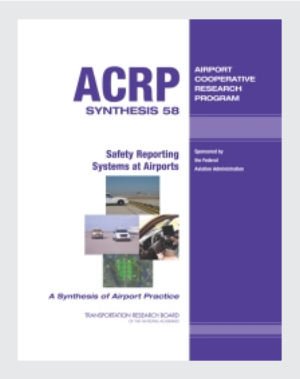

Safety Reporting Systems at Airports

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AIRPORT COOPERATIVE RESEARCH PROGRAM

ACRP SYNTHESIS 58

Safety Reporting Systems at Airports

A Synthesis of Airport Practice

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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.

The need for ACRP was identified in *TRB Special Report 272: Airport Research Needs: Cooperative Solutions* in 2003, based on a study sponsored by the Federal Aviation Administration (FAA). The ACRP carries out applied research on problems that are shared by airport operating agencies and are not being adequately addressed by existing federal research programs. It is modeled after the successful National Cooperative Highway Research Program and Transit Cooperative Research Program. The ACRP undertakes research and other technical activities in a variety of airport subject areas, including design, construction, maintenance, operations, safety, security, policy, planning, human resources, and administration. The ACRP provides a forum where airport operators can cooperatively address common operational problems.

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.

The ACRP benefits from the cooperation and participation of airport professionals, air carriers, shippers, state and local government officials, equipment and service suppliers, other airport users, and research organizations. Each of these participants has different interests and responsibilities, and each is an integral part of this cooperative research effort.

Research problem statements for the ACRP are solicited periodically but may be submitted to the TRB by anyone at any time. It is the responsibility of the AOC to formulate the research program by identifying the highest priority projects and defining funding levels and expected products.

Once selected, each ACRP project is assigned to an expert panel, appointed by the TRB. Panels include experienced practitioners and research specialists; heavy emphasis is placed on including airport professionals, the intended users of the research products. The panels prepare project statements (requests for proposals), select contractors, and provide technical guidance and counsel throughout the life of the project. The process for developing research problem statements and selecting research agencies has been used by TRB in managing cooperative research programs since 1962. As in other TRB activities, ACRP project panels serve voluntarily without compensation.

Primary emphasis is placed on disseminating ACRP results to the intended end-users of the research: airport operating agencies, service providers, and suppliers. The ACRP produces a series of research reports for use by airport operators, local agencies, the FAA, and other interested parties, and industry associations may arrange for workshops, training aids, field visits, and other activities to ensure that results are implemented by airport-industry practitioners.

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Cover figure: Dallas/Fort Worth International Airport Operations Department personnel conducting Part 139 Inspections. (Used with permission.)

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 of airport practice describes safety reporting methods and systems for Title 14 Code of Federal Regulations Part 139 (Part 139) certificated airports by assessing current practices, processes, and systems employed to collect and analyze safety data and information. The range of airport types participating in the study included large, medium, small, non-hub, general aviation, and joint civilian/military joint-use airports at various locations throughout the United States.

Information used in this study was acquired through a review of the literature and interviews with airport operators and industry experts.

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.

SAFETY REPORTING SYSTEMS AT AIRPORTS

SUMMARY

In aviation, certain levels of safety and safe operations are expected in the air, on runways and taxiways, and at the gates. A comprehensive network of technologies, systems, and controls, such as regulations, standards, training, and qualified staff, ensure safety is maintained. The collection, analysis, and reporting of data provide management with the ability to monitor existing operations, forecast possible risks, identify and understand safety trends, and improve operational and functional tasks within the complex aviation industry.

The objective of this synthesis study is to describe safety reporting methods and systems for airports certificated under Title 14 Code of Federal Regulations Part 139 (Part 139) by assessing current practices, processes, and systems used to collect and analyze safety data and information. Airport types participating in the study included large, medium, small, nonhub, general aviation, and joint civilian/military use airports at various locations throughout the United States. The objective of the study, with regard to airport size and operation, is to provide a comprehensive report for all airports interested in collecting, analyzing, and reporting on safety data and, as possible, highlight specific findings by airport size.

