, and IV airports). For many airports that participated in Study 4, the initial documentation developed during Study 1 or 2 had been shelved; however, the documentation was revisited, as required, during the implementation study. To determine whether the initial studies were useful in implementing the SMS, a number of questions were posed to airports regarding the gap analysis, SMS manual, and program plan deliverables developed in the first studies.

A gap analysis, as stated in the *ACRP Report 1: Safety Management Systems for Airports, Volume 2: Guidebook* (hereafter referred to as the ACRP Guidebook), "is intended to identify the processes already existing in your airport, compare what you have against the requirements established by the pillars [components] and elements of the SMS model that you have chosen, and identify what should be done to make these two pictures match" (Ayers et al. 2009).

Many of the airports employed the ICAO checklist located in Appendix 2 to Chapter 7 of the *Safety Management Manual* (SMM) to compare the four SMS components (safety policy, safety risk management, safety assurance, and safety promotion) to the current Part 139 airport operation. ICAO further explains:

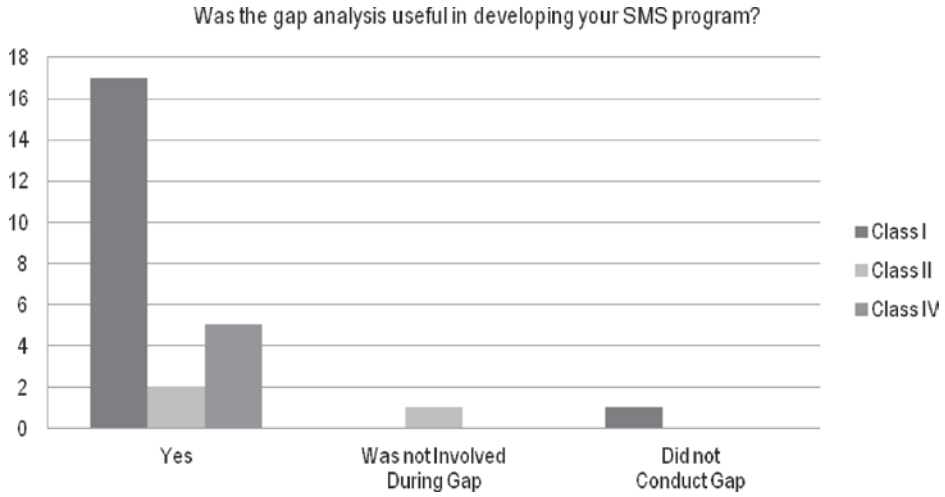

FIGURE 2 Usefulness of gap analysis.

A gap analysis is basically an analysis of the safety arrangements already existing within the organization as compared to those necessary for the SMS to function. The gap analysis is important because the basic organizational structures necessary to start developing an SMS may already exist in the organization: it will seldom be necessary to build an SMS from scratch because most organizations will have various activities related to an SMS in place and functioning. A gap analysis thus reveals the resources, structures and safety arrangements existing in the system to address safety vulnerabilities, specified in terms of hazards that arise as a consequence of the interaction of people and other components of the operational context. It also reveals additional resources, structures and safety arrangements that would be necessary to mitigate safety vulnerabilities and increase operational resilience to the hazards (ICAO 2009).

Survey responses for the survey question, "Was the gap analysis useful in developing your SMS program?" resulted in nearly all airports responding "yes" as demonstrated in Figure 2. When asked what elements of the gap analysis were the most useful, a variety of responses ranging from all elements to policy and safety awareness were listed. The most frequent response, reflected in Figure 3, was that the gap analysis allowed the airport to better identify specific needs necessary to implement SMS. Because more than one analysis tool or method was used by various consultants in the pilot studies, the function of the analysis, as explained by ICAO, is to assist airports in identifying and formally documenting findings to ultimately develop the SMS.

Safety Management System Manual Development

The SMS manual is considered the SMS program's formal documentation and operational guide. The ACRP Guide-

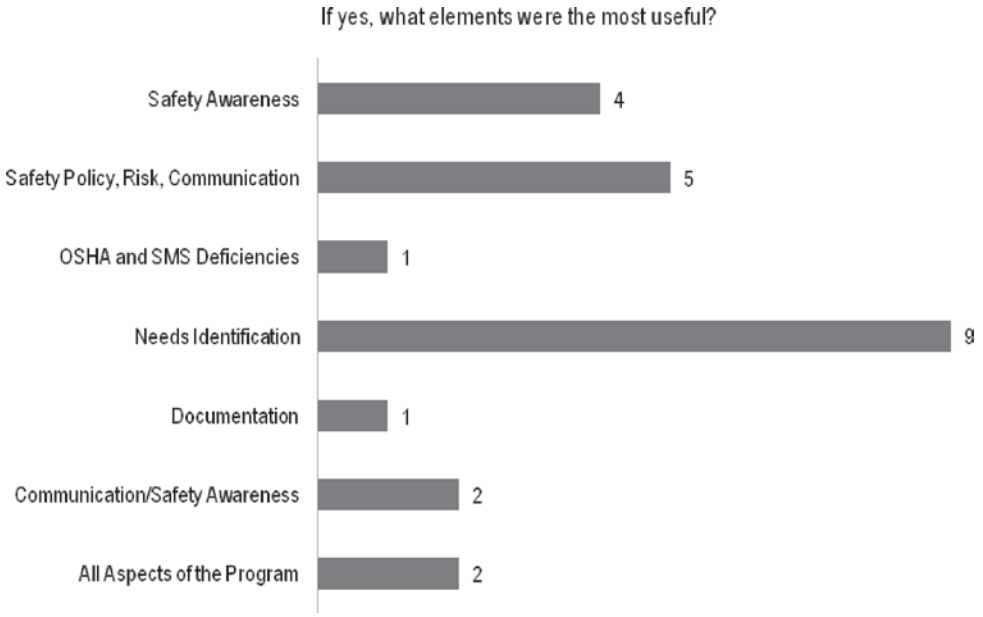

FIGURE 3 Usefulness of gap analysis elements.

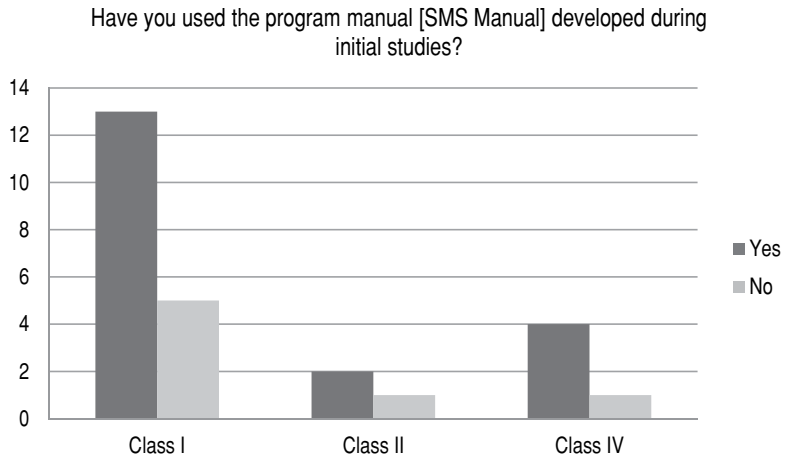

FIGURE 4 Use of original SMS manual.

book states, "SMS documentation is made up of the airport SMS manual and the specific procedures for the SMS processes. Overall, the SMS documentation should provide a description on how the SMS will be or has been set up, who is responsible for what, which processes and procedures are going to be used and when" (Ayers et al. 2009).

Airports were queried to determine whether the SMS manual developed during the initial studies was used for implementation. The SMS manual was a required deliverable for both Studies 1 and 2. As presented in Figure 4, when asked whether the gap analysis was useful in developing the SMS manual, a total of 19 airports indicated "yes" and seven airports responded "no."As discussed earlier, seven of the airports participating in the Synthesis study survey are not implementing SMS, thus the "no" would appear to reflect airports within the nonimplementation group. However, one airport that is implementing reported "no," the original SMS manual was not used as part of the current implementation program because the initial manual did not reflect the airport's current strategy to include additional safety topics such as Occupational Safety and Health Administration into the program. One airport that is not implementing reported "yes," it is using the SRM portion of the SMS manual to support its construction management program. While this airport's SMS program is not rolled out yet, the SRM risk matrix and processes are being used to formally document the risk assessment process for construction projects throughout the airport.

As mentioned earlier in this chapter, the majority of airports (22 of the 31) participated in Pilot Study 1 in 2007; because the FAA's SMS implementation study (Study 4) began midyear in 2010, for most airports more than 2 years had elapsed between the initial and subsequent studies. Some airports continued with their SMS implementation outside of the FAA implementation study, but for many airports the SMS implementation study required a renewed effort with different personnel, stakeholders, managers (airport staff), and, in some cases, new consultant teams. As part of the Synthesis survey, there was interest in determining whether the initial SMS manual and associated SMS implementation plans from Pilot Study 1 or Pilot Study 2 were used for the SMS implementation study. Therefore, the surveyed airports were asked, "Did you revise any of the content and specifically what sections were changed?" Additionally, if implementations had indicated that airports had not used the SMS manual, an additional question asked for clarification or "why not?"

Table 5 provides survey responses. Of the 26 airports surveyed, 19 indicated they had or are currently making significant changes to the SMS manual; all 19 were either participating in the FAA SMS implementation study or were implementing SMS outside of the FAA study. Comments in Table 5 further clarify why airports modified their SMS manuals, including timeline constraints in the initial studies, use of the manual in day-to-day operations, aligning the manual to specific airport operations by either increasing or reducing the level of detail, and leveraging the availability of additional SMS resources and practices to refine content and processes, such as SRM revisions as a result of conducting safety risk assessments (SRAs).

All seven airports that have not revised the SMS manual responded that they were not implementing SMS or that the document is still in draft stages. Specific comments are presented in Table 6.

Program Plan and Schedule Development

In addition to a SMS manual, airports were required to develop a program plan including a program schedule and budget. For similar reasons as the airports' use of the SMS manual, airports were asked whether or not they developed a program plan as part of Study 1 or 2 and if the developed program plan was used for SMS implementation. Program plans were developed using various mechanisms including Microsoft Project schedules and Gantt charts, Excel spreadsheets, and narrative instructions to budget and timelines.

TABLE 5
COMMENTS FOR SMS MANUAL CHANGES

No.	Responses /Comments to: "If yes, did you revise any of the content and specifically what sections were changed?"
1.	We have revised the hazard reporting and SRM process, safety policy, and safety assurance components of the manual. There was very little guidance or resources in the initial phase but we did some things that were spot on and others needed reevaluation. The revisions reflect increased knowledge on the part of the airport team and the consultants.
2.	At this time we are awaiting final revisions from our consultants. We have made a number of updates but we are not sure specifically what sections will be changed with this round of revisions—likely all of them.
3.	As part of the third pilot, the SRM hierarchy of controls and 5-step risk processes were completely revised. In addition the safety assurance scoring methodology was revamped. Also using the Air Traffic Organization (ATO) SMS Guide information we focused on the risk and assurance sections of the manual and revised them accordingly.
4.	The risk matrix and severity/likelihood definitions were adjusted, the safety policy was changed; currently the entire manual is under review and will be revised by the end of the FAA Implementation Study.
5.	The entire manual was revised except the introduction to the appendix that included the Part 139 gap analysis information.
6.	The entire manual is being modified; each section is being changed as we work through the SMS program implementation. New sections and standard operating procedures are being added. The initial manual had the basic structure but it needed to be expanded and have details added for operations.
7.	All sections changed. Originally the manual written for the airport was fairly basic. We used everything that was in the manual but went into more detail on programs and expanded it to include the landside.
8.	Mainly Section 1 Policy and Organizational changes were made; we are trying to find a different way to manage document control; for this particular section, the initial manual description was too complex. Version control needs to be simplified for the program to be feasible and realistic.
9.	Manual revisions come about as part of the second SMS pilot study review and editing process, more so than the SMS Implementation Study. The SRM section was changed as a result of conducting SRAs.
10.	When the initial consultant drafted the SMS manual we did not have many resources and the project timeline was short so we used some of the FAA ATO information as a baseline. Recently we have been revising the manual and rewriting sections. Overall we have reduced the contents of the manual to make it more manageable and useful.
11.	Yes, we have made changes and amendments; sections that came up that did not work the best for the organization were revised. Multiple collateral duties were assigned, such as quarterly reporting. The effort was too burdensome for the safety manager, so instead we compile reports every 6 months, which are distributed to the airport director, as a more realistic effort.
12.	Many of revisions have been made to the policy, forms, processes, etc. The SRM section was updated including forms but the overall process did not change, just the forms to make the process more fluid. We are still changing the audit and evaluation section but we cannot conduct an audit until the program is fully implemented. We have practiced using the forms and made them more congruent.
13.	We have not changed anything yet, mostly because we have not started the formal SMS program and we are only using some of the most basic SMS elements for the current operations, such as SRM.
14.	All aspects have been revised; we are almost constantly adding details and more specific language to the sections such as the policy, risk analysis, and hazard reporting, as we integrate them into the airport's operations.
15.	An internal manager is currently revising and going through the manual to make the SMS processes more useful, including laminated checklists for the airport staff to use. The manual is being consolidated into useful and specific information for management and the staff.
16.	We are completely revamping the document; we are starting from scratch.

TABLE 6
COMMENTS FROM AIRPORTS NOT REVISING SMS MANUAL

	Responses/Comments to: If no, why have you not used it (Manual)?
1.	The document is in draft format and is under discussion.
2.	We have not started the SMS program at this time.
3.	Funding/regulatory concerns have prohibited starting the program.
4.	Staffing issues are limiting the ability to start the program.
5.	No further analysis has been conducted; we have no plans to implement at this time.

ICAO states,

> Once the gap analysis is complete and fully documented, the resources, structures and arrangements that have been identified as missing or deficient will form, together with those already existing, the basis of the SMS Implementation Plan. Organizations may format their SMS Implementation Plan to suit their individual needs; however, a spreadsheet format, Gantt chart or MS Project type layout is recommended for ease of viewing and tracking . . . (ICAO 2009).

Figure 5 illustrates that a total of 20 respondents answered "yes" to the question of whether they had developed an implementation plan (program plan) and six replied "no."

As represented in Figure 5, 20 airports answered "yes" to having developed an implementation plan (program plan) during Study 1 or 2; however, only 10 (Figure 6) airports confirmed the plan was being used as part of the implementation program. When asked if a new program plan was developed as part of Study 4 or implementation outside of the FAA studies, three airports replied "yes" (Figure 7). The remaining six airports participating in SMS implementation activities reported that no program plan was used.

To assess individual SMS program deployment progress, airport representatives were asked to report on SMS program components being implemented. As displayed in Figure 8, 11 of the airports surveyed responded that they are implementing all SMS components and eight others within the implementation group indicated that the respondent airport is implementing one or more of the components, all of which include SRM. Study 4 was limited to implementation of safety risk management and safety assurance components; therefore, half of the implementations are rolling out policy and promotion components to some degree without federal financial assistance.

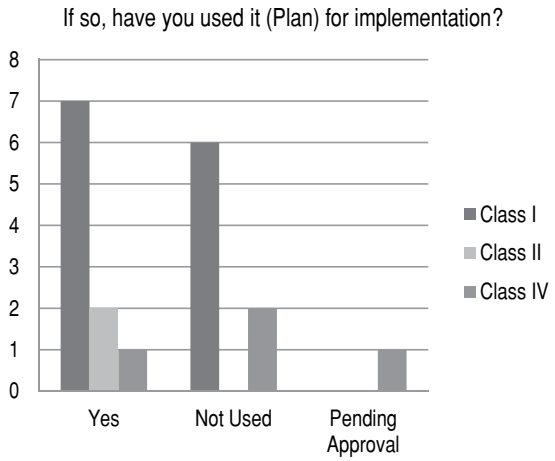

FIGURE 6 Program plan used.

Table 7 provides a summary of SMS components by airport class; of note is the higher proportion of Class I airports implementing "all" components and Class II and IV airports deploying limited portions of the SMS program with a higher occurrence of SRM than other components such as safety policy, safety assurance, and safety promotion. Airport respondents reported that they were actively developing a SRM program and conducting SRAs as part of SMS Study 4 required deliverables and construction projects, as well as participating in Air Traffic Organization-facilitated SRAs.

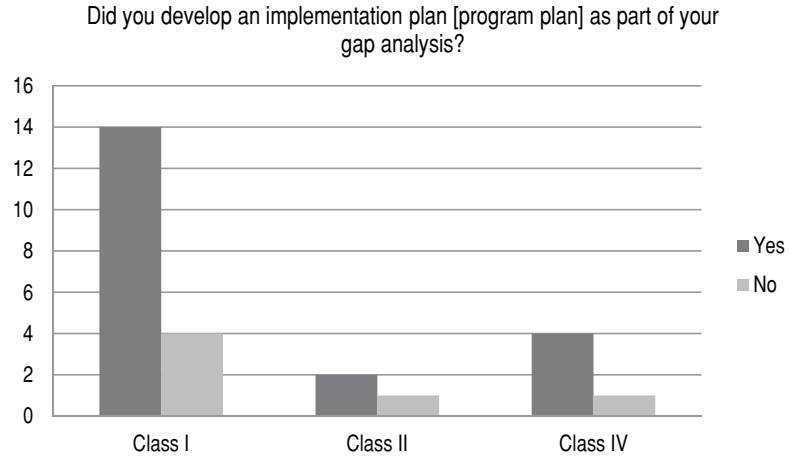

FIGURE 5 Program plan development.

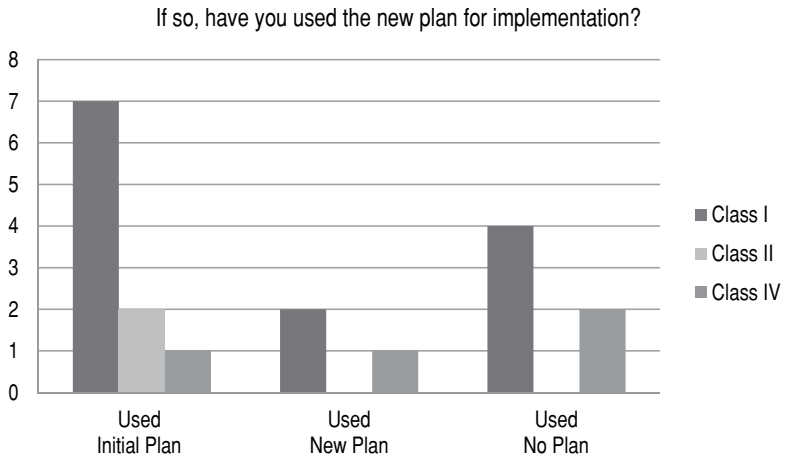

FIGURE 7 New program plan used.

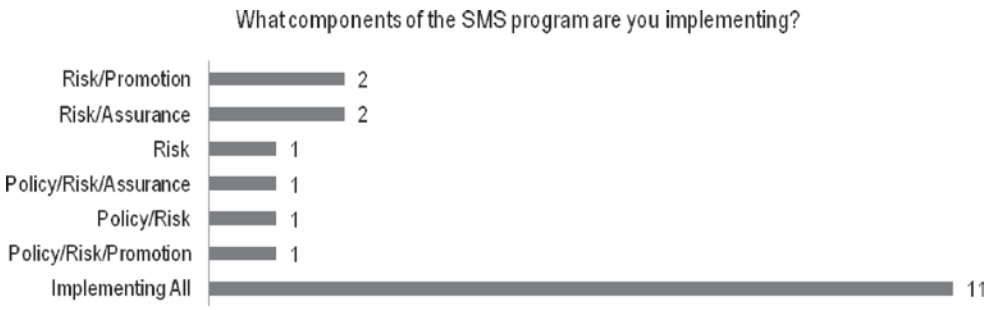

FIGURE 8 SMS components being implemented.

With regard to timelines and the response to the question, "What is your planned schedule to complete implementation?" 16 airports provided various implementation schedules covering the next 5 years. As presented in Table 8, seven airports are within a year of completing the implementation of their SMS components (based on the interview date), six airports plan to complete their program in 1 to 2 years, three airports have 3- to 5-year schedules, and seven stated that they are waiting for the FAA Rule or funding to become available before the SMS program will be rolled out. Of the total airports interviewed, only three did not know the planned implementation schedule or timeline. When responses were reviewed from nonimplementation airports, it was observed that the majority (five of the seven) responded "awaiting regulatory decision." Also, the three airports replying "don't know" are currently implementation airports but are unable to precisely determine the program schedule. Many airports commented that based on the possible SMS Final Rule, airport management is considering adding timeline contingencies to address possible program modifications or adjustments.