The current study includes a literature-based review of various industry, Internet, and publication resources. The study includes a review of aviation, technology, and legal publications, regulatory guidance, and airport examples provided by survey respondents. The core of the study findings is the responses to an interview preparation document composed of 50 questions (see Appendix C) and subsequent airport representative phone interviews. The staffs of 40 airports were contacted by e-mail and 35 interviews were conducted, resulting in a survey response rate of 87%. Interview durations ranged from 30 to 120 minutes, depending on the complexity of the airport and amount of discussion regarding interview questions. The interview information was documented during the phone interview and compiled into an aggregated set of results using a Microsoft Excel spreadsheet.

For the purposes of this study, airport safety data reporting was designated as mandatory or voluntary. Mandatory reporting was data collection and record keeping required under 14 CFR Part 139; other FAA regulatory compliance data, such as the 5010 airport master record program; employee health and safety reporting requirements; or other relevant county, city, or state reporting programs. Voluntary reporting was data collected through a formal safety management system (SMS) or as a part of any other airport-managed program encouraging voluntary participation and reporting.

In particular, the study researched the following three data uses, flows, and functions:

- Internal airport use of safety data, such as accident, incident, health and safety, and near misses for activities on the airfield, terminal, and landside (if relevant).
- Collective state, regional, or multiairport management sharing and reporting of safety information for more than one airport system.
- External airport safety data reporting to agencies such as FAA and NTSB. These systems were researched to gather information on data reporting means and methods, data analysis and reporting, and follow-up practices and procedures.

A summary of findings from the 35 surveyed airport representatives and associated literature review is as follows.

I. Internal airport use of safety data
- Of the 35 airports surveyed, 60% have established a voluntary reporting program with or without the formal implementation of an SMS.
- Multiple means, methods, formats, and processes are used at airports to receive safety concerns from all stakeholders, specifically staff and tenants. Although the same infrastructure exists for mandatory and voluntary reporting (phone lines, safety meetings, and the like), voluntary and mandatory data typically are reported through different systems or software programs.
- Paper-based systems are the method most frequently used to collect and report on Part 139 self-inspection data.
- Regardless of the size of the airport, software programs are rarely integrated across departments or functions. Manual reconciliation is often required to analyze safety concerns and discern trends.
- Airport staff members are skilled at assessment and deployment of safety response based on the type of safety report received. Strong coordination exists among responding departments to resolve safety problems.
- Follow-through on safety concerns is infrequently documented in a single repository or program; multiple silos of safety reports exist in departments such as operations, police, and fire. As a result, airport management has limited holistic understanding of the number, type, and resolution of safety concerns.
- Informal methods are most often used to identify mitigations or solutions to safety issues.
- Data collected through existing programs can serve as a foundation for future integrated safety-related reporting and management.
- The value of data trending and performance measurements goes beyond safety; it contributes to airport management's overall business decisions.
- Even for airports with formal SMS programs, few have dedicated staff assigned to safety data management and oversight.

II. Collective state, regional, or multiairport management sharing and reporting of safety information
- Few airport management staff report outside of the airport to other agencies. Typical challenges include lack of requested data, the need to compile the data manually, and the ability to compile specific data from numerous departments.
- Interviewees at state-managed airports indicated that most of their external reporting relates to budget planning and staffing, not safety.
- In addition, at state-managed airports respondents said that Part 139 reporting typically resides with each airport's management oversight, not within a centralized state-managed office.

III. External airport safety data reporting to agencies
- All airports in the survey report to agencies such as FAA, NTSB, and health and safety organizations such as the Occupational Safety and Health Administration (OSHA) or equivalent state, county, or city programs.
- Many airport interviewees reported that they or their wildlife management teams use the national FAA Wildlife Strike Database to log wildlife strike reports.
- Airport representatives surveyed stated that, with regard to outside agencies, they often report to academic and industry agencies, such as universities, and technical or management surveys for ACRP, ACI-NA, and AAAE.

The proposed audience for this study is operators of airports with Part 139 certification, airport executives, and others responsible for airport safety. However, although the results gathered in this study are intended for Part 139 airports, the information may be helpful to all airports and the industry in developing or obtaining safety reporting solutions that fit particular circumstances and available resources.

CHAPTER ONE

INTRODUCTION

This synthesis study, *Safety Reporting Systems at Airports*, investigates safety data collection, storage, use, and reporting at a range of airports certificated under Title 14, Code of Federal Regulations Part 139 (Part 139). These airports vary in size and operations. The goal is to present findings regarding safety data resources, collection, functions, and information management for airport operators and managers. Specifically, the study considers two aspects of safety data reporting by Part 139 airport operators: mandatory (required as part of regulatory compliance or management oversight) and voluntary [such as safety management systems (SMS), which at the time of this report is not required of Part 139 airports, safety committees, or safety groups]. Figures 1 and 2 describe the various forms of safety reporting for both mandatory and voluntary safety data, including internal and external agencies and departments.

SAFETY DATA AND PART 139 REPORTING

As illustrated in Figure 1, airports certificated under Part 139 collect a variety of safety-related data for internal and external purposes to maintain safe operations. The intent of safety data reporting is to ensure airport operators are providing the most accurate and current information for aviation activities, ranging from design and planning, construction, airfield and airspace changes, daily operations, accident and incident trends, and staff health and safety. All reporting programs are managed within various government agencies, including FAA, NTSB, and the Occupational Safety and Health Administration (OSHA) or equivalent, such as state, county, or city health and safety programs. A brief description of each of the programs is presented here.

One aspect of the FAA's safety oversight of Part 139 airports is to review data collected to ensure compliance with the airport's airport certification manual (ACM).

Airport Certification Manual Records and Reports to Maintain Part 139 Certification

Under Part 139, airport operators are required to collect and retain a variety of information, such as training records, fuel spill data, self-inspections, and airport condition reports. Airport operators also compile and document emergency, wildlife hazard, and snow removal processes and procedures in stand-alone plans referred to within the airport certification manual (ACM). This information is subject to review by FAA airport certification safety inspectors (ACSIs) to maintain the airport operating certificate (AOC). The FAA has also established centralized data reporting programs for foreign object debris (FOD) and wildlife strikes.

A national FAA-hosted Wildlife Strike Database provides a centralized location to report and manage strikes. http://wildlife.faa.gov/

Airport, Runway, and Facilities Information Reported to the FAA's 5010-1 Airport Master Record Program

The FAA Form 5010-1 is a computer report downloaded from the FAA Air Traffic's National Airspace Systems Resources database that provides detailed airport data. Form 5010-1 provides a basis for planning and airport inspections and can be viewed online or downloaded to a Microsoft Excel spreadsheet.