TABLE 7
COMPONENTS IMPLEMENTED BY AIRPORT CLASS

Components Implemented	Class I	Class II	Class IV	Total by Type
All	9	2		11
Policy/Risk/Promotion	1			1
Policy/Risk/Assurance	1			1
Risk/Assurance	1	1		2
Risk/Promotion	1		1	2
Policy/Risk			1	1
Risk			1	1
Count by Class	13	3	3	

Consultant Services

Airport representatives were queried whether consultants were hired for any of the SMS pilot studies. All, with the exception of one airport surveyed, employed consultants to assist with one or more of the pilot studies. The airport representative who replied "no" developed the program internally. When asked for reasons why airports engaged consultants, a variety of responses were recorded and are presented in Figure 9. More than half the responses (14) indicated subject matter expertise as the primary reason. The second and third most frequent responses were "due to staff constraints" and "funding requirement of FAA grant." It was noted that Pilot Studies 1, 2, and 3 did not allow for sponsor "force account" projects, but the Study 4 Participants Guide, Part 139 implementation study, stated "FAA recognizes that some airports may wish to complete all or portions of the [SMS pilot] study using existing staff or infrastructure. In those cases, normal force account approval will apply" (FAA 2010).

TABLE 8
PLANNED SCHEDULE TO COMPLETE IMPLEMENTATION

Anticipated Timeline	Class I	Class II	Class IV	Total by Type
Underway/Implementation Nearly Complete	1	1		2
<1 year	3	1	1	5
1 year	1	1		2
1.5 years	1			1
1 to 2 years	2		1	3
3 years	2			2
4 to 5 years	1			1
Awaiting Regulatory Decision	4		2	6
Pending Funding Decision			1	1
Do Not Know	3			3
Count by Class	18	3	5	

Multiple airports (15) participated in more than one SMS pilot study (see Table 2). There was interest in whether airports sought different skill sets from consultants based on the type of study. Airports that had participated in more than one SMS pilot study were asked if they hired the same consultant for both studies. The local airport knowledge and exposure to the first SMS pilot study analysis offered reduced ramp-up time for consultants participating in the second round of SMS pilot study efforts. Results are presented in Table 9. The majority of airports (eight) hired the same consultant, yet four hired a different consultant. Reasons for hiring new consultants ranged from use of the airport's competitive bid process, existing master contracts with consultant teams, and the knowledge and abilities of consultants who conducted the first studies to compete on competitive bids.

Regarding specific skills expected from consultants, airports responded to the question, "Please describe the types of experience you believe a consultant should have to effectively help an airport develop an SMS" with the top five skills identified as follows:

1. Part 139 airport experience,
2. SMS program development,
3. SMS program implementation,
4. SMS expertise, and
5. Specific airport knowledge.

A list of consultant skills and counts of times mentioned (by airport class) is presented in Table 10.

Reference Documents

As airports and consultants worked together to develop SMS programs, a variety of industry resources, documents, and references was compiled. A list of resources reported by airports was compiled and is presented in the literature and data search section of chapter one. Additionally, airports

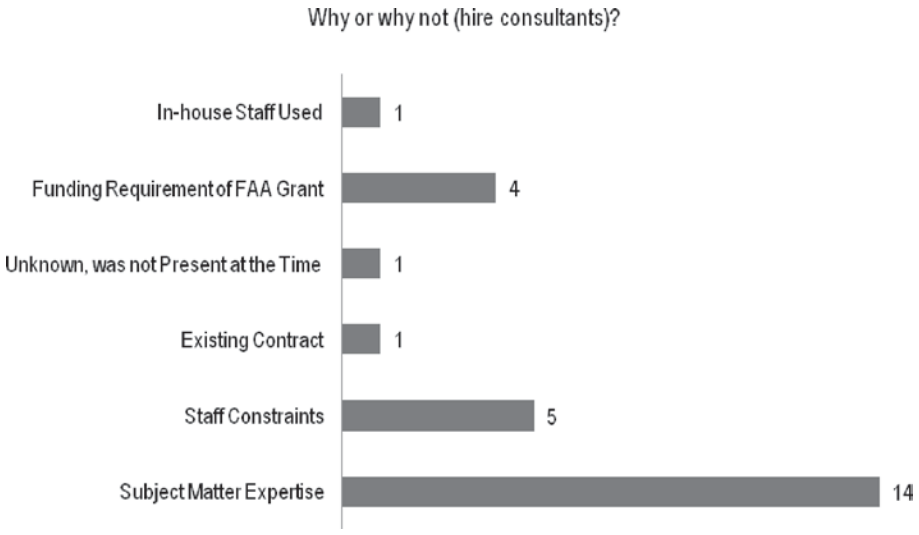

FIGURE 9 Why consultants were hired.

TABLE 9
CONSULTANT HIRING

Consultant Hiring Practices	Class I	Class II	Class IV	Total by Type
Yes, Hired Same Consultant	5	1	2	8
No, Hired Different Consultant	4			4
Only Used Consultant on First	8	2	2	12
Only Used Consultant on Second	1			1
Did Not Use Consultant			1	1
Count by Class	18	3	5	

were questioned as to what document they believed to be the most effective in developing their SMS. The results do not clearly point to a single most useful document, but as presented in Table 11, the FAA AC 150/5200-37, *Introduction to Safety Management Systems for Airport Operators,* and the ICAO Document 9859, *Safety Management Manual*, were most frequently mentioned. Many airports commented that because they believed the future SMS rule would likely be based on the AC, they reviewed the document thoroughly in addition to other resources to ensure the program would ultimately comply with the FAA's existing guidance.

Organizational Structures and Program Management

A number of questions regarding organizational and project management structures, including staff positions and titles and levels of participation in the SMS studies, were posed to airports as part of the interview process. Most airports participating in SMS Implementation Studies have designated both an accountable executive and a safety manager. In some instances, the airport's SMS pilot study program manager was a different staff member than the safety manager; therefore, a question, "What position (title) within the organization is assigned as the program or project manager for the SMS implementation project?" was asked of the airports. Airports not participating in the SMS implementation study were asked to provide the position that was assigned to program management for Pilot Studies 1, 2, and 3. Results by airport size are presented in Table 12. A broad range of positions and departments were represented including operations, maintenance, environmental, safety, risk, and security.

As part of any of the four SMS pilot studies, airports were asked what departments had participated or been involved in the SMS activities. Table 13 presents all responses from the 26 airports surveyed. The top seven departments involved in the SMS, in order of number of responses, are (1) operations, (2) maintenance, (3) fire/aircraft rescue and fire fighting, (4) engineering/construction/facilities, (5) police/sheriff, (6) risk—note that an airport's risk function is not always a separate department or duty, and 7) tenants/fixed-base operators.

TABLE 10
CONSULTANT SKILL SETS

	Part 139 Airport Operations	SMS Program Development	SMS Program Implementation	SMS Expertise	Specific Airport Knowledge	Aviation Expertise in General	Program Management	Safety Expertise	Risk Management	FAA Relationships	Educational/Analytical Background	Practical Hands-on Experience	Comm. and Info. Development Skills	Technical Writing	Critical Thinking	Industry Awareness RE: Rulemaking	Technology Expertise	Facilitation Skills (for SRAs)
Class I 18 Airports Surveyed	10	10	8	2	2	4	5	2	4	2	2	2	2	1	1	1	1	1
Class II 3 Airports Surveyed	3	2	2	3	3	1												
Class IV 5 Airports Surveyed	4		2	4	4	1		2										
Total Count	17	12	12	9	9	6	5	4	4	2	2	2	2	1	1	1	1	1

TABLE 11
MOST USEFUL REFERENCES

	FAA AC 150/5200-37	ICAO SMM Document 9859	Various Industry	ACRP Guide Books Volume 1 and 2	Airport's Part 139 ACM	Transport Canada	Don't Know, or None Specified	IATA Safety Program	Airline SMS Advisory Circulars	Consultant's Documents	FAA Airport SMS NPRM	FAA ATO SMS Manual	OSHA Overall and VPP Program	Bangalore SMS Example	FAA Order 5200.11	Army/Navy Safety	Part 139 Deconstructed for SMS Gap	Civil Aviation Safety Authority (Australia)	ISO 14001
Class I 18 Airports Surveyed	11	11	9	7	4	4	1	2	3	1	2	2	2	2	2	2	1	1	1
Class II 3 Airports Surveyed	2	1	1		1		1	1											
Class IV 5 Airports Surveyed	3	2	2	2	1	1	1			1									
Total Count	16	14	12	9	6	5	3	3	3	2	2	2	2	2	2	2	1	1	1

VPP = Voluntary Protection Program.

TABLE 12
SMS PROJECT PROGRAM MANAGER TITLES

No.	Program Manager Title	Class
1.	Airport Duty Manager	Class II
2.	Airport Manager	Class I
3.	Airport Manager (2)	Class II
4.	Airport Manager	Class IV
5.	Airport Operations Supervisor	Class I
6.	Assistant Director of Airfield Operations	Class I
7.	Aviation Director	Class IV
8.	Outside Consultant	Class IV
9.	Director of Operations and Security and Environmental Compliance	Class I
10.	Director of Safety, Training, and Security	Class I
11.	Environmental Manager	Class I
12.	Fixed-Base Operator (FBO) and Airport Operations Manager	Class IV
13.	Fire Chief	Class I
14.	Manager Airport Operations	Class I
15.	Manager of Operations and Maintenance	Class I
16.	Operations Manager (2)	Class I
17.	Operations Safety Administrator	Class I
18.	Operations/Maintenance Supervisor and Safety Coordinator	Class I
19.	Principal Investigator	Class IV
20.	Risk Management Administrator	Class I
21.	Risk Manager	Class I
22.	Senior Airport Operations Manager	Class I
23.	Superintendent of Airport Operations, Maintenance, and Security	Class I

TABLE 13
DEPARTMENTS INVOLVED IN SMS IMPLEMENTATION STUDIES

	Operations	Maintenance	Fire/ARFF	Eng./Construction/Facilities	Police, Sheriff	Risk Management (risk function is not always a separate department or duty)	Tenants/FBO	Planning	Training	Administrative/Management/ Boards/City/County	Safety (OSHA)/Security	Properties/Finance	Customer Service/PR/HR	Legal	Environmental/Wildlife	Information Technology	FAA	Emergency Management
Class I	18	14	14	13	11	12	8	10	10	6	6	6	3	3	2	4	1	1
Class II	3	3	1	1	2		2	1		2								
Class IV	5	5	5	2	2	2	3	1	1	3	3							
Count	26	22	20	16	15	14	13	12	11	11	9	6	3	3	2	1	1	1

ARFF = Aircraft Rescue and Fire Fighting; FBO = fixed-base operator; OSHA = Occupational Safety and Health Administration; PR = Public Relations; HR = Human Relations.

Within a SMS, the role of the accountable executive is to be accountable for all safety policies, practices, and processes. Today, some airports have functional roles that reflect top management accountabilities but may not use the term "accountable executive." Because the concept of an accountable executive is new, the FAA clarifies in the NPRM that

> [t]his proposal [NPRM] would require an airport to identify an Accountable Executive. The FAA understands that airport operations and organizational structures vary widely. Accordingly, the FAA would not prescribe a particular job title. Nevertheless, the Accountable Executive must be a high-level manager who can influence safety-related decisions and has authority to approve operational decisions and changes because an effective SMS requires high level management involvement in safety decision making. Accordingly, the FAA proposes the international standard definition for an Accountable Executive (i.e., requiring the Accountable Executive to be an individual with ultimate responsibility and accountability, full control of the human and financial resources required to maintain the SMS, and final authority over operations and safety issues). The FAA . . . believes an acceptable accountable executive would be the highest approving authority at the airport for operational decisions and changes (FAA 2010).

The ACRP Guidebook defines the accountable executive as follows, "An Accountable Executive should be identified as ultimately responsible for the safety of personnel, business processes, and activities of the airport organization. Therefore, this should be the person at the top of the organization. This person should demonstrate a commitment to safety by allocating the resources necessary to achieve organizational safety objectives" (Ayers et al. 2009).

As an important reflection on management authority and oversight of the SMS, airport representatives were asked to identify the position and title of the designated or proposed accountable executive as presented in Table 14. Although numerous titles were provided, the general finding is that all levels reported represent upper management positions. The top three titles reported and counted include airport manager, chief executive officer, and president.

TABLE 14
ACCOUNTABLE EXECUTIVE POSITION WITHIN ORGANIZATION

No.	Accountable Executive Position Title	Class
1.	Airport Director/Safety Manager	Class II
2.	Airport Director	Class IV
3.	Airport Executive Director	Class I
4.	Airport Manager (3)	Class I
5.	Airport Manager	Class II
6.	Airport Manager	Class IV
7.	Airport Manager/County Commissioner	Class II
8.	Assistant Director of Aviation	Class I
9.	Aviation Director	Class IV
10.	Aviation Director	Class IV
11.	Aviation General Manager	Class I
12.	Chief Executive Officer (3)	Class I
13.	Chief Financial Officer	Class I
14.	Chief Operating Officer	Class I
15.	Deputy Director of Operations	Class I
16.	Director of Airport Operations	Class I
17.	Director of Aviation	Class I
18.	Executive Director of the Airport Authority	Class I
19.	Executive Vice President of Operations Division	Class I
20.	Fire Chief	Class I
21.	President	Class IV

TABLE 15
DESIGNATED A SAFETY (SMS) MANAGER

Safety (SMS) Manager Designated	Yes	No	Total
Class I	14	4	18
Class II	3	0	3
Class IV	5	0	5
Count	22	4	26

While not a proposed required position by the FAA (in the NPRM), airports were asked whether a safety manager had been designated in addition to the accountable executive. As shown in Table 15, of the 26 airports surveyed, 22 responded "yes" and four replied "no." Because not all airports are implementing SMS, the survey results were analyzed and nonimplementation airports that replied "yes" indicated that a safety manager had been proactively identified within the organization to establish the position if and when the program becomes formal.

All airports were asked to further define the safety manager role as either a full-time or collateral duty position. As shown in Figure 10, of the 26 airports surveyed, four indicated full-time and 20 reported collateral duties. The nonimplementation airports that reported on safety manager duties indicated that collateral duties are anticipated in the future.

As a follow-up to the question on the safety manager position, airports were asked whether they plan on adding staff to support their SMS, specifically, "If you plan on adding staff, how many total positions do you anticipate?" For most airports the staffing plan is proposed for the future. Figure 11 provides a summary of responses by airport class, including the most frequent response of "none" (11) and "one additional staff" as the second most provided answer with six total responses. A review of the collateral duty findings in Figure 10 and the plans to augment staff in Figure 11 indicates that airports are not planning to hire additional staff for the SMS and are intending to expand the duties of their

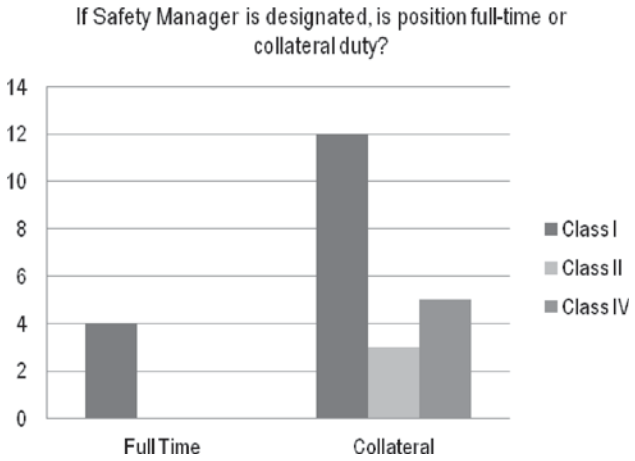

FIGURE 10 Safety manager position full-time or collateral.

existing staff to support the program efforts. Airports were not asked to explain the basis of their replies; therefore, the data results are unable to document the reasons behind the staffing decisions.

Although airports were discussing full-time and collateral duty staffing, the question was asked, "Please describe any duties that will be performed by existing or new staff." Table 16 provides a summary of additional duties planned for staff, including program-level duties and specific efforts associated with the four SMS components (safety policy, safety risk management, safety assurance, and safety promotion). Additional tasks or duties tended to include hazard identification and reporting, SRA coordination and facilitation, training, and overall program management.

Budget

For each of the SMS pilot studies, airports were eligible for grant funds to support the project efforts. Each SMS pilot study scope of work limited some expenditure types. Allowable funding was typically based on service level and hub type,

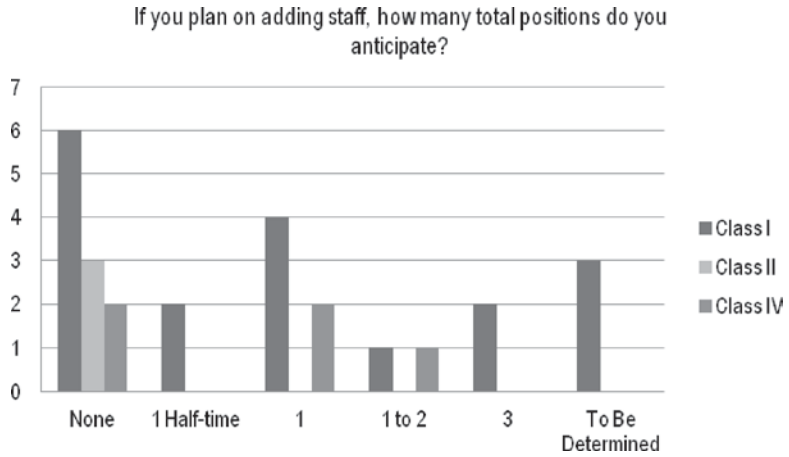

FIGURE 11 Additional staff planned.

TABLE 16
SMS STAFF DUTIES

Class	Program	Safety Policy	Safety Risk Management	Safety Assurance	Safety Promotion
Class I	Program development and management, including coordination with information technology		SRA logistics including facilitation		
Class I	Participate in safety meetings and manage program			Data quality reviews	Training
Class I	Safety manager for all aspects		SRM, SRA	Forensics, data tracking, reporting, and expanded inspection program	Training development and rollout
Class I	Project manager for SMS, coordinate other department efforts such as maintenance and technology			Data management	
Class I	Accountable for program			Quality assurance audits and coordination	
Class I				Reporting processes	Awareness training for staff and tenants
Class I	Program manager for all SMS elements including OSHA, supervise staff in department and develop program elements, report to management	Assist with policy deployment to staff and tenants	Conduct and coordinate SRAs	Manage audit program	Manage and deliver training program
Class I	Participate in safety review board and provide oversight		Execute and facilitate SRAs including panel logistics	Update hazard and audit lists	
Class I				Audits, inspections	SMS trainer
Class I			Coordinate SRAs	Collect and analyze data	
Class I				Hazard reporting	
Class I	Overall management of program		Risk analysis and reporting	Investigations	
Class I				Reporting hazards	Promoting safety culture
Class I	Report to management			Maintain hazard log, track mitigations	Communicate issues, provide training
Class I	Coordinate program				Provide training
Class I				Conduct inspections	Manage training requirements, oversee training dept. efforts
Class I	Manage program as needed and expanded, develop SMS Plan		Work with construction to implement SMS		Communicate with airport community
Class II	Attend safety meetings			Record keeping and reporting, provide statistical reports	Conduct annual safety training
Class II				Hazard reporting and management	
Class IV	Program management				
Class IV	Develop safety plan, manage program				
Class IV	Senior supervisor with safety and training responsibilities			Data analysis and reports	Provide training
Class IV	Oversee staff and program from a high-level perspective				
Class IV					Communicate and report concerns from staff and tenants

TABLE 17
GRANT FUNDING

SMS Pilot Study	Year	Amount Range
Study 1—Gap Analysis, SMS Manual, Implementation Plan Open to Class I, II, III, and IV Airports	2007	$67,000–$200,000
Study 2—Gap Analysis, SMS Manual, Implementation Plan Limited to Class II, III, and IV Airports	2008 to 2010	$36,000–$100,000
Study 3—Proof of Concept	2008 to 2009	$180,000–$375,000
Study 4—Implementation	2010 to 2012	$78,500–$500,000

where applicable. The cost amounts in Table 17 were provided by the FAA and are presented by each SMS pilot study as rounded actuals. Note that not all airports pursued reimbursement for the total allowable amount of grant funding.

Airports surveyed were also asked whether the funded amounts were sufficient to support the SMS pilot study costs. Responses are reflected in Figure 12. Eighteen of the airports reported that "yes" the funding was sufficient to complete the studies, four replied "no," and the remaining two did not apply for funding and, therefore, the question was not relevant.

A set of three questions focused on whether airports believed there were hidden costs within the SMS implementation study project or in the future development or operation of the SMS. Results from the questions are presented in Tables 18 and 19.

With regard to the project or program challenges, the majority (13) responded that there were no challenges. The remaining responses included program management, training, SRA mitigations, software, and reporting.

Airports were asked to consider foreseeable hidden costs and possible future challenges with funding. Similar results were reported from each question and have been consolidated in Table 18. The top three responses included (1) program management, (2) software procurement, and (3) SRA mitigations.

According to the SMS NPRM, "One of the most important aspects of hazard identification is systematically documenting and tracking potential hazards. This documented data allows meaningful analysis of operational safety-related trends on the airfield and of overall airport system safety" (FAA 2010). The NPRM further states, "Few certificated airports [within the SMS pilot studies] indicated formal procedures to systematically review safety-related data. All pilot study airports have record-keeping and retrieval systems in place, but each indicated room for improvement. Improved systems would allow for trend and other data analysis to proactively identify operational hazards and potentially prevent future incidents or accidents" (FAA 2010).

In order to collect information from SMS pilot study airports, each of the four studies included assessments or deliverables associated with data collection and reporting, software analysis, and/or software procurement. Studies 1 and 2 asked airport representatives to investigate nonpunitive reporting systems and SRM trend analysis and SRM documentation management (electronic or paper). Study 3 included several activities related to data collection, data tracking and trending activities, and reporting systems, including the following:

1. Reviewing third-party data collection, collaboration, and reporting systems to collect, store, and report on SMS events, trends, and activities;

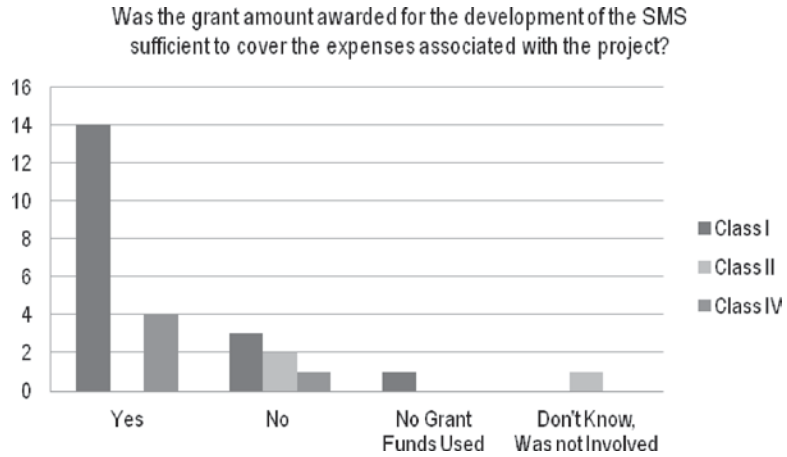

FIGURE 12 Sufficiency of grant amount.

TABLE 18
FUNDING-RELATED CHALLENGES WITHIN THE PROJECT

	No Challenges Reported	Training	Technology/Software Procurement	SRA Mitigations	Collateral Duties by Airport Staff	SMS Pilot Study Documents Deficient, Not Useful	Not Adequate Funding for Implementation	Lack of Guidance Is Costly
Class I	10	3	3	1	2	1		1
Class II	1			1				
Class IV	2						1	
Count	13	3	3	2	2	1	1	1

2. Developing a tracking and trending program for foreign object debris/damage (FOD) identification and control;
3. Developing a personnel training and record-keeping program with the ability to alert or query data and integrate into any of the airport's related tracking or training programs currently in use;
4. Developing a ramp and baggage makeup area (if applicable) self-inspection program and processes for reporting, tracking, and trending safety issues; and
5. Developing a minimum standard for safe operations on the ramp and in the baggage makeup area (if applicable) to list baseline incidents and accidents for trending.

Under the FAA's list of eligible expenses, Study 4 allowed for the procurement of hazard and mitigation tracking software systems and safety reporting software systems. Additionally, Study 4 included a number of software and data reporting study tasks and deliverables, including the following:

1. Implement a safety reporting and/or data collection system or applicable processes in conformance with the airport's SMS manual or other documentation developed for the airport under the first pilot studies;
2. Collect hazard reports, incident and accident reports, and other safety-related data and information under the airport's SMS manual or other applicable documentation;
3. Analyze the information collected through the reporting and/or data collection system or applicable processes; and
4. Report on (if software was purchased or developed) the usefulness of the software, costs associated with development, procurement, and maintenance, and challenges or lessons learned using the software.

Additional information regarding data collection and trending is presented in chapter five.

TABLE 19
POSSIBLE HIDDEN COSTS AND FUNDING-RELATED CHALLENGES IN THE FUTURE

	Program Management	Software Procurement/ Technology	SRA Mitigations	Training Program	Data Reporting	Promotional Culture Program	Availability of Future Funding
Class I	7	7	5	2	2	2	2
Class II	3	1	1				
Class IV	3	1					
Count	13	9	6	2	2	2	2

LESSONS LEARNED

This chapter presents survey response information relating to the overall program management, staffing, and budgeting for a SMS. The majority of airports were able to reply to all questions, regardless of their implementation or nonimplementation status. Trends from the analysis by section are presented here, including lessons learned gleaned from the surveyed airports and subsequent analysis of the compiled information.

SMS Program Management

Lesson Learned: A clear definition of the SMS project development documents, such as a program plan and schedule, assists with the airport's ability to design, plan, and deploy the SMS.

Gap Analysis Process and Report

The overall consensus from the surveyed airports is that conducting a gap analysis is useful as a means to assess the current operational activities and to serve as a baseline needs assessment for SMS development. Many consultants used the ICAO gap analysis checklist as a tool to assess SMS and Part 139 operations because there was not one available from the FAA for their use. ICAO strongly encourages the use of

Many consultants used the ICAO gap analysis checklist as a tool to assess SMS and Part 139 operations because there was not one available from the FAA for their use.

the gap analysis in the SMS manual and indicates that the gap analysis tool assists in developing the SMS Implementation [Program] Plan. At the time, and even currently, this is the best known tool for performing the gap analysis.

Lesson Learned: Ensuring adequate or flexible SMS program timelines to conduct a gap analysis (or other business analysis efforts) assists airports in developing program plans.

SMS Manual Development

Study 1 and 2 project durations totaled 6 months. Survey respondents reported that the timeline restricted, to some degree, the ability for staff to develop a complete and thorough SMS manual. However; all airports and consultants developed and delivered a SMS manual as part of the required SMS pilot study program deliverables. Most implementations indicated that airports used the SMS manuals developed in the initial SMS pilot study as a baseline and have either completely revised or revamped the SMS manual as part of the implementation process. Two of the three airports participating in Study 3, Proof of Concept, indicated that the SMS manual was revised as part of the SMS pilot study and was further updated during the SMS implementation study as program components were rolled out and, specifically, as SRM tools (such as the risk matrix) were tested while conducting SRAs.

Some airports reported they have increased the contents; others have reduced the amount of information to align the SMS manual with current airport operations. Additionally, some airports stated that the initial SMS manual was developed as an academic exercise and, as the program is being deployed, staff is testing processes and procedures to align with standard operating procedures and, in some cases, with new SMS software programs.

Lesson Learned: Allowing adequate time to design, develop, test, and deploy the SMS manual through the life of the program implementation improves the quality of the manual and associated processes.

Program Plan Development

Most airports developed a program plan during Pilot Studies 1 and 2; however, only approximately half have used the program plan for SMS deployment. Airports commented that the SMS components are being rolled out as needed or encountered (safety risk management, for example, as a result of conducting safety risk assessments) and because no formal milestones are set, the program timeline is flexible. As reflected in the number of airports reporting that they are implementing all SMS components (11), the majority (15) of the group are either not implementing at all (7) or are only implementing some of the components (6). Some airports commented that the program schedule was fluid to ensure that any changes to the SMS Final Rule could be addressed.

Lesson Learned: Development of flexible program plans supports the airports' SMS implementation timelines and staffing constraints.

Consultant Services

All airports, except one, employed consultants to assist with the various SMS pilot study deliverables and activities. Consultants were selected through a variety of means such as requests for proposals, master contract agreements, and other formal processes and procedures. Owing to limited SMS experience at U.S. airports, many of the consultants participating in the first studies brought expertise from non-U.S. efforts (such as Canada and Europe) or from other safety-related professions; however, during the past 4 years, consultants have gained U.S. experience.

As part of the survey, desired consultant skills with airports were discussed. The top three skills reported from the survey that airports believe their consultants need are Part 139 operations expertise, SMS development skills, and SMS implementation experience. Additionally, four of the five Class IV airports indicated airport familiarity and all three of the Class II airports also confirmed that specific airport knowledge was a key skill necessary for SMS consultants.

Lesson Learned: Local airport and U.S. Part 139 experience are valuable SMS consultant skills in consultant selection in addition to SMS development and deployment expertise.

Reference Documents

During the early pilot studies (2007 and 2009), few U.S.-centric guides or documents existed to assist airports and consultants in designing and developing SMS programs. The most frequent reference reported by airports surveyed was the FAA AC 150/5200-37 (2007). Airports commented that as a potential Part 139 addition, the AC served as the single most important available document to assist airports in developing a program that they believed could comply with future FAA requirements. Many airports commented that the lack of guidance documentation from the FAA was a concern. FAA has since committed to updating the AC using lessons learned from the pilot studies.

The second most frequently used reference was reported as the ICAO *Safety Management Manual*. The manual provided a solid SMS outline including sample checklists and forms for SMS program development; however, some of the ICAO-focused aspects of the SMM were incompatible with U.S.

The most frequent reference reported by airports surveyed was the FAA AC 150/5200-37.

airport operations and were discarded. Airports also reported that industry conferences, presentations, and workshops were of great value (especially in the early stages of the pilot studies) to allow for information sharing and document exchange.

Lesson Learned: Formal SMS guidance, documentation, and information-sharing opportunities support the SMS design and development.

Staffing

Most airports, even those within the nonimplementation group, have identified safety manager and accountable executive positions or titles within the organization. The majority of SMS programs are currently (or will be) managed from the operations division or department. Few airports have hired full-time staff to support the SMS program; the majority indicated collateral duties will be assigned to support the SMS. Most airports do not plan on hiring staff and only a few airports indicated an additional staff member or two may be employed. Budget constraints were reported as the primary reason for leveraging existing staff instead of employing new hires. Many airports (including implementation airports) are delaying staffing decisions until the rule is finalized.

Nearly all airports and consultants involved other departments in each of the pilot studies; however, additional departments, such as legal and properties, were engaged as part of the SMS implementation study to address safety policy development and revisions to leases, licenses, and rules and regulations. The departments most often reported to be involved in the program (other than operations) are maintenance and fire/aircraft rescue and fire fighting.

Lesson Learned: Collateral duties are the reported norm for current and future SMS staff responsibilities; budget constraints and delayed hiring decisions based on forthcoming FAA rulemaking are cited as the primary reasons new hires are not planned.

Technological solutions to compile, assess, and trend data were cited as critical to Safety Assurance and audit programs.

Budget

Federal grant funding for SMS studies, according to surveyed airports, provided adequate funds to develop the required deliverables. Future budget concerns, including possible hidden costs, include software and technology, training, and program management. Airports stated that the need to track and trend data in a software system was either more costly than anticipated (including additional staff time) or was expected to be a significant program cost in the future. Airports also stated that procurement and implementation of a software program were important to the SMS program's success. Technological solutions to compile, assess, and trend data were cited as critical to safety assurance and audit programs.

ICAO states that

> predictive safety data collection systems are essentially statistical systems, whereby a considerable volume of operational data, which alone are largely meaningless, are collected and analyzed, and combined with data from reactive and proactive safety data collection systems. The aggregation of data thus leads to the development of a most complete intelligence that allows organizations to navigate around obstacles and currents and position themselves optimally within the drift (ICAO 2009).

Lesson Learned: Data collection, analysis, and trending are core functions of SMS and require early planning for adequate budgets to procure or build technological solutions.

CHAPTER THREE

SAFETY MANAGEMENT SYSTEM AND SAFETY POLICY

BACKGROUND

The ACRP Guidebook defines safety policy as, "the fundamental approach to managing safety that is to be adopted within an organization. Safety policy further defines the organization's commitment to safety and overall safety vision" (Ayers et al. 2009). The FAA states that "Safety Policy provides the foundation or framework for the SMS. It outlines the methods and tools for achieving desired safety outcomes. Safety Policy also details management's responsibility and accountability for safety" (FAA 2010).

At the heart of a SMS is the safety policy component that guides and commits the organization, its staff, and tenants to safe operations. Safety policy includes numerous elements and functions including development of a safety policy statement, which is often comprised of a mission, a vision, core values, and is backed by quantifiable SMS objectives or goals. Additionally, the safety policy component works in conjunction with the identified roles and responsibilities of the assigned SMS staff to ensure accountability at all levels of the organization. The FAA NPRM further indicates that "This proposal [NPRM] would require a certificate holder to establish a safety policy that

- Identifies the accountable executive;
- Identifies and communicates the safety organizational structure;
- Identifies the lines of safety responsibility and accountability;
- Establishes and maintains a safety policy statement;
- Ensures the safety policy statement is available to all employees;
- Establishes and maintains safety objectives; and
- Establishes and maintains an acceptable level of safety for the organization" (FAA 2010).

Because it guides and frames the entire SMS, safety policy was a critical component in each of the FAA SMS pilot studies and a safety policy statement was required for each participating airport as part of the creation and revision of its SMS manual. Airports were interviewed and surveyed to understand the process and scope used in implementing the safety policy component (such as identifying and documenting staff roles and responsibilities within the SMS manual) as well as the contents, specificity, distribution, and publication of the safety policy statement and the extent to which it was or will be tied to other SMS components, such as safety assurance.

CHAPTER CONTENTS

This chapter presents findings related to the development and implementation of a safety policy statement and safety objectives at SMS pilot study airports. Survey findings for management commitment and responsibility and staffing and assignment of duties (also associated with the safety policy component) are presented in chapter two.

FINDINGS AND ANALYSIS

Airports were asked a number of questions relating to the approval, publication, and distribution of the safety policy statement as part of the four FAA SMS pilot studies.

Policy Deployment and Approval

Airports were asked whether an approved safety policy statement was in place at their airports (Figure 13). Sixteen airport respondents indicated "yes," nine replied "no," and one answered that the safety policy statement was "being developed." Some airports commented that the term "policy" was not used because of local regulatory or governmental limitations. Terms such as "safety statement" and "safety commitment" were used in place of "safety policy" to comply. Also, safety policy statements were developed by various means and methods, including some that were developed by committees and boards and others by individuals such as safety managers and reviewed by top management. Most safety policy statements averaged approximately one page in length.

The 16 airports with approved safety policy statements were asked who or what entity approved the policy. A broad array of responses included CEOs, boards, counties, directors, and presidents. No significant trends were noted except that all approving agencies appear to be at the highest level of authority within the organization. A list of approving agencies or individuals is presented in Table 20.

Policy Staff and Tenants

For many airports the approved safety policy statement has been shared only with internal staff. As presented in Figure 14, airports were asked whether the safety policy statement had been shared with staff and/or tenants. Of the airports that have safety policies in place, seven airports responded to

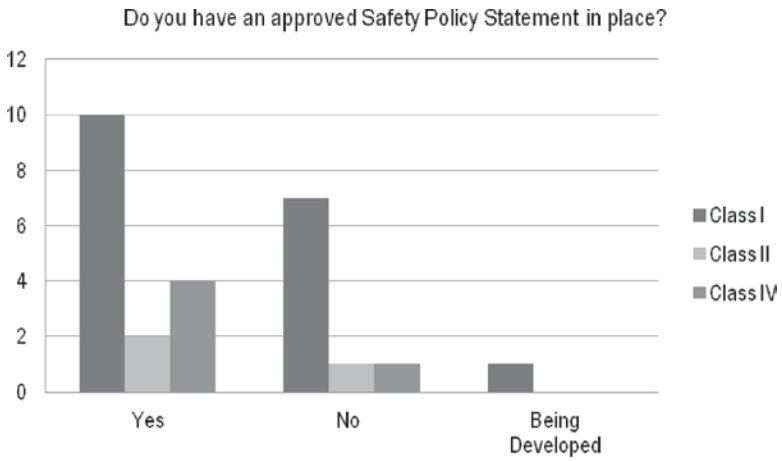

FIGURE 13 Approved safety policy statement in place.

that a safety policy statement was shared with both staff and tenants, six airports responded that the safety policy statement was shared internally, and three airports indicated that the safety policy statement was not published. Nine airports responded that there is currently no safety policy statement in place. Comments regarding internal versus external publication of the policy included that airports had initiated the SMS program internally first (staff only) and were planning to include tenants in the future as the external program was rolled out. Routes or distribution means to share the policy included all-hands meetings, safety meetings, e-mails, training sessions, and formal posting of the safety policy statement in staff and tenant areas.

TABLE 20
APPROVERS OF SAFETY POLICY STATEMENTS

Class	Approving Agency/Person
Class I	Written by the county and approved by the county council
Class I	Airport Commission
Class I	Chief Executive Officer (CEO)
Class I	Senior staff
Class I	Executive Director/CEO
Class I	Deputy Administrator of Airports will approve policy
Class I	Airport Board
Class I	Board and CEO at a public meeting
Class I	Accountable Executive/Responsible Executive
Class I	Airport Authority Board
Class I	Deputy Director of Operations
Class I	Airport Director
Class II	Airport Director
Class II	Airport Manager
Class IV	President
Class IV	Aviation Director
Class IV	Airport Board
Class IV	Speedway Organization

Policy and Objectives

Included in many safety policy statements are associated program objectives; typically these objectives are measured as part of the SMS safety assurance program through performance metrics to ensure the program is on track. The airports participating in the SMS studies were asked whether program objectives were set as part of the safety policy statement development process. As presented in Figure 15, eight airports reported safety objectives were included in the safety policy statement, nine replied that objectives were not included in the safety policy statement, and nine indicated that they did not have a safety policy statement in place. Correlating this information with the number of airports with approved safety policy statements (16), the survey results indicate that only eight of the 16 airports included safety objectives in their safety policy statements, and the remaining eight had not. Because the airports were not asked why the safety policy statement did not include objectives, it is unclear as to whether the airport has no SMS safety objectives or the objectives are identified and tracked in another document or program than the safety policy statement. Additional questions regarding safety policy objectives were discussed as part of the SMS safety assurance component presented in chapter five.

LESSONS LEARNED

Safety Policy Statement Development

Because of the diverse city, county, authority, and state airport management structures, safety policy statements were developed and approved through various official processes and functions.

Lesson Learned: The method to develop and deploy a safety policy statement requires various approval processes depending on the airport management structure. Airport safety policy development includes investigating the proper route and

FIGURE 14 Safety policy statement published to staff and/or tenants.

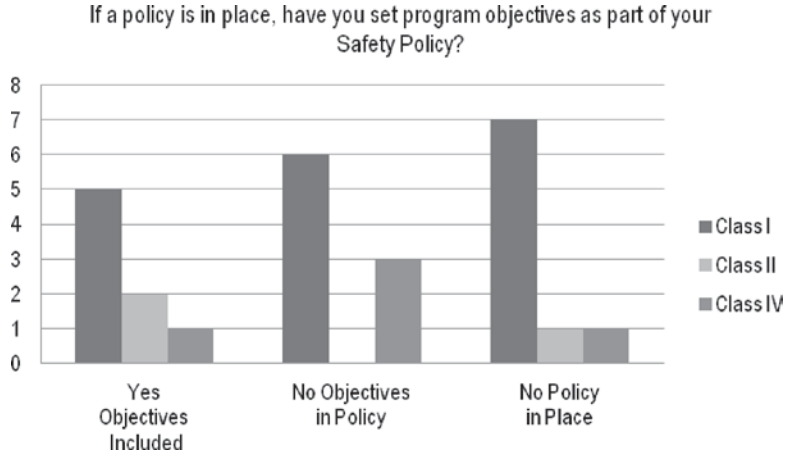

FIGURE 15 Policy mapped to objectives.

approval function early in the SMS program to ensure that adequate time is allocated.

Safety Policy Statement Deployment

Various means to publish and distribute the safety policy statement were discussed during the interview process, including rolling out the policy during all-hands and tenant meetings. Some airports posted the policy in both staff and tenant areas as a reference; other airports published the policy on the airport or city websites.

Lesson Learned: Deployment of the safety policy is unique to each airport's internal and external communication paths. Some airports develop a communication plan to roll out the safety policy statement in conjunction with the SMS program.

Safety Policy and Objectives

Safety policy objectives were not included in every implementation's safety policy statement or documentation. Some airports may have separated the objectives into other SMS program documentation.

Lesson Learned: Linking safety policy objectives to measurable goals and metrics provides management the ability to report on SMS program activities and progress.