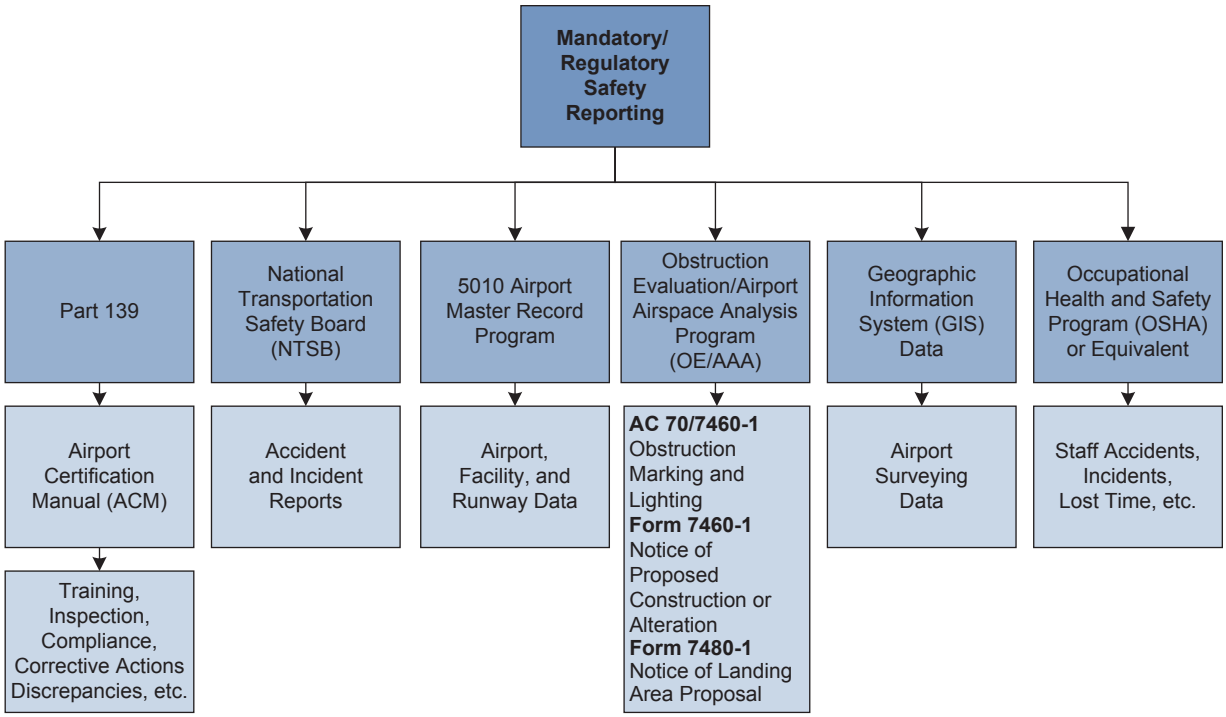

FIGURE 1 Mandatory (regulatory) safety data reporting.

Obstruction Evaluation/Airport Airspace Analysis Program Notices

According to FAA, the mission of the Obstruction Evaluation/Airport Airspace Analysis program is to conduct aeronautical studies to analyze obstacle data on airport construction proposals regarding airport airspace matters. These aeronautical studies analyze the impact of airport construction and potential hazards to navigation on the National Airspace System. Title 14 CFR Part 157 requires notice, which is submitted on Form 7460-1 Notice of Proposed Construction or Alteration;