CHAPTER FOUR

SAFETY MANAGEMENT SYSTEM AND SAFETY RISK MANAGEMENT

BACKGROUND

At the core of SMS is the component relating to safety risk management. The ICAO defines SRM as " . . . a generic term that encompasses the assessment and mitigation of the safety risks of the consequences of hazards that threaten the capabilities of an organization, to a level as low as reasonably practicable. The objective of Safety Risk Management is to provide the foundations for a balanced allocation of resources between all assessed safety risks and those safety risks the control and mitigation of which is viable" (ICAO 2009). The FAA currently defines SRM as "the composite of the likelihood (i.e., risk) of the potential effect of a hazard, and predicted severity of that effect. As an example, the possibility of an overshoot by an aircraft landing on an icy runway would be considered a safety risk of the hazard. The hazard is "icy runway" and the risk is "possibility of an overshoot" (FAA 2007).

Fundamentally SRM is a formal, structured set of processes to proactively identify hazards, classify and prioritize associated safety risks, apply corrective actions to mitigate the risks, and continuously improve operational safety. One of the key tasks and deliverables within the SMS implementation study was the requirement to conduct a minimum of three safety risk assessments. A SRA is the formal process of analyzing a "system" change and assessing the associated hazards and risks, proposing mitigations, and assigning oversight or monitoring of the corrective action.

CHAPTER CONTENTS

This chapter presents findings relating to the development and implementation of SRM processes with specific questions focusing on SRAs.

FINDINGS AND ANALYSIS

SRAs were conducted as part of the implementation study; however, some airports participated in non-FAA SMS pilot study SRAs, which is noted and included in the chapter findings.

Safety Risk Assessments

Figure 16 provides information on SMS pilot study airports that have conducted SRAs. Airports participating in the SMS implementation study were required to conduct SRAs. As expected, all SMS implementation study airports (all 14 participating in the survey) replied "yes" to having conducted SRAs within the study. Nine other airports reported "yes" they had conducted SRAs and three replied "no" they had not performed SRAs. Collectively, the results are that 23 of the surveyed airports have conducted SRAs and only three have not.

For airports replying "yes" to having conducted SRAs, a list of SRA topics was collected and is presented in Table 21. The majority of topics focused on airside hazards, including wildlife, ramp operations, snow removal, irregular operations, and construction; however, some airports conducted terminal or landside SRAs on topics such as pedestrian walkways, conveyance systems, signage, and change management. The range and type of SRAs conducted suggest that the SRA process may be applied to any aspect of airport operations, not merely the airside.

A subject matter expert typically conducts SRAs. However, for more complex issues, airports have found it helpful to use a panel of experts, including airport staff and stakeholders. The airport then designates someone to formally manage the five-step risk assessment process and associated documentation developed for the SRA. In these cases, a facilitator is used to engage the panel, cultivating discussion among panel members about potential hazards, risks, and mitigations. Figure 17 provides a summary of SRA facilitations at the SMS pilot study airports with 10 implementation personnel as the facilitators, six consultants facilitating, four combined consultant and implementation personnel facilitators, and three FAA or other facilitators. Comments from airports (specifically the SMS implementation study airports) indicated that consultants conducted the first or second SRA (a minimum of three SRAs was required as part of the SMS implementation study deliverables) and subsequent SRAs were either cofacilitated (four) or the airport personnel took over the SRA facilitation.

LESSONS LEARNED

Synthesis study questions focused on SRAs and did not include discussions regarding the airport's overall SRM processes. The SRAs conducted as part of the SMS implementation

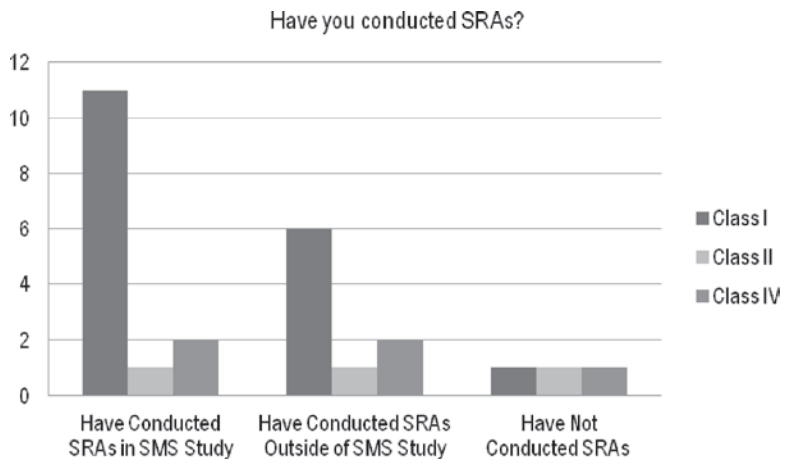

FIGURE 16 SRAs conducted.

TABLE 21
SRA TOPICS BY AIRPORT SIZE

Airport	SRA Topics Reported by SMS Pilot Study Airports
Class IV	Blind Spots on the Ramp Area, New Technical Center Pedestrian Routes, Wildlife
Class II	Entire Airport Incorporating Review of Records (including tenant's documents)
Class I	Vehicle Traffic on Ramp, FOD, Taxiway Conversion, Restricted Crossing for Baggage Transport
Class I	Winter Weather Operations, Surface Incidents on the Aircraft Movement Area and Ramp, Construction Safety-Terminal A, Phase I, Pavement Rehabilitations
Class I	Runway Reconstruction
Class I	Tower Glass Replacement for FAA Tower, High-Speed Turnoff for Runway, Construction with Runway Safety Area
Class I	Proposed Changes in Level of Service, Airside Vehicle Program, Closing Taxiway, Taxiway Widening, Aircraft Size Relating to Barriers of the Taxiway
Class I	Airbus 380 Operations, Runway Pavement, All Hazardous Inventory Assessment
Class I	Change Management
Class I	General Hazards, Wildlife Issues, Signs, and Stoplights
Class I	Fire and Master Evacuation Plan, Decouple Runway, Customs Use of the Ramp, Wildlife
Class I	Public Conveyance Systems, Commercial Ramp Operations, Capital Budget Process
Class I	Environmental, Bypass Taxiway, Convert Nonmovement to Movement Area
Class I	Special Events, Winter Operations, New Terminal Orientation on the Ramp, Gate Usage During Construction, Request from FBO to Taxi Aircraft, Overlay Project, UPS Ramp to Introduce the SRA Concept to the Airport Community
Class I	Major Runway Rehabilitation, Escalator Issues, Cut Over Taxiway
Class I	Car Show, Snow Removal, Runway Marking and Operations, Air National Guard for Testing
Class I	Taxiway Project
Class II	Retaining Wall with Drop-off on Perimeter, Signage in Movement Area, Runway Safety Area Markings
Class IV	Construction Pavement Projects, Annual Air Show
Class IV	Airfield Incursions Hot Spots, Wildlife Hazards, Ramp Operations Analysis
Class I	Ground Service Vehicles, Employee Safety Awareness, Fuel Service Vehicles, Movement Driving Awareness Regarding Safety, Safety Identification, and Reporting Systems
Class I	Public Safety Burning Structure, Burning Aircraft, and Hazardous Materials
Class I	Irregular Operations, Roofing Project, Commercial Ramp System, Community Fly-in Event
Class I	Jetway Safety, Operations on Closed Runways, Wildlife Hazard Management

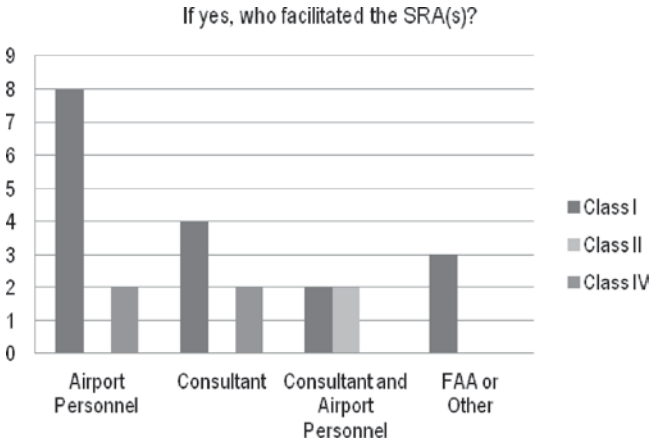

FIGURE 17 Personnel or organization who facilitated SRAs.

study and other non-SMS pilot study activities provided the opportunity to assess the integration of the SRA as a core element of the SRM. No information was collected regarding the airport's development of risk matrices, severity and likelihood definitions, and so forth.

Safety Risk Management

Although no specific questions were asked regarding the airport's overall SRM processes, valuable information was acquired on the mechanisms for conducting and facilitating SRAs.

Lesson Learned: SRM is facilitated by the development of various topic-related SRAs.

Safety Risk Assessments

The broad SRA topics presented by airports for both air and landside operations demonstrate that the five-step SRA process recommended by ICAO and FAA can be applied to various aspects of airport operations.

Lessons Learned: Airports are conducting SRAs outside the specific context of SMS pilot studies. SRAs are developed and managed by a broad range of personnel with subject matter expertise.

CHAPTER FIVE

SAFETY MANAGEMENT SYSTEM AND SAFETY ASSURANCE

BACKGROUND

FAA states in its NPRM, "Safety Assurance is a set of processes that monitor the organization's performance in meeting its current safety standards and objectives as well as contribute to continuous safety improvement." Safety assurance essentially serves as a checks-and-balances system to ensure that SMS processes and procedures and risk mitigation strategies are having their intended effect (FAA 2010). ICAO states,

> Assurance can simply be defined as "something that gives confidence." The Safety Risk Management process in the SMS starts with the organization obtaining a good understanding of its operational processes and the environments in which it operates; progresses through hazard identification, safety risk assessment and safety risk mitigation, and culminates in development and implementation of appropriate safety risk controls (ICAO 2009).

As a further explanation,

> The primary task of Safety Assurance is control. This is achieved through safety performance monitoring and measurement, the process by which the safety performance of the organization is verified in comparison with the Safety Policy and approved safety objectives. Safety assurance control is conducted by monitoring and measuring the outcomes of activities that operational personnel must engage in for the delivery of services by the organization. [Therefore,] a process of permanent examination, analysis and assessment of these controls must continue throughout the daily operation of the system. The Safety Assurance process mirrors that of quality assurance, with requirements regarding analysis, documentation, auditing, and management reviews of the effectiveness of the safety risk controls (ICAO 2009).

The ACRP Guidebook states,

> One of the core concepts addressed by SMS is continuous improvement. The elements grouped under this pillar [component] provide the tools to accomplish that. This includes ensuring that all measures put in place are adhered to, reviewing and evaluating the actions taken to ensure that they are producing the desired effects, and monitoring business activities and their impact on safety to help determine where your efforts should be directed. Safety Assurance differs from SRM because the target of Safety Assurance is to identify and evaluate deficiencies and improve the performance of the system, instead of looking at individual hazards and associated risks. The focus of Safety Assurance is the effectiveness of the SMS (Ayers et al. 2009).

To focus on the principle of continuous improvement, SMS requires a strong and comprehensive Safety Assurance program that includes " . . . self-auditing, external auditing, and safety oversight. Safety oversight can be achieved through auditing and surveillance practices. Safety Assurance aims to ensure that the activities, plans, and actions taken to improve safety are implemented and effective" (Ayers et al. 2009).

CHAPTER CONTENTS

This chapter presents findings relating to the safety assurance component, including plans for expanded inspections to the ramp area and the baggage makeup area, audit and evaluation program development and use, and safety policy objectives metrics and measurements.

Within the required tasks documented in the FAA's *Participant Guide for Part 139 SMS Implementation Study*, the FAA requested that airport participants "Conduct an internal audit/evaluation following the methods and procedures prescribed under the Safety Assurance component of the airport's SMS manual or applicable documentation and report the findings of its internal audit/evaluation" (FAA 2011).

The ACRP Guidebook defines internal audits as "an internal inspection or assessment of the activities, systems, and processes used by the organization related to safety and the SMS" and "periodic assessments, audits, and inspections . . . is very similar to the gap analysis prior to SMS implementation, with the difference that an assessment should check the overall performance of the system and identify areas for improvement" (Ayers et al. 2009).

Owing to the short duration of the SMS implementation study, the ability of participating airports to conduct audits was restricted based on the limited amount of data that could be collected within the 13-month pilot study time frame. Thus many airports did not conduct formal SMS audits and, instead, performed SMS evaluations to assess the current state of SMS components.

FINDINGS AND ANALYSIS

All Part 139 airports conduct daily inspections. Within SMS, inspection data are used (now or in the future) by airports as inputs into safety assurance audits. Questions relating to the

extension or expansion of the Part 139 program were asked to assess whether airports were considering or had modified the current inspection program to encompass a broader reach into the ramp areas and the terminal (baggage makeup areas specifically). As mentioned previously, airports interviewed were in the preliminary stages of SMS implementation and, though they were able to discuss current inspection programs, they were not yet in a position to thoroughly discuss audits because of the lack of available data.

Inspection Programs

In shown in Figure 18, implementation and nonimplementation airports were asked whether, through the SMS, they intended to extend or expand the current inspection program to the ramp. Four airports reported that they had existing detailed ramp inspection programs currently in place. Fifteen airports reported that they had or planned to extend the inspection program to the ramps and seven responded "no" they had not extended inspections to the ramps.

As outlined in the FAA's NPRM for implementations, the FAA states that with regard to regulation of the nonmovement area,

> Under this proposal, an airport would implement its SMS throughout the airport environment, including the movement and non-movement areas (including runways, taxiways, run-up areas, ramps, apron areas, and on-airport fuel farms). The FAA acknowledges the proposal extends the scope of part 139 by including the non-movement areas, but the FAA has concluded that ensuring safety in air transportation requires that an SMS applies to any place that affects safety during aircraft operations.

The FAA later states, "[it] does not intend to require airports to extend their SMS to the landside environment such as terminal areas. Nevertheless, an airport may voluntarily expand its SMS to all airside and landside environments" (FAA 2010).

Airports were queried whether they planned to extend the inspection program to the baggage makeup area. The three airports that had participated in the proof-of-concept study were asked to investigate the inclusion of the baggage makeup area in the SMS program as a means to manage ground service provider activities away from the ramp. One of the three airports that participated in the follow-on/proof-of-concept study has begun to implement a focused baggage makeup area inspection program as part of the SMS to address safety concerns such as speeding and FOD originating in ground service provider, staff, and tenant baggage carts and tugs. Of the implementation and nonimplementation airports, the response results (Figure 19) include eight "yes," 13 "no," two "not sure," and three indicated that their general aviation airport had no baggage makeup area and therefore the question was not applicable.

Airport comments regarding the extension of the program to the terminal and landside included statements that planned airport-wide reporting and management will require consistent reporting throughout the airport organization and that restricting the safety program to the airside was not consistent with the safety policy and objectives. Also one airport commented that training staff and tenants to be safe in a certain way on the airside and another way in the terminal and landside areas would lead to confusion and inconsistent reporting; safety reporting was planned to encompass all airport activities regardless of location.

Audit and Evaluation Programs and Quality Assurance

The remaining questions relating to the safety assurance component of SMS focused on the audit and evaluation portion of the SMS program. Airports were asked whether as

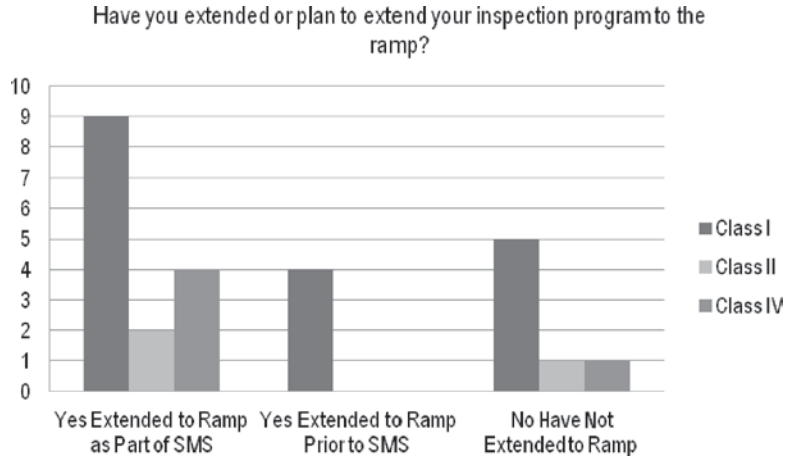

FIGURE 18 Inspections extended to the ramp.

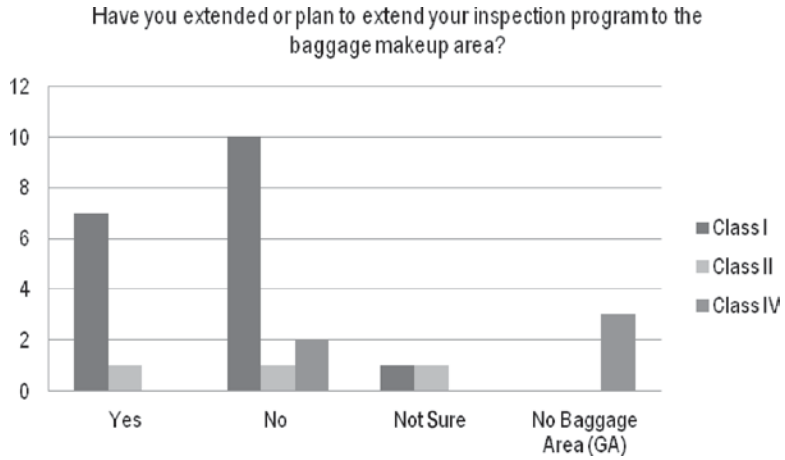

FIGURE 19 Inspections extended to baggage makeup.

part of their SMS they developed an evaluation or audit program. One of the deliverables in the SMS implementation study group was to conduct an program evaluation or audit. Therefore, expectations were that all 14 SMS implementation study airports participating in the survey would reply "yes" to the question. However, as shown in Figure 20, nine airport respondents replied "yes" to having developed an SMS evaluation or audit program, 13 responded "no," and the remaining four commented that the program evaluation and audit was "being developed."

Assuming that some of the airports responding "yes" to developing an SMS evaluation or audit program would eventually perform the evaluation or audit, airports were asked if they had completed the task. As shown in Figure 21, one of the respondent airports replied "yes" to having conducted an SMS evaluation or audit, five replied "no," and 13 SMS implementation study respondents replied, "not yet." Only one of the total group had completed an audit or evaluation; however, owing to the timing of the Synthesis interviews (August–September 2011) most of the SMS implementation study airports had not yet completed the audit and evaluation task and report and replied, "not yet."

Data Collection

In an effort to link program audit and evaluation to the safety policy objectives, airports were asked to provide information on data elements that they intended to collect to measure SMS performance. For the majority of airports surveyed, they were in the early stages of compiling existing data and formalizing hazard reporting, including procurement or development of software or database systems to assist in reporting, collecting, or trend analysis. Figure 22 represents responses of nine airports stating "none," meaning no data elements have been identified to measure performance, seven responding "not defined yet" or "not initiated," and the remaining 11 replying "using a formal system" and "accidents/incidents/wildlife."

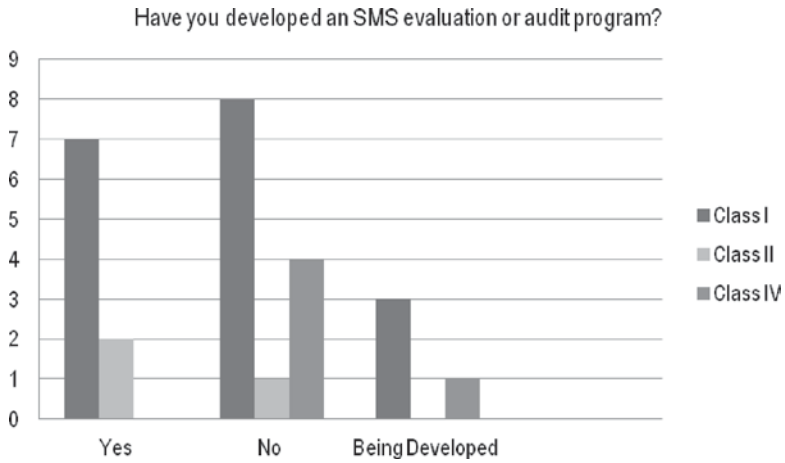

FIGURE 20 Evaluation or audit program developed.