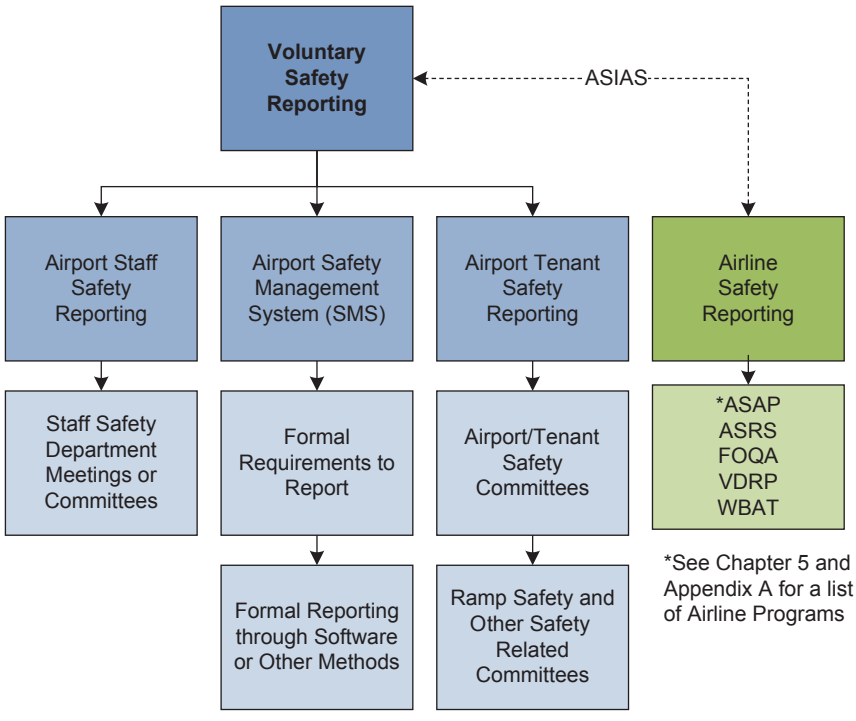

FIGURE 2 Voluntary safety data reporting.

Form 7460-2 Notice of Actual Construction or Alteration; and Form 7480-1 Notice of Landing Area Proposal (FAA 2009).

Geographic Information System Data

The FAA's geographic information system program is intended to ensure that airport surveying data are collected, processed, and made available for airport use and planning and for instrument approach procedure development; to provide guidance on the proper collection and submission of airport surveying data to the National Geodetic Service for validation; and to allow airport operators and their consultants access to detailed technical guidance on the performance and accuracy requirements of airport and aeronautical surveys (FAA 2009).

NTSB Reports for Accidents and Incidents under Title 49 CFR 830

NTSB investigations identify accident and incident root causes; the results subsequently are published for review by the aviation community for safety awareness and potential improvements within aviation operations. The FAA's Office of Accident Investigation & Prevention oversees aircraft accident investigation and activities related to NTSB investigations and findings. The FAA Office of Accident Investigation & Prevention website offers links to the NTSB data, the Aviation Safety Information Analysis and Sharing (ASIAS) database for Preliminary Accident and Incident Reports, and additional safety databases, including FAA Accident and Incident Data System, Aviation Safety Reporting System (ASRS), and NTSB Safety Recommendations.

OSHA or Equivalent for Health and Safety Oversight, Including Reporting of Accidents, Incidents, or Injuries of Airport Staff

According to OSHA, state and local government workers are excluded from federal coverage under the Occupational Safety and Health Act of 1970 (the "OSH Act"). Section 2 (11) of the OSH Act encourages states to develop and operate their own state occupational safety and health programs. Many states, counties, and cities have established OSHA-equivalent programs that require similar airport operator reporting of employee injuries and accidents (OSHA 2014).

VOLUNTARY SAFETY DATA REPORTING

In addition to collecting, managing, and reporting mandatory safety data, many airports gather voluntary safety-related information from staff and tenants through data collection programs such as SMS and informally through safety meetings and safety groups. Types of data collected within a voluntary reporting program can include accident or incident information, near misses, safety concerns, hazardous conditions or behaviors, and other safety items that would not typically be reported to airport staff or management outside of a voluntary reporting program. Voluntary safety reporting at airports introduces challenges owing to the nature of airport ownership and management primarily by government entities that introduce public disclosure of airport-related data. A detailed discussion of public disclosure, the freedom of information act (FOIA), and state sunshine laws is presented in chapter six.

In addition to formal SMS programs, airports often establish safety committees and groups to collect voluntary safety data.

Figure 2 provides a summary of voluntary safety data programs, including a list of airline reporting systems briefly described in "Safety Data and Part 139 reporting" as part of the NTSB and FAA ASIAS programs; these programs are discussed in greater detail in chapter five. The purpose of collecting airline information for this synthesis study was to gain a broader perspective of existing aviation safety data programs to better understand voluntary safety reporting throughout the aviation industry.

A recent introduction and importance of voluntary safety reporting programs at U.S. airports is a result of four FAA SMS pilot study programs conducted from 2007 through 2011 at airports certificated under Part 139. The possible requirement for airports to report voluntary data has been an ongoing topic of discussion under the FAA's proposed SMS rule making and as part of the International Civil Aviation

Organization (ICAO) safety initiative. SMS, as described in FAA Order 8000.369A Safety Management, is "The formal, top-down, organization-wide approach to managing safety risk and assuring the effectiveness of safety risk controls. It includes systematic procedures, practices, and policies for the management of safety risk" (FAA 2013).