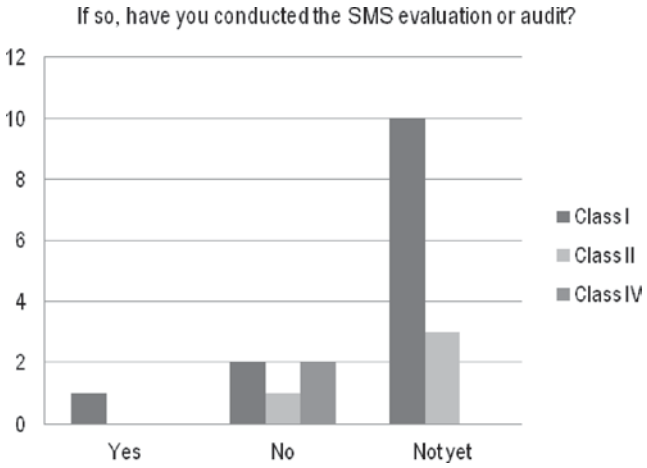

FIGURE 21 Evaluation or audit conducted.

As part of the implementation study, some airports purchased or developed data or software systems. Although individual airport efforts varied, these systems were typically developed or purchased to track, monitor, and report on hazards, accidents, incidents, risk, mitigations, non-Part 139 inspections, and audits. A variety of industry systems and software products exist to support the SMS. Table 22 presents airport respondents' plans for collecting and trending data, including a list of software solutions. For some smaller airports, spreadsheets, MS Access databases, and paper-based tracking were reported. Other airports are considering expanding existing systems such as Maximo or their Airport Security and Operations Compliance System or have purchased products such as Eagle, E-risk, Intelex, OAG Incident Reporter, SMSPro, TRA, and so forth.

TABLE 22
SOFTWARE AND OTHER MEANS TO COLLECT DATA

Class	How Do You Plan on Collecting and Trending Data?
Class I	Airport Security & Operations Compliance System (ASOCS)
Class I	Current asset management system
Class II	Custom developed
Class I	Custom mobile reporting on SMS database for safety critical systems
Class I	Custom online database
Class I	Eagle software
Class I	ESIS e-risk
Class II	In-house custom-built system
Class I	Intelex software
Class I	Maximo
Class I	Multiple programs
Class I	OAG Incident Reporter
Class IV	OAG Incident Reporter
Class II	Paper-based reporting
Class IV	Paper-based reporting
Class IV	Paper-based reporting
Class II	SMS Pro
Class I	TBD could be in-house or purchased
Class I	TRA software
Class I	Using an in-house Access database
Class IV	Using Excel

LESSONS LEARNED

Inspections

Airports conduct daily inspections for Part 139 compliance; extending inspections to the ramp and to other non-airside locations is being considered by many airports for a vari-

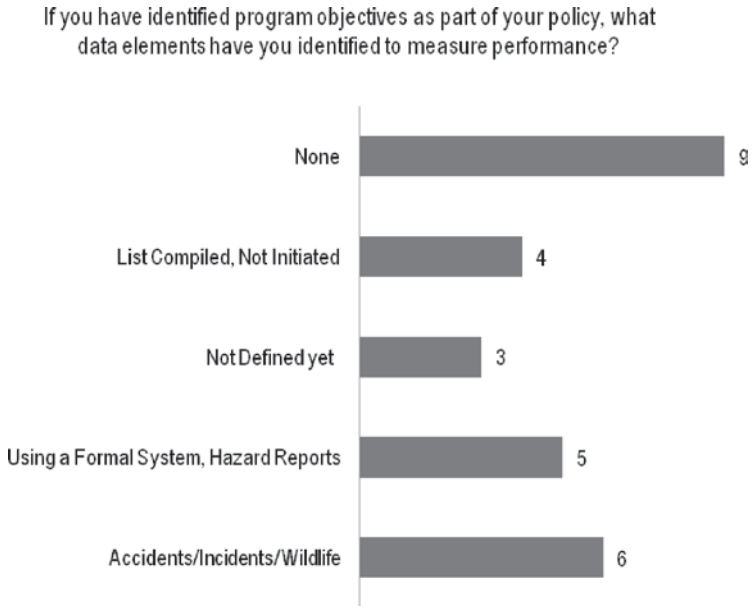

FIGURE 22 Data elements to measure performance.

ety of reasons, including consistent reporting and program management.

Lesson Learned: Expansion of the SMS program to the terminal and landside operations might be considered in addition to the movement and nonmovement areas as the SMS program is being designed and developed.

Audits

Audit results benefit from a solid baseline set of data and a few year's worth of information to assess trends.

Lesson Learned: Conducting a program audit in Year 1 can be challenging. Performing a program evaluation where incremental milestones have been achieved may be of greater use to management, especially with regard to assessing SMS policy objectives and goals.

Data Collection

Data collection and use as part of the safety assurance component of the airport SMS are being addressed by airports using fit-for-purpose solutions such as commercial off-the-shelf software, custom application development, and paper-based systems. Data collection at some airports is currently or is planned to include the landside and terminal areas for continuity of management and reporting.

Lesson Learned: Data collection and trending are at the core of safety assurance and data collection solutions vary depending on airport size and SMS program scope.

CHAPTER SIX

SAFETY MANAGEMENT SYSTEM AND SAFETY PROMOTION

BACKGROUND

The FAA states in its NPRM,

> Safety Promotion includes processes and procedures used to create an environment where safety objectives can be achieved. Safety promotion is essential to create an organization's positive safety culture. Safety culture is characterized by knowledge and understanding of an organization's SMS, effective communications, competency in job responsibilities, ongoing training, and information sharing. Safety Promotion elements include training programs, communication of critical safety issues, and confidential reporting systems (FAA 2010).

ICAO discusses in the SMM that

> many of the processes and procedures specified in the Safety Policy and objectives and Safety Risk Management and Safety Assurance components of the SMS provide the structural building blocks of an SMS. However, the organization must also set in place processes and procedures that allow for communication among operational personnel and with the organization's management. Organizations must make every effort to communicate their objectives, as well as the current status of the organization's activities and significant events. Likewise, organizations must supply a means of upward communication in an environment of openness (ICAO 2009).

With regard to training, ICAO further clarifies that

> safety training within an organization must ensure that personnel are trained and competent to perform their safety management duties. The SMS manual (SMSM) should specify initial and recurrent safety training standards for operational personnel, managers and supervisors, senior managers and the accountable executive. The amount of safety training should be appropriate to the individual's responsibility and involvement in the SMS. The SMSM should also specify safety training responsibilities, including contents, frequency, validation and safety training records management (ICAO 2009).

CHAPTER CONTENTS

This chapter focuses on the training and safety cultural aspects of the SMS promotion component. Questions asked of airports focused primarily on training program development, number and type of staff trained, and plans for tenant orientation or training programs. Cultural challenges and types of promotional activities were collected as part of the discussions and are also presented in this chapter.

FINDINGS AND ANALYSIS

As described by ICAO, the safety promotion component of SMS includes "a) training and education, including safety competency; and b) safety communication" (ICAO 2009). ICAO addresses culture outside of the specific safety promotion component and applies culture broadly to the entire SMS set of activities, data collection, and reporting processes, stating:

> Culture can be described in the simplest terms as a "collective programming of the mind." Culture influences the values, beliefs, and behavior that we share with the other members of our various social groups. Culture binds us together as members of groups and provides clues and cues as to how to behave in both normal and unusual situations. Culture sets the rules of the game, or the framework for all our interpersonal interactions. It is the sum total of the way people conduct their affairs in a particular social milieu and provides a context in which things happen. In terms of the management of safety, understanding culture is as important as understanding context, since culture is an important determinant of human performance (ICAO 2009).

Analysis for this chapter primarily focused on training programs with the interview survey containing six questions relating to training and two to safety culture.

Training

As airports begin to develop SMS training programs for their staff and possibly tenants, training scope, curriculum, delivery methods, duration, and recurrence could be considered as part of the SMS development process. A set of questions, including a question related to the training or orientation of airport tenants, was compiled to collect information on training programs and staff participation. Figures 23 and 24 present responses to questions related to developing training programs and training staff. Of the airports surveyed (Figure 23), 11 responded that they had developed a training program for staff, 12 replied that they had not developed a training program, and the remaining three airports stated that they were in the process of building their training program.

Within the list of eligible expenses for the implementation study, the FAA specifically included (1) costs associated with developing training materials for SRM or safety assurance techniques and (2) costs associated with contractor-assisted training for SRM or safety assurance techniques. Not all SMS

FIGURE 23 Training programs for staff.

implementation study airports developed training programs or delivered training to staff. As presented in Figure 24, 15 airports trained staff in one or more courses or instructional programs, four airports indicated they have not trained staff yet, and seven responded they had no program in place yet.

Airports provided a list of training modules and curriculum that they are developing for internal staff, which is presented in Table 23. The curriculum includes orientation and management training and specific technical courses, such as root cause analysis and human factors. The top four courses reported are

1. Safety Orientation;
2. Introduction for Managers;
3. Safety Assurance, Hazard Identification, and Audits; and
4. Safety Risk Assessments and Safety Risk Management

The 15 airports that replied that they trained staff (Figure 24) were asked to provide a list of types of staff trained. Figure 25 represents the types of staff who attended training. The largest percentage of staff trained was cited as "various airport personnel." However, no further questions were asked on what was meant by this term.

Because of the potential challenges in developing a training program, airports were asked if they encountered challenges and to provide a description of the concerns. Figure 26 presents a list of challenges with time restrictions and funding as the top two responses. Many airports commented that they were planning on developing in-house training, had engaged the consultant to provide or coordinate the training, or had sent staff to external academic or industry specialized training courses.

Responses to the question regarding tenant training or providing orientation to tenants are reflected in Figure 27. Nearly one-third of the responses (eight) reported that tenant training is still under discussion. Four airports replied that a training overview would be part of the SMS and another three indicated they would include the training as part of other existing training programs (i.e., security identification display area

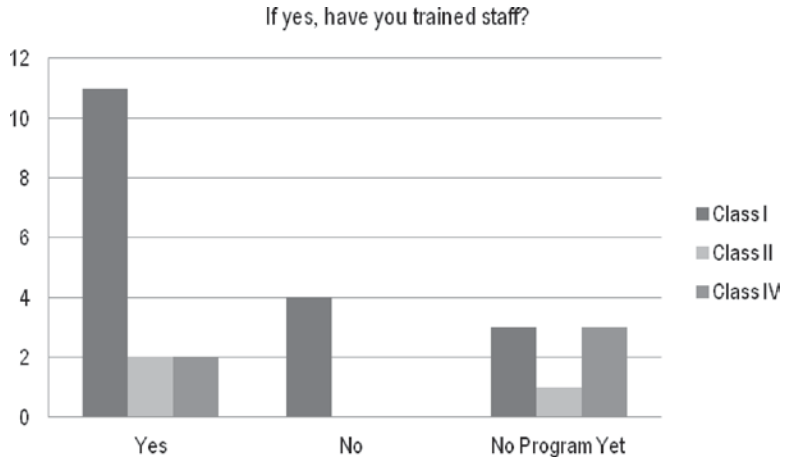

FIGURE 24 Staff trained as part of SMS.

TABLE 23
TYPES OF TRAINING CURRICULUM PLANNED OR DELIVERED

	Safety Orientation	Intro for Managers	Safety Assurance, Hazard ID, Audits	SRA/SRM Course	Human Factors	Root Cause	SMS Manual Overview	Outlined Only Not Deploying Training
Class I		X	X	X				X
Class I	X	X			X	X		
Class I	X			X				
Class I	X	X			X			
Class I	X		X		X			
Class I								X
Class I	X	X	X	X	X	X	X	
Class I	X							
Class I		X	X					
Class I			X	X				
Class I	X	X	X	X				
Class II	X							
Class II	X	X						
Class II							X	
Class IV			X	X				
Class IV	X							
Count	10	7	7	6	4	2	2	2

training), and another four stated they would wait for the regulatory requirement before developing a SMS training program.

Safety Culture

ICAO provides guidance regarding safety culture in the SMM, stating that

> The attempts to protect safety information and the reporter from punishment were developed using the term *culture*, for example, "non-punishing culture," "non-blame/blame-free culture," and lately "safety culture" or "just culture." The word culture does have specific meanings and the context in which it is used in this case can lead to misperception and misunderstanding. Nevertheless, safety and just culture have become broadly accepted, although not universally defined, terms to describe the context in which safety practices are fostered within an organization. These safety practices include a series of organizational processes, procedures and policies that aim to achieve a specific outcome, the identification of hazards. The processes (effective safety reporting), procedures (hazard reporting system) and policies (Safety Policy, fair treatment of reporters, etc.) are complex, specific ideas and behaviors that can be packaged in such a way as to make them easily understandable to a wide audience and therefore easier to apply on a large scale. However, their substance and application will reflect the culture, in the true sense of the word, of the state or organization that develops them. Global adoption of a single, common safety or just culture could therefore be considered discriminatory, perhaps even judgmental, if the local culture is not the same (ICAO 2009).

Airports were posed two questions relating to their experiences with regard to cultural challenges. A compiled list of challenges is presented in Figure 28, with "Buy-in" and "Reluctance to Change" as the top two reported challenges.

To encourage staff and tenants to engage in the SMS, airports used a variety of promotional methods, such as committee meetings, training, and face-to-face communication, as a means to educate and increase awareness. Table 24 provides an overview of each of the types of techniques by airport class.

LESSONS LEARNED

According to the Patrick Hudson paper on *Safety Management and Safety Culture*, Hudson states that "Advanced safety cultures can only be built upon a combination of a top-down commitment to improve and the realization that the workforce is where that improvement has to take place. The workforce has to be trusted and has a duty to inform. What this means in practice is that in an advanced safety culture it becomes possible

FIGURE 25 Staff trained by department.

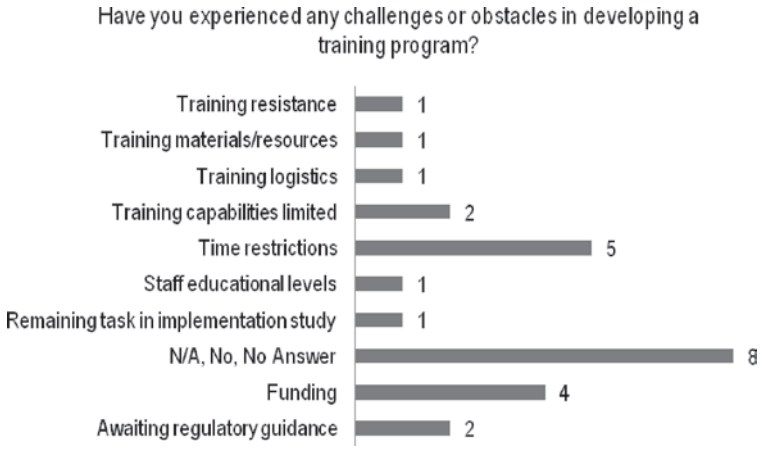

FIGURE 26 Training challenges.

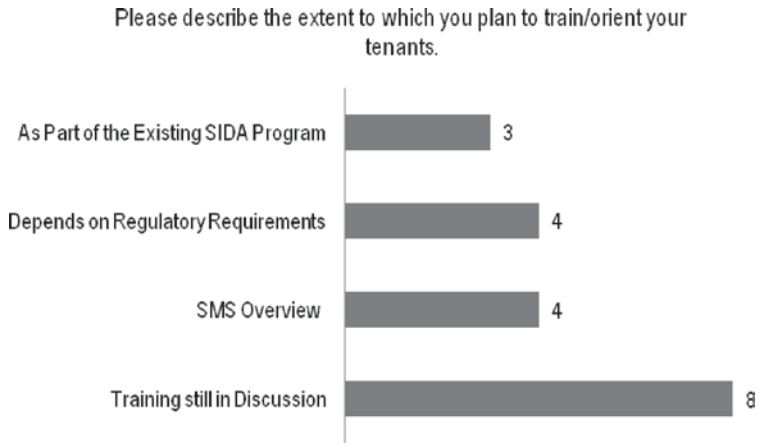

FIGURE 27 Tenant training plans.

to reap extra benefits, beyond having fewer accidents, such as reductions in the audit frequency" (Hudson n.d.).

As documented in the ACRP Guidebook,

> Culture is equivalent to a set of shared values held by the employees, the management, and the airport organization in general. Improving culture therefore means changing these values. However, changing individual and organizational values is not easy. Indeed, attempting to act directly on values is most likely to be met with cynicism, resistance and, ultimately, failure. Changing values is a long process that can only be achieved by first changing practices. Therefore, safety culture promotion efforts might focus on altering practices, in combination with a demonstrable and visible change in management

FIGURE 28 Cultural challenges.

TABLE 24
TYPES OF SAFETY CULTURE PROMOTIONAL METHODS

	Meetings /Committees	Face to Face Communication	Training/Education	Promotional Campaigns/Events	Reporting	Management	Newsletters	Hotline
Class I	10	0	5	8	4	3	2	3
Class II	1	0	1	1	0	1	0	0
Class IV	1	1	1	3	3	1	0	0
Count	12	7	7	5	3	2	1	1

attitude and leadership. Establishing an effective SMS will assist in this process, but it is not sufficient.

Training

A variety of training programs were developed by airports and consultants to address the new or expanded skills needed for staff and management to implement and operate the SMS. Plans for airports to provide SMS training or orientation for tenants are unclear at this time for many airports.

Lesson Learned: Training programs are scalable to each airport and operation, including staff skills development based on positions and additional duties assigned.

Culture

The two questions asked of airports do not provide a thorough assessment of airport approaches to safety culture; however, responses relating to cultural challenges indicate that airports were aware of and addressed cultural aspects of the SMS program and had developed strategies to increase or change safety culture awareness. Methods included face-to-face communication and training as means to engage staff and tenants in conversations relating to culture.

Lesson Learned: Staff buy-in and reluctance to change can affect implementation of a SMS; early activities such as direct communication and training are documented means to promote SMS.

CHAPTER SEVEN

SAFETY MANAGEMENT SYSTEM CHALLENGES AND BENEFITS

BACKGROUND

The majority of airports that participated in the ACRP Survey (19) were in the process of implementing the SMS. The Synthesis study was interested in discussing some of the challenges encountered and benefits achieved as part of the SMS studies.

As the aviation industry expands, challenges are encountered which must be mitigated through technology and improvements in business processes. ICAO comments that

> As global aviation activity and complexity continue to grow, deeply changed operational contexts with their new challenges make traditional methods of managing safety to an acceptable level less effective and efficient. Different, evolved methods of understanding and managing safety are necessary. There is a transition currently taking place in international civil aviation, which reflects a significant shift from the paradigm espoused by the safety endeavours of the past. [Therefore,] there is a developing tendency in civil aviation to integrate all these different management systems. There are clear benefits to such integration:
>
> a) reduction of duplication and therefore of costs;
> b) reduction of overall organizational risks and an increase in profitability;
> c) balance of potentially conflicting objectives;
> d) elimination of potentially conflicting responsibilities and relationships; and
> e) diffusion of power systems (ICAO 2009).

The ACRP Guidebook provides a listing of common challenges relating to the implementation and adoption of a SMS. Challenges include management commitment, behavioral change, maintaining momentum, cultural characteristics, taking responsibility for safety, and airport stakeholders. The Guidebook documents various strategies and solutions to address challenges for airport operators, including the statement, "SMS will require change, and people are naturally resistant to change. Too often, the importance of this human characteristic is disregarded. If not handled properly, it can lead to misunderstanding and frustration" (Ayers et al. 2009).

CHAPTER CONTENTS

This chapter presents findings from the questions relating to program challenges, benefits, and the airport's commitment to continue SMS in the future. Five questions were asked relating to challenges, how challenges were overcome, program benefits achieved, and the airport's planned pursuit of SMS in the future.

FINDINGS AND ANALYSIS

Challenges

The Synthesis was interested in capturing responses from the FAA pilot airports to discuss how identified challenges were overcome. The lessons learned from airport's methods to resolve or mitigate challenges could provide practical advice to airports in the future as they implement a SMS. As presented in Figure 29, of the 26 airports surveyed, the top three challenges were

1. Lack of FAA support/resources (six);
2. Stakeholder buy-in (six); and
3. Educating staff (four).

The FAA's May 2011 Technical Report, *Federal Aviation Administration Airport Safety Management Systems* (*SMS*) *Pilot Studies*, states, "In general, airport operators found the guidance was sufficient. They suggested we further clarify areas such as SMS development, support tools, and templates" (FAA 2011). However, as indicated in Figure 30, survey results from the Synthesis study respondents indicate that lack of FAA support was one of the two most significant challenges identified among the survey respondents. As reported in Table 11, the most frequent document reportedly used by SMS pilot study airports was the AC 150/5200-37 *Introduction to Safety Management Systems for Airport Operators*. The AC was authored in early 2007 and until the SMS NPRM was published in October 2010, no other FAA-authored guidance documents existed. Additionally, airports surveyed noted that the importance of the AC over all other documents was its ability to provide insights into the future FAA rulemaking.

With regard to mitigations or methods to overcome the challenges, a variety of responses were collected, as shown in Figure 30. The top two frequent replies were "getting stakeholder buy-in" (six) and "lack of FAA support/resources" (six). Other methods that SMS pilot study airports believed would help overcome the challenges they faced include networking, working with local FAA offices, raising awareness, persistence, training, time management, and hiring experts.

FIGURE 29 Most significant SMS challenge.

TABLE 25
BENEFITS FROM SMS PROGRAM

	Increased Safety Awareness	Improved Collaboration	Improved Communication	Improved Documentation	Increased Security	None at This Time
Class I	10	5	3	4	0	0
Class II	1	1	1	0	0	1
Class IV	6	0	0	0	1	0
Count	17	6	4	4	1	1

Benefits

Early in the survey (Question 11), airports were asked if they had seen benefits as a result of the SMS studies they had participated in or programs developed after the studies were completed. The most frequent response from all the airports, as presented in Table 25, was increased safety awareness. The second most common response was improved collaboration. Many airports saw better communication and collaboration both internally among airport departments and with tenants through safety committee meetings and SRA panel sessions.

Pursuit of Safety Management Systems

The final two questions in the survey asked respondents if their airport would continue the development and implementation of the SMS. Figure 31 presents responses from all airports, with 24 replying "yes" and only two responding "no."

When asked why airports would continue with implementation of the SMS components (Figure 32), more than half (14) indicated it was because the program was beneficial, one-third (seven) indicated that it would likely be a regulatory requirement, and others spoke of the increased safety awareness.

LESSONS LEARNED

The FAA NPRM states that,

> While the NTSB has not formally recommended the FAA require an SMS for certificated airports, the FAA has concluded those same organizational factors apply to all regulated sectors of the aviation industry. Airports operate in similar environments as air carriers and business flight operators where adherence to standard operating procedures, proactive identification, mitigation of hazards and risks, and effective communications are crucial to continued operational safety. Accordingly, certificated airports could realize similar SMS benefits as an aircraft operator. The FAA envisions an SMS would provide an airport with an added layer of safety to help reduce the number of near-misses, incidents, and accidents. An SMS also would ensure that all levels of airport management understand safety implications of airfield operations (FAA 2010).

FIGURE 30 Methods to overcome challenges.

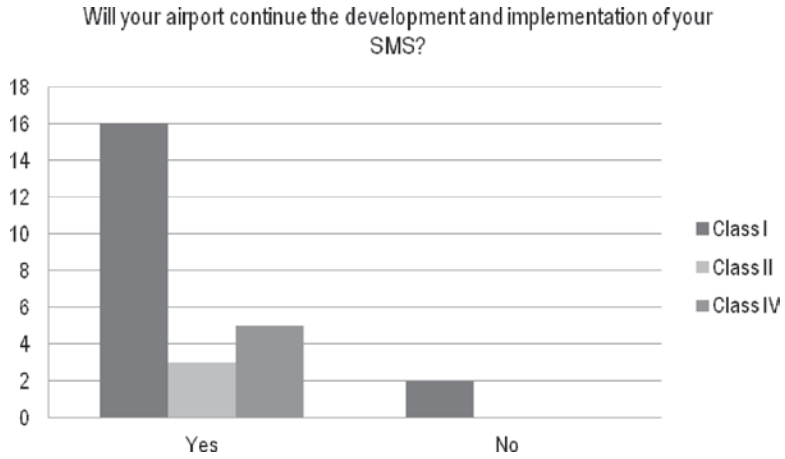

FIGURE 31 Continuation of SMS.

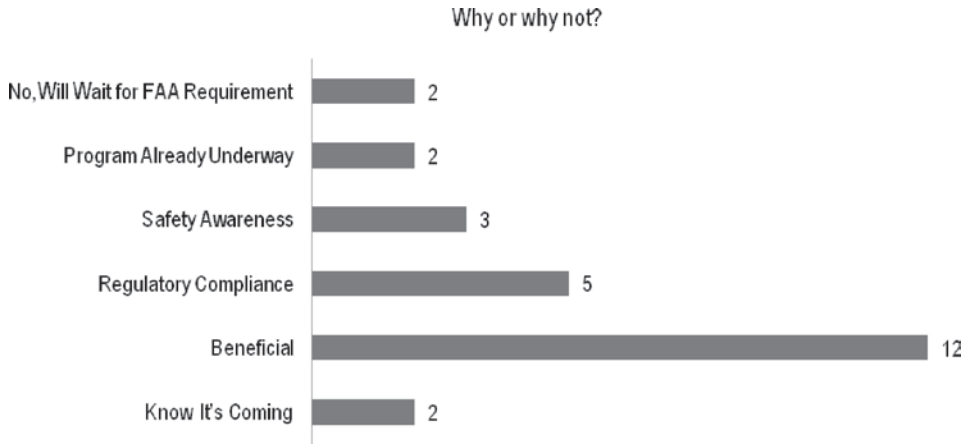

FIGURE 32 Reasons to pursue SMS program.

The FAA further reports in the May 2011 report on SMS implementations that, with regard to SMS pilot study benefits, "Overall, airport operators benefitted from improved communication and increased safety awareness" (FAA 2011).

Challenges

Survey results from the Synthesis study report that lack of FAA support was one of the most significant challenges.

Lesson Learned: Airports are awaiting additional resources and forthcoming SMS guidance from the FAA.

Benefits

Predictive safety relies on collecting and compiling information in a proactive manner. SMS provides a framework for improved data collection and analysis with regard to safety. Hazard analysis and safety risk assessments allow management to formally document safety concerns.

Lesson Learned: Improved communication, increased safety awareness, integration of disparate departments and staff through collective assessment of risk and budgets, and data collection and trending analysis to provide a higher level of awareness are reported as benefits of the SMS pilot studies.

CHAPTER EIGHT

CONCLUSIONS

This ACRP Synthesis study effort provided an opportunity to survey airports that participated in one of the four FAA safety management system (SMS) pilot studies. Results from 26 of the 31 airport participants offer insight into the various program efforts, challenges, and outcomes. The pilot studies allowed airports of various size, location, and operation the ability to assess the impact of a SMS on CFR Part 139 operations.

Although no U.S. airport has completely implemented SMS, 18 of the 26 interviewed airports indicated that some level of SMS implementation is underway. Whether the implementation is the result of the FAA SMS pilot study activities or through individual airport initiatives, U.S. airports are gaining valuable experience integrating SMS into Part 139 operations.

TRENDS

General trends and common themes have been documented in each chapter, including key lessons learned, which are comprehensively listed in the following section. Overall implementations participating in the four FAA SMS pilot studies indicated the efforts were of value and, many believe, provided a head start for compliance with the upcoming rulemaking.

LESSONS LEARNED

A summary of lessons learned from the SMS pilot study interviews is presented here. Each chapter and topic provides additional detail and discussion for the lessons learned.

- **SMS Pilot Study Program Management:** Clearly defining the SMS project development documents, such as a program plan and schedule, assist with the airport's ability to design, plan, and deploy the SMS.
- **Gap Analysis Process and Report:** Ensuring adequate or flexible SMS program timelines to conduct a gap analysis (or other business analysis efforts) assists airports in developing program plans.
- **SMS Manual Development:** Allowing adequate time to design, develop, test, and deploy the SMS manual through the life of the program implementation improves the quality of the manual and associated processes.
- **Program Plan Development:** Developing program plans to be flexible supports the airports' SMS implementation timelines and staffing constraints.
- **Consultant Services:** Local airport and U.S. Part 139 experience are valuable SMS consultant skills in consultant selection in addition to SMS development and deployment expertise.
- **Reference Documents:** Formal SMS guidance, documentation, and information-sharing opportunities support the SMS design and development.
- **Staffing:** Collateral duties are the reported norm for current and future SMS staff responsibilities; budget constraints and delayed hiring decisions based on forthcoming FAA rulemaking are cited as the primary reasons new hires are not planned.
- **Budget:** Data collection, analysis, and trending are core functions of SMS and require early planning for adequate budgets to procure or build technological solutions.
- **Safety Policy Development:** The method to develop and deploy a safety policy statement requires various approval processes depending on the airport management structure. Airport safety policy development includes investigating the proper route and approval function early in the SMS program to ensure that adequate time is allocated.
- **Safety Policy Deployment:** Deployment of the safety policy is unique to each airport's internal and external communication paths. Some airports develop a communication plan to roll out the safety policy statement in conjunction with the SMS program.
- **Safety Policy and Objectives:** Linking safety policy objectives to measurable goals and metrics provides management the ability to report on SMS program activities and progress.
- **Safety Risk Management:** Safety risk management is facilitated by the development of various topic-related safety risk assessments.
- **Safety Risk Assessment:** (1) Airports are conducting safety risk assessments (SRAs) outside the specific context of SMS pilot studies. (2) SRAs are developed and managed by a broad range of personnel with subject matter expertise.
- **Inspections:** Expansion of the SMS program to the terminal and landside operations might be considered

in addition to the movement and nonmovement areas as the SMS program is being designed and developed.
- **Audits:** Conducting a program audit in Year 1 can be challenging. Performing a program evaluation where incremental milestones have been achieved may be of greater use to management, especially with regard to assessing SMS policy objectives and goals.
- **Data Collection:** (1) Data collection and use as part of the safety assurance component of the airport SMS is being addressed by airports using fit-for-purpose solutions, such as commercial off-the-shelf software, custom application development, and paper-based systems. Data collection at some airports currently includes or plans to include the landside and terminal areas for continuity of management and reporting. (2) Data collection and trending is at the core of safety assurance and data collection solutions vary depending on airport size and SMS program scope.
- **Training:** Training programs are scalable to each airport and operation, including staff skills development based on positions and additional duties assigned.
- **Culture:** Staff buy-in and reluctance to change can affect implementation of a SMS; early activities such as direct communication and training are documented means to promote SMS.
- **Challenges:** Airports are awaiting additional resources and forthcoming SMS guidance from the FAA.
- **Benefits:** Improved communication, increased safety awareness, integration of disparate departments and staff through collective assessment of risk and budgets, and data collection and trending analysis to provide a higher level of awareness are reported as benefits of the SMS pilot studies.

FURTHER RESEARCH

Further research resulting from identified gaps could include the following:

- Research into revising the existing ACRP Guidebook or a new guidebook that reflects the upcoming revisions to the FAA AC 150/5200-37.
- Research into synthesizing information relating to other operators such as airlines, fixed-base operators, and air traffic, and including SMS harmonization and integration.
- Research into collecting best practices from Air Traffic, airlines, fixed-base operators, and airports designing and developing SMS programs independently to provide insights and strategies to manage challenges, issues, and concerns.
- Research into developing an SRA training guide or manual; currently no standard SRA training or process exists to guide airports or facilitators in facilitation, documentation, and corrective actions. To date, there is no formal facilitation training for airport-related SRAs. The FAA offers numerous SMS-related courses through the Integrated Learning Environment. Although primarily developed for FAA employees implementing requirements of FAA Order 5200.11, the agency released the training to the public in the interest of promoting SMS initiatives and education; however, the training does not address Part 139 SMS.
- Research into developing a Part 139 gap analysis checklist and guide; the aviation industry could benefit from research and development of a gap analysis checklist that is geared for Part 139 airports.
- Future research that follows up with pilot study respondents in 3 to 4 years to develop a full range of lessons learned after regulatory guidance is finalized.

GLOSSARY OF TERMS AND ACRONYMS

GLOSSARY OF TERMS

Accident: FAA System Safety Definition: An unplanned fortuitous event that results in harm (i.e., loss, fatality, injury, system loss); also see Risk Severity. The specific type and level of harm must be defined; the worst-case severity that can be expected as the result of the specific event under study. Various contributory hazards can result in a single accident; also see Contributory Hazard, Cause, Root Cause, and Initiating Events (www.aviationglossary.com/aviation-safety-terms/accident/).

Airport Categories: Airport categories are defined as follows:

1. **Commercial service airports** are publicly owned airports that have at least 2,500 passenger boardings each calendar year and receive scheduled passenger service. Passenger boardings refer to revenue passenger boardings on an aircraft in service in air commerce whether or not in scheduled service. The definition also includes passengers who continue on an aircraft in international flight that stops at an airport in any of the 50 states for a nontraffic purpose, such as refueling or aircraft maintenance rather than passenger activity. Passenger boardings at airports that receive scheduled passenger service are also referred to as enplanements.
    A. **Nonprimary commercial service airports** are commercial service airports that have at least 2,500 and no more than 10,000 passenger boardings each year.
    B. **Primary airports** are commercial service airports that have more than 10,000 passenger boardings each year. Hub categories for primary airports are defined as a percentage of total passenger boardings within the United States in the most current calendar year ending before the start of the current fiscal year. For example, calendar year 2001 data are used for fiscal year 2003 because the fiscal year began 9 months after the end of that calendar year. The table depicts the formulas used for the definition of airport categories based on statutory provisions cited within the table, including Hub Type described in 49 U.S.C. 47102.
2. **Cargo service airports** are airports that, in addition to any other air transportation services that may be available, are served by aircraft providing air transportation of only cargo with a total annual landed weight of more than 100 million pounds. "Landed weight" means the weight of aircraft transporting only cargo in intrastate, interstate, and foreign air transportation. An airport may be both a commercial service and a cargo service airport.
3. **Reliever airports** are airports designated by the FAA to relieve congestion at commercial service airports and to provide improved general aviation access to the overall community. These may be publicly or privately owned.
4. The remaining airports, while not specifically defined in Title 49 U.S.C, are commonly described as **general aviation airports**. This airport type is the largest single group of airports in the U.S. system. The category also includes privately owned, public use airports that enplane 2,500 or more passengers annually and receive scheduled airline service. The airport privatization pilot program authorized under Title 49 U.S.C., Section 47134, may affect individual general aviation airports (FAA 2012).

Airside: All activities that take place on the movement and nonmovement areas of an airport (as compared to terminal or landside).

Baggage makeup area: The area in which an airport's baggage delivery system is housed, where baggage screening occurs, and where bags are loaded, unloaded, and transferred using carts and other ground service equipment.

Causes: Actions, omissions, events, conditions, or a combination thereof, which led to the accident or incident. Events that result in a hazard or failure are causes; causes can occur by themselves or in combinations.

Class: Airports are classified into four classes, based on the type of air carrier operations served:

Type of Air Carrier Operation	Class I	Class II	Class III	Class IV
Scheduled large air carrier aircraft (30+ seats)	X			
Unscheduled large air carrier aircraft (30+ seats)	X	X		X
Scheduled small air carrier aircraft (10–30 seats)	X	X	X	

Class I airports: Airports serving all types of scheduled operations of air carrier aircraft designed for at least 31 passenger seats (large air carrier aircraft) and any other type of air carrier operations are Class I airports. These airports currently hold an Air Operator's Certificate (AOC) and may serve any air carrier operations covered under Part 139. Accordingly, the operators of these airports must comply with all Part 139 requirements.

Class II airports: Airports that currently hold a limited AOC (or airports that have maintained an AOC after loss of scheduled large air carrier aircraft service) are either Class II airports or Class IV airports. Class II airports are those airports that serve scheduled operations of small air carrier aircraft and unscheduled operations of large air carrier aircraft. Class II airports are not permitted to serve scheduled large air carrier operations.

Class III airports: Class III airports are those airports that serve only scheduled operations of small air carrier aircraft. As specified in the authorizing statute, airport certification requirements are not applicable to certain airports in the state of Alaska.

Class IV airports: Airports that currently hold a limited AOC (or airports that have maintained an AOC after loss of scheduled large air carrier aircraft service) are now either Class II or Class IV airports. Class IV airports are those airports that serve only unscheduled operations of large air carrier aircraft.

Effect: The potential outcome or harm of the hazard if it occurs in the defined system state (FAA 2012).

Federal Docket Management System: The FAA assigns a docket identifier (ID) to each rulemaking document proceeding which is posted on the Federal Docket Management System. Each rulemaking document that FAA issues in a particular rulemaking proceeding, as well as public comments on the proceeding, displays the same docket ID. The Federal Docket Management System can be found at http://www.regulations.gov (FAA 2012).

Final rule: A final rule sets out new or revised requirements and their effective date. It also may remove requirements. When preceded by a Notice of Proposed Rulemaking (NPRM), a final rule will also identify significant substantive issues raised by individuals in response to the NPRM and will give the agency's response.

Foreign object debris/damage (FOD): Foreign object debris or foreign object damage. According to the National Aerospace Standard 412, maintained by the National Association of FOD Prevention, Inc., foreign object debris is a substance, debris, or article alien to the vehicle or system which would potentially cause damage. FOD is any damage attributed to a foreign object that can be expressed in physical or economic terms that may or may not degrade the product's required safety and/or performance characteristics. FOD includes a wide range of material, including loose hardware, pavement fragments, catering supplies, building materials, rocks, sand, pieces of luggage, and even wildlife [NAS 412 Foreign Object Damage/Foreign Object Debris (FOD) Prevention, http://www.nafpi.com/(2012)].

Hazard: Any real or potential condition that can cause injury, illness, or death to people; damage to or loss of a system, equipment, or property; or damage to the environment. A hazard is a condition that is a prerequisite to an accident or incident (FAA 2006).

Hub type: Airports are defined by a percentage of annual passenger boardings:

1. Large hub: 1% or more
2. Medium hub: At least 0.25%, but less than 1%
3. Small hub: At least 0.05%, but less than 0.25%
4. Nonhub primary: More than 10,000, but less than 0.05%
5. Nonprimary commercial service: At least 2,500 and no more than 10,000 (FAA 2012).

Human factors: Human factors involve gathering information about human abilities, limitations, and other characteristics, and applying it to tools, machines, systems, tasks, jobs, and environments to produce safe, comfortable, and effective human use. In aviation, human factors involve the study and application to better understand how humans can most safely and efficiently be integrated with the technology. That understanding is then translated into design, training, policies, or procedures to help humans perform better.

Incident: "An occurrence other than an accident, associated with the operation of an aircraft, which affects or could affect the safety of operations" (FAA 2006).

Investigation: A process conducted for the purpose of accident or incident prevention, which includes the gathering and analysis of information, the drawing of conclusions, including the determination of causes, and, when appropriate, the making of safety recommendations.

Movement area: The runways, taxiways, and other areas of an airport that are used for taxiing or hover taxiing, air taxiing, and takeoff and landing of aircraft, exclusive of loading ramps and aircraft parking areas (FAA 14 CFR 139.3).

Notice of Proposed Rulemaking: A NPRM proposes FAA's specific regulatory changes for public comment and contains supporting information. It includes proposed regulatory text.

Nonmovement area: The nonmovement area consists of aircraft gates, the terminal, cargo facilities, hardstands, taxi lanes, the perimeter roads, and the vehicle drive lanes. This area is also referred to as the ramp, apron, or tarmac. Both aircraft and ground vehicles move on the nonmovement area.

Property damage: Any damage or adverse condition that limits or prevents the use of a structure or building or that requires repairs.

Risk: The composite of predicted severity and likelihood of the potential effect of a hazard in the worst credible system state. Types of risk include:

1. *Identified risk:* That risk that has been determined to exist using analytical tools. The time and costs of analysis efforts, the quality of the risk management program, and the state of the technology involved affect the amount of risk that can be identified
2. *Unidentified risk:* That risk that has not yet been identified. Some risk is not identifiable or measurable, but is no less important. Mishap investigations may reveal some previously unidentified risks.
3. *Total risk:* The sum of identified and unidentified risk. Ideally, identified risk will comprise the larger portion of the two.
4. *Acceptable risk:* The part of identified risk that is allowed to persist after controls are applied. Risk can be determined acceptable when further efforts to reduce it would cause degradation of the probability of success of the operation, or when a point of diminishing returns has been reached.

5. *Unacceptable risk:* The portion of identified risk that cannot be tolerated, but must be either eliminated or controlled.
6. *Residual risk:* The remaining safety risk that exists after all control techniques have been implemented or exhausted, and all controls have been verified. Only verified controls can be used for the assessment of residual safety risk.

Root cause analysis: A systematic approach to identifying, investigating, categorizing, and eliminating the root causes of safety related incidents.

Safety: A condition in which the risk of harm or damage is limited to an acceptable level.

Safety management system (SMS): A formal, top-down business-like approach to managing safety risk. It includes systematic procedures, practices, and policies for the management of safety. It also includes safety risk management, safety policy, safety assurance, and safety promotion (FAA 2007).

Safety risk management (SRM): A generic term that encompasses the assessment and mitigation of the safety risks of the consequences of hazards that threaten the capabilities of an organization, to a level as low as reasonably practicable. The objective of safety risk management is to provide the foundations for a balanced allocation of resources between all assessed safety risks and those safety risks for which control and mitigation are viable. A formal process within the SMS composed of describing the system, identifying the hazards, and assessing, analyzing, and controlling the risk. The SRM process is embedded in the operational system; it is not a separate and distinct process.