In 2001, ICAO, an agency of the United Nations with international aviation coordination and oversight, adopted a new standard requiring that all 192 member states (including the United States) establish SMS requirements for certain aviation service providers. In July 2013, ICAO published Annex 19 SMS, which addresses standards and recommended practices to assist member states in managing aviation safety risks. Specifically, Annex 19 calls out the requirement for member states to implement both mandatory and voluntary reporting programs, "Each [Member] State shall establish a mandatory incident reporting system to facilitate collection of information on actual or potential safety deficiencies. Each [Member] State shall establish a voluntary incident reporting system to facilitate collection of information on actual or potential safety deficiencies that may not be captured by the mandatory incident reporting system" (ICAO 2013).

The introduction of voluntary safety reporting programs in conjunction with existing Part 139 reporting requirements was a key aspect of the synthesis study. Airport representatives were asked to describe both mandatory and voluntary programs to document data types; software systems; manual data collection, analysis, and reporting; system integration (if any); staff responsibilities; reporting and data uses; challenges; and benefits.

SYNTHESIS STUDY APPROACH AND OBJECTIVES

The objective of this synthesis study is to provide a summary report of mandatory and voluntary safety data collection strategies, systems, processes, and uses at U.S. airports of various size and operations. Although intended for airports certificated under Part 139, the results may be useful to all airport managers, operators, and industry.

This report comprises eight chapters and four appendices:

Chapter one—Introduction
Chapter two—Existing Part 139 Data Requirements
Chapter three—Airport Safety Data Collection
Chapter four—Staff Responsibilities and Functions
Chapter five—Data Use and Sharing with External Entities
Chapter six—Legal Concerns
Chapter seven—Special Concerns
Chapter eight—Conclusions
Appendix A—Detailed Survey Responses
Appendix B—Information Technology Primer
Appendix C—Survey Questionnaire
Appendix D—Airport Respondent Information

STUDY ELEMENTS AND INVESTIGATION

The study approach for this project included:

1. Investigating available literature and Internet sources regarding mandatory and voluntary safety data programs within FAA, and additional aviation and airlines programs, to compile a list of safety reporting types, purposes, and uses.
2. Researching use of software programs identified within the airport staff interviews and writing an information technology primer to provide basic technology background for software selection, procurement, and implementation.
3. Conducting airport staff interviews on the uses of data as management tools at airports certificated under Part 139; the airports were of varying sizes and operations and were located across the United States.

4. Compiling and presenting results from airport staff interviews to report trends and findings.
5. Providing a legal perspective on data protection and liabilities.
6. Presenting a discussion of benefits and challenges relating to safety data from airport staff interviews.

LITERATURE AND DATA SEARCH

The research team reviewed literature and software systems, surveyed 35 airport representatives, and compiled results for this report.

To support the airport staff interviews conducted, a detailed literature review was performed using numerous industry, Internet, and publication resources, including a broad range of published ACRP reports. Source documents focused largely on U.S. resources to ensure Part 139 perspective and relevance was maintained. FAA resources were extracted from specific websites, advisory circulars, and regulatory guidance and compliance documents supporting Part 139, including ACM requirements. A number of Government Accountability Office (GAO) reports were referenced, as were other industry reports regarding safety and data collection and analysis; some were specifically oriented to FAA data collection practices. The table of U.S. aviation voluntary reporting systems (Appendix A, Table A2) was compiled by web searches; the ASIAS reporting program information was reviewed by an FAA representative for accuracy. All other airline, air traffic, and maintenance voluntary reporting program details presented in Table A2 are documented from information gathered on the Internet.