Safety risk: The composite of the likelihood (i.e., risk) of the potential effect of a hazard, and predicted severity of that effect (FAA 2010).

Safety risk mitigation: Anything that mitigates the safety risk of a hazard. It is important that safety risk controls necessary to mitigate an unacceptable risk be mandatory, measurable, and monitored for effectiveness.

Safety risk assessment (SRA): A SRA is the formal process of analyzing a "system" change and assessing the associated hazards and risks, proposing mitigations, and assigning oversight or monitoring of the corrective action.

ACRONYMS

AC	Advisory Circular
ACM	*Airport Certification Manual*
AIP	Airport Improvement Program
ARFF	Aircraft Rescue and Fire Fighting
FBO	Fixed-base operator
FOD	Foreign object debris/damage
ICAO	International Civil Aviation Organization
NPRM	Notice of Proposed Rulemaking
OSHA	Occupational Safety and Health Administration
SMM	*Safety Management Manual*
SMS	Safety management system
SRA	Safety risk assessment
SRM	Safety risk management

REFERENCES

Advisory Circular 150/5200-37, *Introduction to Safety Management Systems for Airport Operators,* FAA, U.S. Department of Transportation, Washington, D.C., June 2006.

Airport SMS Pilot 1 Findings, AAAE/MITRE/ACI-NA Safety Management Systems for Airports Conference, FAA, U.S. Department of Transportation, Washington, D.C., Oct. 2008.

Annual Runway Safety Report, FAA, U.S. Department of Transportation, Washington, D.C., 2010.

Ashford, N., H. P. Martin Stanton, and C. Moore, *Airport Operations,* McGraw-Hill, New York, N.Y., 1996.

Ayers, M., et al., *ACRP Report 1: Safety Management Systems for Airports, Volume 2: Guidebook.* Transportation Research Board of the National Academies, Washington, D.C., 2009.

External SMS Efforts, Part 139 Rulemaking, Airport SMS Pilot Studies Website, FAA, U.S. Department of Transportation, Washington, D.C., June 2011.

Hudson, P., *Safety Management and Safety Culture—The Long, Hard and Winding Road,* Centre for Safety Research, Leiden University, Netherlands, n.d., p. 10.

Ludwig, D., et al., *ACRP Report 1: Safety Management Systems for Airports, Volume 1: Overview.* Transportation Research Board of the National Academies, Washington, D.C., 2007.

Safety Enhancements, Part 139, Certification of Airports. *Federal Register,* Vol. 76, No. 21, Docket FAA-2010-0247, FAA, U.S. Department of Transportation, Washington, D.C., 2010.

Safety Management Manual (*SMM*), 2nd ed., International Civil Aviation Organization, Montreal, QC, Canada, 2009.

Safety Management System for Certificated Airports, *Federal Register,* Vol. 75, No. 194, Docket FAA-2010-0997, FAA, U.S. Department of Transportation, Washington, D.C., 2010.

APPENDIX A

Canadian Interview Summary

Although not a part of the FAA studies, administrators from three Canadian airports were interviewed (all Class I equivalents) using the same set of questions to guide the discussion. The Canadian airports were selected based on size, location, and SMS implementation status. In 2005, Transport Canada, which certifies and regulates all airports in Canada, initiated an aviation-wide SMS program. Certain airports (with a certificate issued under Section 302.03) began implementation in 2008 and are in the final phases of SMS implementation. Because U.S. airports are in the early stages of implementation, the Canadian airport perspective (albeit a small survey group) was considered useful to provide a more thorough analysis of later stages within the implementation process.

The three airports included:

- Vancouver International Airport (YVR), Vancouver, Canada;
- Edmonton International Airport (YEG), Alberta, Canada; and
- Montréal–Mirabel International Airport (YUL), Montreal, Canada.

The airports were interviewed using the same survey questions as U.S. airports to maintain continuity. Questions relating to FAA pilot studies or funding were modified or adjusted to address Canadian experiences. The survey information was not included in the broader survey assessment and is presented in this appendix as supplementary information.

BACKGROUND

Transport Canada (TC) is responsible for transportation policies and programs throughout Canada. TC's oversight includes air, marine, road, and rail transportation. TC as an ICAO contracting state began the nation's comprehensive SMS program in early 2000. The following list outlines SMS aviation development in Canada per the TC SMS website.

- 2000–present: Development of Notice of Proposed Amendments (17 NPAs) and changes to the Aeronautics Act.
- 2001: Published *Introduction to Safety Management Systems* (TP 13739).
- 2001–2004: Educational Campaign on Concepts and Principles.
- 2002: Published *Safety Management Systems for Flight Operations and Aircraft Maintenance Organizations* (TP 13881). Note: Advisory Circular 107-001 replaces TP 13881, Revision 1, dated 2002-03-01, *Safety Management Systems for Flight Operations and Aircraft Maintenance Organizations.*
- 2004: Published *Safety Management Systems for Small Aviation Operations—A Practical Guide to Implementation* (TP 14135).
- 2004: Safety Management Systems: Transport Canada's Implementation Plan (TC website 2011).

SAFETY MANAGEMENT SYSTEM IMPLEMENTATION IN CANADA

Unlike the U.S. airports participating in Studies 1 and 2 that developed all four components of the SMS simultaneously, Transport Canada used a phased project approach, which developed program aspects sequentially building on and testing each phase within a 3-year period. Canadian airports began development of their SMS program in a four-phase approach beginning in 2005 with the following milestones.

For large airports (such as the airports interviewed) [CAR 302.500 (1)], SMS implementation milestone dates included the following:

1. Before March 31, 2008,
   a. Ensure that the accountable executive submits the signed statement required by CAR 106.02(1)(c); and
   b. Complete Phase I of the SMS implementation phases outlined in the Advisory Circular 300-002, *Implementation Procedures for Safety Management Systems for Airport Operators.*
2. Before March 31, 2009, correct any deficiencies in the project plan submitted as part of Phase I that have been identified by Transport Canada and complete Phase II of the SMS implementation phases.
3. Before March 31, 2010, complete Phase III of the SMS implementation phases in accordance with the project plan.
4. Before March 31, 2011, complete Phase IV of the SMS implementation program in accordance with the project plan.

The four phases include:

Phase I: Assignment of accountable executive, gap analysis, and project plan.
Phase II: Development of the safety management plan, reactive processes, investigation and analysis, risk man-

agement, training for personnel assigned duties, and documented policies and procedures.

Phase III: Deployment of proactive processes, documented policies and procedures, and training for personnel assigned duties.

Phase IV: Quality assurance, emergency preparedness and response, training for personnel, and documented policies and procedures.

All three of the airports interviewed had finished all four SMS phases; however, all had not completed an official TC audit at the time of the interviews.

INTERVIEW FINDINGS AND OBSERVATIONS

Because of the limited number of airport staff interviewed, graphs and charts were not developed; in its place a summary of key findings and observations from the interviews is presented here by topics or SMS phase.

Phase I Analysis and Preparatory Documentation

Per the required SMS Phase I elements, all Canadian airports interviewed conducted a gap analysis and developed a project plan. When asked whether the gap analysis was useful, comments included that, when the gap analysis was conducted, the airside operations findings were nominal; however, the ability to document the findings in the gap analysis assisted with getting buy-in from upper management and including identifying resources and funding to support other aspects of the program, such as increased data collection and trending. Airports also commented that the gap analysis timeline was short and that a longer period would have helped with analysis and documentation.

Canadian airports developed implementation plans as part of Phase I, but according to one airport, the airport team revised the plan annually as part of the ongoing program with the plan submitted in March, reviewed over the summer, and revised in the fall; this occurred each year. The initial plan developed was a blueprint, but as the program was rolled out, the plan changed to reflect new or revised aspects of the program.

Phase II Safety Management Plan

Airports began authoring the program manual (Safety Management Plan) as part of Phase II and used the outline provided by TC. If airports varied the contents, TC did not approve the manual and airports were required to revise or adjust the contents to align with the prescribed format. When asked whether the Safety Management Plan had been revised (either through TC review or internal changes), all airports commented that "yes" the Safety Management Plan had evolved either as a result of implementation, which required revisions to processes and procedures, or as a result of new advisory circulars and industry information. The initial documents were considered the "backbone" of the program, but as the program progressed, there was a need to revise aspects such as the proactive investigation procedures, additional training, and reporting. One of the airports commented that it removed the "fluff" in the original document and focused on developing a very straightforward document that staff can pick up and easily use.

Consultant Assistance and Resources

All three Canadian airports interviewed stated they did not hire consultants to lead the development of the SMS program. Canadian airports did not receive funding or grants to implement the program; costs were managed internally by each airport, which limited the opportunity in some cases to hire consultants. Two airports stated that they had enlisted experts in specific areas, such as training and human factors, but the program was led and managed internally. Additionally, Montreal reported that finding a bilingual consultant would have been challenging and thus the decision was made to develop the program in-house. Airports also commented that in the early days, TC and the airports were working closely on a regional basis and that bringing consultants from outside (or not familiar with the airport or TC processes) would have limited the flexibility and continuous change needed to develop and refine the program as it evolved.

TC provided a number of resources, references, guides, and templates for Canadian airports. When asked what other references Canadian airports used, responses included the ICAO SMM, the Australian Civil Aviation Safety Authority program, airline resources, Canadian Airport Council information, articles, and references from industry experts such as James Reason, and formal training programs.

Staffing and Positions

All three airports reported having both a safety manager and accountable executive in place. TC regulations require formal assignment of the accountable executive. For all, the safety manager (also referred to as accountable manager) position is a collateral duty and, as of the interview date, no additional positions have been added, although some are being considered for the future.

Safety Policy

As part of TC requirements, all airports stated that an approved safety policy is in place and has been rolled out to staff through initial SMS training. Airports also confirmed that safety policies have not been shared with tenants and, for some, the policy is focused only on airport staff; therefore, tenants are not expected to comply. All airports reported

that policy objectives are in place and are being monitored through data tracking and trending and reviewed annually.

Safety Risk Management

Each airport surveyed indicated that it had conducted a number of safety risk assessments, including one airport that had conducted a complete hazardous inventory and assigned mitigations to multiple departments. Other topics included new equipment type (Airbus 380) operations, runway pavement replacement, construction programs, and airside vehicle program changes.

Safety Assurance

Under the TC requirements, all airports are required to implement reactive and proactive investigation and analysis processes and audit programs. Each airport reported that proactive investigations, including training for staff, were underway. Also airports stated that audit programs were completed or nearly finished and staff had completed internal audits and were scheduling external audits by the end of 2011.

Data tracking and trending challenges include disparate systems and consolidation for reporting (manual processes), developing, and purchasing new systems and integrating reports, finding the right level of data to collect and analyze. In one case the airport reported that there are too much data and trending is difficult, but the annual audit program and review would assist in refining the process and reports.

Safety Promotion—Culture and Training

As part of the implementation and safety promotion aspects of the program, airports were asked if they encountered any safety culture challenges. Responses included staff complacency as a result of not seeing immediate benefits from the program and from delayed management support. Also reported was the lack of communication across departments to resolve collective issues and the lack of top management buy-in.

TC required structured training programs throughout Phases II, III, and IV; therefore, Canadian airports developed thorough and detailed training programs, including SMS overview, awareness training, reactive and proactive process training, how and why to report dangers and incidents, and human factors. Two airports have developed online courses in addition to in-class training programs. All airports reported training has been accomplished for the majority of internal staff over the past few years. Airports interviewed are not planning on offering training to tenants at this time, stating that most have their own training and that safety meetings and briefings are used to keep tenants up to date.

Challenges and Benefits

When airports were asked what the most significant challenge encountered, replies included the following:

1. The toughest challenge was to try to assemble the different practices and ways of operating into a single process or function,
2. The most significant challenge was trying to build and manage the program simultaneously, and
3. Trying to understand TC's expectations for program development and implementation.

These challenges were overcome by a variety of methods, including developing working groups, continuously reviewing the program and documentation, and working closely with TC both regionally and nationally to align the airport's program and TC's regulatory requirements. Airports also created a national working group that shared and reported best practices.

Some of the benefits noted from the interviewees included the following:

1. Breaking old ways and procedures by introducing new methods through SMS; SMS allowed for staff to report on operational deficiencies or inaccuracies through the program and standard operating procedures were adjusted to reflect the changes.
2. Integration of disparate departments and staff through collective assessment of risk and budgetary management.
3. Data collection and reporting are used for trending and provide a higher level of awareness.
4. Increased awareness throughout the organization with regard to safety and hazard identification.
5. Increased reporting, especially for the nonpunitive reporting program.

All three airports reported that they will continue pursuing SMS (required by TC) but airports also commented that they would likely be implementing it even without the requirement. One airport quoted "SMS is a classic management system, why are we afraid of it?" Another airport commented that the ability to make decisions on reliable data, not just gut decisions, is a key benefit to the program. Also, the program audits and review offer management a consistent report on safety and ensure that budget and funding are in place. In the past there was no structured way of identifying and developing proactive safety programs. Consistently airports stated that with SMS, communication across departments and with tenants improved, safety awareness increased, and, although the program was challenging to develop and implement, improvements are underway.

APPENDIX B

Questionnaire

The following information was sent to all implementation representatives before the scheduled interview for review and preparation of documents or information necessary to participate in the survey.

AIRPORT COOPERATIVE RESEARCH PROGRAM SYNTHESIS S11-04-07

Lessons Learned from Airport Safety Management Systems Pilot Study

Background

In 2007 and 2008, the FAA selected 31 airports to participate in the first and second round of the initial SMS pilot study with the intent to gather information on the impact of SMS on Part 139 U.S. airports. In 2009, the FAA conducted a second SMS pilot study involving selection of three airports from the 31 to validate findings from the original study. In 2010, FAA continued its efforts to study implementation of SMS, and selected 14 airports for the third SMS pilot study. To date, limited documentation of results associated with SMS pilot programs is available. Airport operators would benefit from pilot program airports' experiences and "lessons learned."

Objective

The objective of this Synthesis project is to provide airport operators with data and experience from SMS pilot airports. The results gathered in this Synthesis of Practice may be helpful to all airports.

Procedure

An interview will be conducted to access the lessons learned and experience of the SMS pilot airports. A member of the Synthesis team will read the questions to the participant, allowing the participant time to sufficiently answer each question. A second member of the team will record the answers given by the participants. The answers provided by the interview participants are valuable contributions to the objectives of this research project. Thank you for your participation in this study.

Interview Questionnaire

Gap Analysis

1. Was the gap analysis useful in developing your SMS program?
   1.1. If yes, what elements were the most useful?
2. Have you used the safety program manual (SMS Manual) developed during the gap study?
   2.1. If yes, did you revise any of the content and specifically what sections were changed?
   2.2. If no, why have you not used it?

Implementation Plan

3. Did you develop an Implementation (Program) Plan as part of your gap analysis?
   3.1. If so, have you used it for implementation?
   3.2. If no, was a new (Program/Implementation) plan developed?
4. What elements of the SMS program are you implementing (Policy, Risk, Assurance, Promotion)?
5. What is your planned schedule to complete implementation?

Development

6. Did you hire a consultant for any of the SMS pilot studies?
   6.1. Why or why not?
7. Did you hire the same consultant for each of the studies?
8. Please describe the types of experience you believe a consultant should have to effectively help an airport develop an SMS.
9. Please describe the most significant challenge you experienced while developing your SMS. Please limit this answer to the *most* significant challenge you experienced throughout this process.
   9.1. How was the challenge overcome?
10. Please describe the different reference documents did you use to aid in the development of your SMS?
    10.1. Which document was most useful in the development of the SMS?
11. Please describe any benefits have you seen as a result of the development of the SMS?

Safety Culture

12. Please describe any cultural challenges experienced during the development of the SMS.
13. Please describe any methods or techniques used to promote the safety culture among the airport stakeholders.

Budgetary

14. What was the total amount funded for each phase (Airport and FAA grant funds combined)?
15. Was the grant amount awarded for the development of the SMS sufficient to cover the expenses associated with the project?
16. Have there been, or can you foresee, any hidden costs associated with the development or implementation of the SMS?
17. Please describe any funding-related challenges you experienced during the project.
18. If you have not yet experienced any funding-related challenges, please describe any financial challenges that you believe may be problematic in the future.

Organizational

19. What position (title) within the organization is assigned as the program or project manager for the SMS implementation project?
20. Please indicate the different departments involved in the SMS implementation (Ops, Risk, Fire/Aircraft Rescue and Fire Fighting, Police, Maintenance, Planning, Engineering/Construction, Properties/Finance, Training, etc.)?
21. Please indicate where the accountable executive is located within your organizational structure?
22. Have you designated a safety manager?
    22.1. If so, is the position a full-time role or collateral duty?
23. If you plan on adding staff, how many total positions do you anticipate?
24. Please describe any duties that will be performed by existing or new staff?

Training

24. Have you developed a training program for your staff on SMS?
    24.1. If yes, what training modules or curriculum components have been identified?
    24.2. If yes, have you trained staff?
        24.2.1. If yes, who has been trained?
25. Have you experienced any challenges or obstacles in developing a training program?
26. Please describe the extent to which you plan to train/orient your tenants?

Safety Policy

27. Do you have an approved safety policy in place?
    27.1. If a policy is in place, who approved the safety policy?
    27.2. If a policy is in place, has it been shared with staff and or tenants?
    27.3. If a policy is in place, have you set program objectives as part of your policy?

SRA

28. Have you conducted SRAs?
    28.1. If yes, what were the topics?
    28.2. If yes, who facilitated the SRA(s)?

Safety Assurance

29. Have you extended or plan to extend your inspection program to the ramp?
30. Have you extended or plan to extend your inspection program to the baggage makeup area?
31. Have you developed an SMS evaluation or audit program?
    31.1. If so, have you conducted the SMS evaluation or audit?
32. If you have identified program objectives as part of your policy, what data elements have you identified to measure performance?
33. How do you plan on collecting and trending data?

Conclusion

34. Will your airport continue the development and implementation of your SMS?
35. Why or why not?

APPENDIX C

Detailed Safety Management System Pilot Study Background

This section provides an overview of each FAA SMS pilot study as issued by the FAA, including dates, duration, number of participants, FAA-defined objectives, scope of work, and key deliverables. This information can be found on the FAA's Airport SMS site at the following URL: http://www.faa.gov/airports/airport_safety/safety_management_systems/

FIRST SMS PILOT STUDY (STUDY 1)—CLASS I, II, III, AND IV AIRPORTS

Dates: April 2007 to late 2007 (staggered starts)

Duration: 6 months (see Figure 1 for comprehensive SMS pilot study timelines)

Number of Participants: 22 (see Table 2 for a list of participants)

Objective: The FAA conducted the first pilot study program to evaluate the implementation of SMS at airports of varying size and complexity. The pilot program would allow airports and the FAA to gain experience establishing airport-specific SMSs that are tailored for the individual airport. This information would provide FAA information on SMS best practices and lessons learned to assist the FAA in development of a Notice of Proposed Rulemaking to incorporate SMS into 14 C.F.R. Part 139, *Certification of Airports*.

Scope of Work: The airport operators that participated in the first SMS pilot study were responsible for developing and documenting their SMS programs in a safety program manual (SPM). The SPM was required to identify "gaps" between the Airport Certification Program and the SMS being developed for the airport. While developing the SPM, airport operators were advised to extract SMS principles from the existing airport certification manual, memorandums of understanding and memorandums of agreement, safety during construction plans, surface movement guidance control plans, airport emergency plans, and other documents to address SMS requirements.

Deliverables: The development of the SMS manual and program should be completed 6 months after award of the Airport Improvement Program (AIP) grant. To help FAA evaluate the SMS airport-specific development process, copies of the following documents must be provided to the FAA as they are completed. The FAA encourages sponsors and their consultants to refer other interim draft documents, questions, and comments to the FAA at any time in the process for consultation and information exchange.

a. Gap Analysis

The gap analysis should identify procedures, policies, documentation, and actions that the airport needs to implement as part of its SMS that go beyond the current Part 139 requirements addressed by the airport's certification manual.

Estimated completion date: 2 months from project start

b. Draft Plan

A draft of the complete SMS manual and program. The draft should address the gap analysis and describe safety risk management, risk mitigation strategies, and documentation processes.

Estimated completion date: 5 months from project start

c. Final Plan

A copy of the final SMS manual and program to be implemented by the sponsor.

Estimated completion date: 6 months from project start

The contents and scope of the SMS manual and program plan should address the following:

1) Written safety policy statement and description of how it is communicated to airport employees.
2) Identification and description of the airport safety goals.
3) A plan for employee SMS indoctrination and training. SMS indoctrination training should provide an outline of proposed curriculum and resources.
4) Documented process to identify training requirements for systems safety.
5) A plan to validate training effectiveness and the process to gain training feedback, including usable metrics.
6) A defined process to communicate safety policies and objectives throughout the organization. Include examples of how information will be communicated and any processes for follow-up.
7) A plan and description of employee nonpunitive reporting systems, existing and new.
8) An organizational chart identifying the names and safety responsibilities of all key personnel, such as the following:
   - Top management,
   - Safety manager,
   - Department heads/managers, and
   - Established safety committees and chairpersons.

9) Description of the safety risk management process, including application of "The Five Phases of SRM," as discussed in the FAA Advisory Circular 150/5200-37, *Introduction to Safety Management Systems for Airport Operators.*
10) Guidance on the use of SRM and trend analysis.
11) Defined process for documenting the results of SRM to include a description of how documents will be stored (i.e., electronic or paper).
12) Description of how top management will follow-up on SRM to ensure that safety mitigation strategies are appropriate.
13) A description of the airport quality management and/or risk management program (if applicable) and its integration into the airport SMS.
14) Description of a plan to integrate apron safety management into the airport SMS. (FAA review of the plan will be limited to measures to prevent accidents or incidents involving aircraft.) The plan could include the following:
    a. A description of current apron safety management practices already in place, such as reporting requirements to the NTSB, Flight Standards, or the Occupational Safety and Health Administration.
    b. An explanation of how current apron safety management practices meet the intent of SMS. This could include the safety plans and practices of tenants and operators at the airport, which should complement the airport SMS.
15) A detailed method to document self-auditing processes and their findings. Self-auditing may be part of the airport self-inspection process. If it is, explain how the self-inspection process addresses systems safety (i.e., if the self-inspection program identifies a hazard on the airport it should determine the risk and document the process for follow-up).
16) A detailed method to document self-inspection reviews, analysis, and findings.
17) A description or plan to integrate the tailored SMS program plan into the overall operation of the airport.
18) Documented plan for training and education, safety communication, competency, and continuous improvement processes.
19) Procedures to promote safety awareness and participation in nonpunitive reporting systems.
20) Process to document and review lessons learned from within the organization.
21) Schedule for implementation and anticipated associated costs.

SECOND SMS PILOT STUDY (STUDY 2)—CLASS II, III, AND IV AIRPORTS

Dates: July 2008 to early 2010

Duration: 6 months (staggered starts)

Number of Participants: 9 (see Table 2 for a list of participants)

Objective: The second pilot study was aimed at collecting additional information to assist the FAA in determining scope, scalability, and implementation of SMS at smaller airport operations. Therefore, the second pilot study was limited to airports with Class II, III, and IV airport operating certificates.

Scope of Work: Airports in the second SMS pilot study were tasked to assess their existing Part 139 operations with regard to integration of a SMS (including safety policy, safety risk management, safety assurance, and safety promotion) and to develop a SMS program plan and manual. The airports were not required to deploy the SMS, merely to prepare for and outline the tasks, staff, and programs necessary to support the SMS.

Deliverables: See SMS Pilot Study 1 for a list of deliverables; the same deliverables were required for Study 2.

STUDY 3—FOLLOW-ON/PROOF-OF-CONCEPT PILOT STUDY

Dates: November 2008 to March 2010

Duration: 13 months (staggered starts)

Number of Participants: 3 (see Table 2 for a list of participants)

Objective: The FAA conducted the SMS follow-on/proof-of-concept pilot study at three airports of varying size and complexity. The follow-on study allowed the FAA to gain more information on the ability of airports to integrate an SMS into their operating structures. Information and experience gained through this follow-on study will be helpful as FAA continues development of its Notice of Proposed Rulemaking to incorporate SMS into Title 14 Code of Federal Regulations (CFR) Part 139, *Certification of Airports.*

Scope of Work: In the SMS follow-on/proof-of-concept study, the three participating airports were directed to use a proof-of-concept approach to "prove-out" key elements and components of the SMS manual and implementation plans developed in the first SMS pilot study. Airports began implementation of their SMS manuals and verified whether key elements and components established or envisioned in the SMS manual were functional within the airport operating environment. The study tasks were extensive and reflect a 13-month project duration.

A. Airport Safety Policy

Task 1: Develop standard elements for an SMS policy. With the large variety of recommended policy statements available internationally, the approach will be to develop a policy template with a yes/no decision tree for each airport to use. This policy template will provide guidance on what is appropriate for an airport of similar size and operation. To com-

plete this task, the airport will develop a core set of policy elements and develop a decision tree that allows for an airport to develop and refine its safety policy. Airports should also report on what policy or format works best in their operating environment and if they have made any changes to their SMS program to incorporate findings under this task.

Task 2: Define safety manager's roles and responsibilities including safety committee functions, where applicable. While roles and responsibilities of a "safety manager" may vary at each airport, a core set of duties will be developed to help guide airports in determining who in the organization may best serve the SMS program. This includes development of a safety committee's functions, including authority and reporting capabilities. These roles will be reviewed with regard to the current Part 139 activities within the airport's organization for assessment of future impact of SMS on Part 139 staffing and management. To complete this task, the airport will develop a comprehensive set of duties; develop options for shared and single safety management position, develop safety committee activities and sample process flows for reporting, and provide guidance on how to engage current staff in safety committee activities. If changes are made to the airport's SMS as a result of the findings under this task, the airport should report on those changes.

Task 3: Review nonpunitive programs with regard to legal authority. Preliminary research on nonpunitive SMS programs reveals that an airport may not have the authority to protect the person from punitive measures by organizations outside the airport's SMS program. To complete this task, the airport will develop nonpunitive language that can align with airport's authority and recommend language for rules and regulations that may assist with nonpunitive program implementation at airports of similar size and operations. If changes are made to the airport's SMS as a result of work done under this task, the airport should report on those changes.

Task 4: Research third-party data collection, collaboration, and reporting systems. Under the Freedom of Information Act, the public can request a variety of information from airports. To encourage reporting under the airport's SMS program, research of a third-party database to collect, store, and report on SMS events, trends, and activities will protect the data from requests under the Act. Obviously, the level of detail and expanse of the reporting system will vary from airport to airport. Therefore, under this task, the airport will develop a list of requirements for third-party hosting, collaborate with FAA's Joint Planning and Development Office for best practices and possible joint development of a system, and report out on the pros and cons of systems with a recommendation for Part 139 airports of similar size and operations.

B. Safety Risk Management

Task 1: Identify hazards. Hazard identification is the core of the SMS program. An effective hazard identification approach is likely the most important aspect of risk management. Under this task, the airport will develop a typical list of hazards for movement and nonmovement areas, including the ramp and bagwell (if applicable), for the airport, which would also be applicable to airports of similar size, class, and operation, and a hazard analysis approach and checklist. The airport should report on any changes made to their SMS program as a result of work done under this task.

Task 2: Determine the risk, assess the risk, and analyze the risk associated with hazards identified under Subpart B, Task 1. A variety of risk matrices exist in the aviation industry, many of which are automated. The focus of this task is to develop and refine the most effective risk matrix for a Part 139 airport of similar size, class, and operations. Although FAA suggested a risk matrix structure in its Advisory Circular 150/5200-37, *Introduction to Safety Management Systems for Airport Operators,* there may be risk matrices that are more applicable or useful to airport operators. Under this task, the airport will reevaluate the risk matrix developed during the first pilot study, develop a prototype risk matrix using findings from research and automate where possible, develop a guide to using the risk matrix, and develop a guide to assessing and analyzing risk that could be used by operational personnel. If the airport finds FAA's suggested risk matrix format sufficient for its operations and structure, the airport should report that finding and provide any additional information or data to explain the rationale for their finding. The airport should report on any changes made to its SMS program as a result of work accomplished under this task.

Task 3: Treat (mitigate) the risks for hazards identified and analyzed under Subpart B, Tasks 1 and 2. Corrective measures and controls are directly related to risk mitigation and will be developed as part of the risk management program. Under this task, using the hazards developed under Subpart B, Task 1, the airport will develop business flows and tracking tools for corrective measures and overall risk mitigation for the given airport's size, class, and operations; and develop a guide for developing and implementing risk mitigation strategies and individual corrective measures and controls.

Task 4: Reevaluate, analyze, and communicate risks. Risk mitigation strategies are successful when a program for continuous improvement is developed as part of the safety risk management process. Identified risks that are mitigated or resolved often lead to new risks. Trending and tracking of risks and outcomes allow for the SMS program to play a proactive role in airport safety. Under this task, the airport will develop a risk evaluation process and procedures applicable to an airport of similar size and operations, develop a guide to risk evaluation and reporting processes for use by operational personnel, and develop communication tools such as dashboards (i.e., quick reference charts, statistics, information) or charts with risk mitigation results that can be reported to top managers within the airport.

C. Safety Assurance

Task 1: Establish a foreign object debris (FOD) program for the movement area, ramp, and bagwell areas (if applicable). Damage from foreign object debris to aircraft presents a great challenge for airport operators. Under this task, the airport will identify areas on the airfield needing FOD control, develop new policy and procedures to reduce potential for FOD damage, develop training protocols (i.e., who needs training, how often, what are major components of the training curriculum) for FOD training as appropriate for the given airport's size and operations, and develop a tracking and trending program for FOD identification and control.

Task 2: Develop a personnel training and record-keeping program that meets the requirements developed under the airport's SMS program. Part 139 prescribes requirements for personnel training and record keeping. However, an airport's SMS training and record-keeping requirements will far surpass those items currently required under Part 139. Under this task, the airport will develop record-keeping processes with abilities to alert or query data for recurrent or refresher training or record-keeping elements under the airport's SMS and develop a tracking system that can integrate into any of the airport's related tracking or training programs currently in use.

Task 3: Develop a ramp and bagwell (*if applicable*) *self-inspection program that ensures that safety is maintained.* Although FAA currently does not regulate airport ramp areas, the increase in safety-related incidents in the ramp and baggage makeup areas in airports is disturbing. Self-inspection techniques required under Part 139 for movement areas may be useful to an airport to decrease the number of incidents in nonmovement areas. Under this task, the airport will review Part 139 to determine if requirements for self-inspection in the movement areas would be useful for self-inspection in the nonmovement areas, including the ramp and bagwell (if applicable); develop maps of the nonmovement area; create an audit checklist/self-inspection form for the given airport; create forms for reporting and documenting hazards, incidents, and accidents; and develop processes for reporting, tracking, and trending safety issues on the ramp and baggage makeup area (if applicable).

Task 4: Develop a minimum standard for safe operations on the ramp and in the bagwell (*if applicable*). As discussed under Task 3, the ramp and bagwell are not currently regulated under Part 139 and present increased potential for incidents and accidents. Under this task, the airport will develop a minimum standard for safe operations, identify areas of concern or potential for increased incidents and accidents, and list baseline incidents and accidents for trending.

D. Safety Promotion:

At this time, no federal funds may be used in the implementation of proving of safety promotion actions under the airport's SMS.

Deliverables:

a. Monthly Progress Reporting: To help FAA evaluate implementation of the airport's SMS while it develops its proposed rulemaking, the airport will report on the status of its efforts under this study on a monthly basis. Monthly progress reports should include a written summary of status and an explanation of any difficulties or successes in implementing its SMS with specific focus on the tasks listed previously, any recommended changes to its SMS manual and implementation plans developed under the first pilot study, and any findings made or items developed under the preceding tasks.

b. Final Report: The final report will include all forms, templates, training protocols, maps, and other documents for all tasks under this study, a report on the airport's efforts under this study, and a revised estimate of cost for implementation of the airport's SMS. Should the airport make any changes to its SMS documents developed under the first pilot study as a result of its efforts under this follow-on study, the airport will provide the FAA with its updated documents, including SMS manual and implementation plan with either a tracked changes copy or cover letter identifying the changes made.

STUDY 4—SMS IMPLEMENTATION PILOT STUDY

Dates: September 2010 through spring of 2012

Duration: 13 months (staggered starts)

Number of Participants: 14 (see Table 2 for a list of participants)

Objective: The FAA conducted the SMS implementation study as a final SMS pilot study effort offered to all prior airport SMS pilot study participants. The intent of the study was to examine how airports implement safety risk management and safety assurance throughout their airfield environment, including the movement and nonmovement areas where applicable. The study also intended to assess the validity of SMS documentation developed during the first pilot studies by reviewing and revising the SMS manual. Results of the study are expected to directly assist FAA in the development of standards and guidance related to SMS for certificated airports.

Scope of Work:

5. Implement safety risk management procedures, processes, or policies as formulated under the airport's SMS manual or other documentation developed for the airport under the first pilot studies.
6. Conduct at least three safety risk analyses/assessments within 6 months of the AIP grant award or study start. These analyses/assessments should not include analyses/assessments required under FAA Air Traffic Organization SMS. The analyses/assessments can address hazards in the movement or nonmovement areas of the airport.

7. Implement a safety reporting and/or data collection system or applicable processes in conformance with the airport's SMS manual or other documentation developed for the airport under the first pilot studies.
8. Collect hazard reports, incident and accident reports, and other safety-related data/information under the airport's SMS manual or other applicable documentation within 2 months of AIP grant award or study start.
9. Analyze the information collected through the reporting and/or data collection system or applicable processes within 5 months of AIP grant award or study start.
10. Conduct an internal audit/evaluation following the methods and procedures prescribed under the safety assurance component of the airport's SMS manual or applicable documentation within 8 months of AIP grant award or study start.

Deliverables:

1. *Study Plan:* Develop a plan for completing study tasks including proposed safety risk analysis/assessment and a report detailing what costs the airport plans to allocate to its AIP funding (i.e., consultant services, infrastructure, etc.).
2. *Monthly Reports:* Provide monthly reports on the status of implementing study tasks and developing study deliverables including any pertinent findings or challenges.
3. *SRM Analysis:* Provide documentation of the processes or procedures used to conduct the analysis and findings from the analysis.
4. *Final Report:* Provide a final report on study findings and deliverables for the airport. The report will include copies of all deliverables and any changes to the original SMS manual, implementation, or other documentation developed under the first pilot studies. The report will detail how the airport accomplished each of the study tasks and any trends discovered during safety risk management or safety assurance processes or procedures. If software is purchased or developed for the purposes of this study, the airport will report on the usefulness of the software; costs associated with development, procurement, and maintenance; and challenges or lessons learned using the software. The report will also include a discussion of challenges or lessons learned through the study relative to safety risk management and safety assurance. Finally, the airport will report the findings of its internal audit and evaluation.

APPENDIX D

Safety Management System Pilot Study Airport Profiles

A list of airports that participated in one of the FAA SMS pilot studies is presented in Table D1.

Source: FAA NPIAS, http://www.faa.gov/airports/planning_capacity/npias/reports/extracted 04/01/2012.

TABLE D1
SMS PILOT STUDY AIRPORT PROFILE

Facility Name	Loc ID	State	City	Based Aircraft	Annual Operations	Enplanements (CY 09)	Airport Operating Certificate Class	Service Level	2011–2015 Dev. Cost
Austin–Bergstrom Intl.	AUS	TX	Austin	196	149,124	4,027,100	Class I	Medium hub	1,900,645,789
Baltimore/Washington Intl. Thurgood Marshall	BWI	MD	Baltimore	75	67,827	10,338,950	Class I	Large hub	684,013,874
Blue Grass	LEX	KY	Lexington	143	65,159	450,464	Class I	Small hub	231,038,405
Boeing Field/King County Intl.	BFI	WA	Seattle	471	248,938	35,863	Class II	Non-hub primary	226,062,147
Cheyenne Rgnl./Jerry Olson Field	CYS	WY	Cheyenne	99	57,723	12,608	Class II	Non-hub primary	106,537,822
Concord Rgnl.	JQF	NC	Concord	181	68,283	7,191	Class IV	Reliever	124,978,458
Dallas/Fort Worth Intl.	DFW	TX	Dallas–Fort Worth	0	194,542	26,663,984	Class I	Large hub	81,311,169
Daytona Beach Intl.	DAB	FL	Daytona Beach	231	287,665	202,417	Class I	Non-hub primary	148,155,673
Detroit Metropolitan Wayne County	DTW	MI	Detroit	6	221,358	15,211,402	Class I	Large hub	291,234,803
Dubuque Rgnl.	DBQ	IA	Dubuque	74	44,862	39,359	Class I	Non-hub primary	148,348,672
Fort Worth Alliance	AFW	TX	Fort Worth	155	92,342	1,222	Class IV	Reliever	172,966,502
Hartsfield–Jackson Atlanta Intl.	ATL	GA	Atlanta	3	249,089	42,280,868	Class I	Large hub	207,992,632
Indianapolis Intl.	IND	IN	Indianapolis	71	73,126	3,732,534	Class I	Medium hub	37,169,283
Jackson–Evers Intl.	JAN	MS	Jackson	37	56,327	635,116	Class I	Small hub	20,495,831
Jacksonville Intl.	JAX	FL	Jacksonville	54	39,958	2,777,041	Class I	Medium hub	47,263,881
Kona Intl at Keahole	KOA	HI	Kailua/Kona	60	97,229	1,279,968	Class I	Small hub	23,047,239
North Las Vegas	VGT	NV	Las Vegas	644	140,191	26,526	Class III	Non-hub primary	69,397,735
Ohio State University	OSU	OH	Columbus	171	73,267	28	Class IV	Reliever	32,064,541
Pittsburgh Intl.	PIT	PA	Pittsburgh	51	50,028	3,956,842	Class I	Medium hub	6,980,001
Sacramento Intl.	SMF	CA	Sacramento	9	38,949	4,460,600	Class I	Medium hub	27,741,079
San Antonio Intl.	SAT	TX	San Antonio	215	82,782	3,791,928	Class I	Medium hub	111,488,255
Santa Maria Pub./Capt. G Allan Hancock Field	SMX	CA	Santa Maria	257	55,309	43,631	Class I	Non-hub primary	24,290,244
Seattle–Tacoma Intl.	SEA	WA	Seattle	4	21,938	15,273,092	Class I	Large hub	23,266,521
Show Low Rgnl.	SOW	AZ	Show Low	47	12,302	4,470	Class III	Non-primary Commercial Service	38,058,860
Sloulin Fld Intl.	ISN	ND	Williston	44	25,036	11,338	Class II	Non-hub primary	13,955,472
South Bend Rgnl.	SBN	IN	South Bend	46	22,586	318,974	Class I	Non-hub primary	96,863,072
Southern Illinois	MDH	IL	Carbondale/ Murphysboro	89	77,553	14	Class IV	General aviation	8,561,495
Talladega Muni	ASN	AL	Talladega	44	41,000	2	NA (formerly Class IV)	General aviation	46,187,861
Tallahassee Rgnl.	TLH	FL	Tallahassee	127	81,827	360,441	Class I	Small hub	27,161,706
Teterboro	TEB	NJ	Teterboro	132	172,137	6,447	Class IV	Reliever	8,837,685
Toledo Express	TOL	OH	Toledo	91	37,112	93,669	Class I	Non-hub primary	5,296,191

Intl. = International; Rgnl. = Regional.

Abbreviations used without definitions in TRB publications:

AAAE	American Association of Airport Executives
AASHO	American Association of State Highway Officials
AASHTO	American Association of State Highway and Transportation Officials
ACI–NA	Airports Council International–North America
ACRP	Airport Cooperative Research Program
ADA	Americans with Disabilities Act
APTA	American Public Transportation Association
ASCE	American Society of Civil Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
ATA	American Trucking Associations
CTAA	Community Transportation Association of America
CTBSSP	Commercial Truck and Bus Safety Synthesis Program
DHS	Department of Homeland Security
DOE	Department of Energy
EPA	Environmental Protection Agency
FAA	Federal Aviation Administration
FHWA	Federal Highway Administration
FMCSA	Federal Motor Carrier Safety Administration
FRA	Federal Railroad Administration
FTA	Federal Transit Administration
HMCRP	Hazardous Materials Cooperative Research Program
IEEE	Institute of Electrical and Electronics Engineers
ISTEA	Intermodal Surface Transportation Efficiency Act of 1991
ITE	Institute of Transportation Engineers
NASA	National Aeronautics and Space Administration
NASAO	National Association of State Aviation Officials
NCFRP	National Cooperative Freight Research Program
NCHRP	National Cooperative Highway Research Program
NHTSA	National Highway Traffic Safety Administration
NTSB	National Transportation Safety Board
PHMSA	Pipeline and Hazardous Materials Safety Administration
RITA	Research and Innovative Technology Administration
SAE	Society of Automotive Engineers
SAFETEA-LU	Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (2005)
TCRP	Transit Cooperative Research Program
TEA-21	Transportation Equity Act for the 21st Century (1998)
TRB	Transportation Research Board
TSA	Transportation Security Administration
U.S.DOT	United States Department of Transportation