AIRPORT REPRESENTATIVE INTERVIEWS

The synthesis study approach for identifying and interviewing airport operations or management staff included an e-mail survey requesting a phone interview, sent to 40 airport representatives. Thirty-five (87%) of the 40 indicated their interest in participating in an interview. Detailed questions (see Appendix C) were developed and sent to the airport representative before the scheduled interview. Early in development of the survey, it was determined that using an online or written survey instrument for the synthesis study data gathering would limit the project findings and constrain the ability to ask for clarification or discuss specific aspects of the responses. Five of the 35 airports completed the forms before the call, and two airports did not participate in phone discussion and provided responses solely through e-mail correspondence. Appendix D provides a list of airports that participated in the study interviews. All survey responses were consolidated into a Microsoft Excel spreadsheet, standardized, deidentified, sorted, and analyzed. Responses are presented within this document in various formats, tables, and figures.

SURVEY RESPONDENTS

The safety data survey participants all represented airports certificated under Part 139. Data regarding the National Plan of Integrated Airport Systems (NPIAS) airport hub and class size are provided in Tables 1 and 2.

TABLE 1
AIRPORTS IN SURVEY BY NPIAS CATEGORY

NPIAS Hub Size	Total Count by Hub Size	Service Type
Large hub	10	Primary
Medium hub	9	Primary
Small hub	5	Primary
Nonhub	9	Primary
Other	2	1 Reliever, 1 general aviation

TABLE 2
AIRPORTS IN SURVEY BY PART 139 AOC CLASS

Part 139 Classification	Total in Survey Group
Class I	32
Class II	0
Class III	1
Class IV	2

Airports surveyed represented states throughout the United States, including Alaska, Alabama, Arizona, California, Florida, Georgia, Iowa, Idaho, Illinois, Indiana, Kentucky, Maryland, Michigan, Minnesota, Missouri, Nevada, New York, Ohio, Oregon, South Carolina, Tennessee, Texas, Utah, Virginia, Washington, and Wyoming. A list of participating airports is provided in Appendix D.

To further classify types of survey respondents, four groups were identified and defined with regard to voluntary collection of safety data; the objective was to assess whether airports with SMS programs in place were more likely to have voluntary safety reporting programs. The four groups were:

- Airports that have an SMS program and a voluntary safety data reporting program.
- Airports that have an SMS program and no voluntary safety data reporting program.
- Airports that have no SMS program and a voluntary safety data reporting program.
- Airports that have no SMS program and no voluntary safety data reporting program.

As illustrated in Table 3, more than half (57%) of the airport representatives surveyed have implemented an SMS program. Twelve (34%) airports surveyed participated in one of the FAA's four SMS Pilot Studies, indicating that the other six airports have implemented a formal SMS outside of the FAA SMS Pilot Studies.

As shown in Table 4, of the 35 airports surveyed, 17 (49%) have both an SMS and a voluntary reporting program, 11 (31%) have neither SMS nor voluntary reporting programs, four (11%) have an SMS but no voluntary reporting program, and three (9%) have no SMS yet have a voluntary reporting program in place.

TABLE 3
SMS PILOT STUDY PROGRAM PARTICIPATION
AND IMPLEMENTATION

Airport Hub Size	SMS Pilot Study Participation (Yes/No)	Count	SMS Program Implemented (Yes/No)	Count
Large	Yes	5	Yes	7
	No	5	No	3
Medium	Yes	2	Yes	6
	No	7	No	3
Small	Yes	0	Yes	0
	No	5	No	5
Non-hub	Yes	3	Yes	5
	No	6	No	4
GA/Reliever	Yes	2	Yes	2
	No	0	No	0
Total	Yes	12 (34%)	Yes	20 (57%)
	No	23 (66%)	No	15 (42%)

TABLE 4
SUMMARY OF VOLUNTARY AND SMS REPORTING PROGRAMS

No.	SMS and Voluntary Programs	Total Count	Percentage	Total
1	SMS and voluntary	17	49%	60%
2	SMS and no voluntary	4	11%	
3	No SMS and voluntary	3	9%	40%
4	No SMS and no voluntary	11	31%	

Survey findings suggest that SMS implementations often result in development of voluntary reporting programs (49%/11%), which reflects the typical SMS program requirement to develop a voluntary safety reporting program. Survey findings also show that the 31% of the respondents with no SMS have not implemented a voluntary reporting program. The small percentage of staff surveyed from airports that have an SMS and no voluntary program, commented that the airports planned to roll out a program eventually. Airport representatives reporting they have a voluntary program but no SMS said that reporting was part of the overall airport culture and had been established in the past outside of a formal SMS program.

The survey results suggest that SMS implementations typically result in voluntary reporting programs.

CHAPTER TWO

EXISTING PART 139 DATA REQUIREMENTS

Certificated airports within any state, territory, or possession of the United States and the District of Columbia are regulated by the FAA under Title 14 CFR Part 139. FAA issues AOCs to airport operators to "ensure safety in air transportation. To obtain a certificate, an airport must agree to certain operational and safety standards" (FAA 2014).

PART 139 COMPLIANCE

Airport certification standards are maintained through requirements set forth in Part 139, and compliance is demonstrated through written documentation in an ACM. Annually, or more frequently if necessary, FAA Airport Certification Safety Inspectors (ACSIs) conduct on-site visits and review ACM and other files and paperwork as part of an airport certification inspection. The ACSI assesses compliance with safety and regulatory requirements through documentation review, data analysis, and observance of airport operational procedures. To retain an AOC, airports are required to collect and compile a variety of information, including airfield self-inspection reports; Notices to Airmen (NOTAM); Aircraft Rescue and Fire Fighting (ARFF) training and accidents/incidents; fueling facility inspections; and training documentation. This information is reviewed by the FAA during the periodic inspection.

Part 139 Subpart D—Operations outlines safety-related information collected at airports.

PART 139 DATA COLLECTION

A variety of safety-related data are compiled by specific Part 139 sections, primarily under Subpart D—Operations. The primary means to collect airport safety data is through the airport safety self-inspection program. An effective self-inspection program enables an airport operator to operate in compliance with Part 139 standards on a "day-to-day basis" (FAA 2004).

The primary areas of airport self-inspection programs include pavement areas, safety areas, markings, signs, lighting, ARFF, fueling operations, navigational aids, ground vehicles, obstructions, public protection, wildlife hazard management, construction, FOD, and snow and ice control. Airport operators are required to document, collect, and provide records to the FAA ACSI upon request. FAA states, "For even the smallest airport, it is desirable to use a safety self-inspection checklist that constitutes a written record of conditions noted, and acts as a check on follow-up actions taken. The scheduled use of a dated checklist will assure the regularity and thoroughness of safety inspections and follow-up. The checklist can be an important administrative tool for airport management. It can provide a snapshot of the condition of the airport, indicating trends, defining problem areas, indicating systems that are beginning to deteriorate and helping to define budgetary requirements. It is most desirable to use a format . . . in which each inspected area of the airport complex is positively noted" (FAA 2004).

Table 5 presents sections, descriptions, and relevant data types, such as records, reports, inspections, and plans, typically collected for compliance and management oversight by Part 139 airport operators. As described previously, certain records must be made available to the FAA ACSI and must be retained for a designated length of time. Table 5 demonstrates that airport operators collect a wide assortment of information to support safe airport operations and compliance; however, in most cases the information compiled is not centralized and is not maintained in an electronic

TABLE 5
PART 139 SECTIONS AND SAFETY DATA REPORTING TYPES

Subpart D—Operations Part 139 Section	Subpart D—Operations Part 139 Description	Information and Types Data Collected
§139.301	Records	Airport personnel, emergency personnel, fueling personnel training records, airport fueling agent inspection records, self-inspection records, accident and incident records, airport condition records and dissemination
§139.303	Personnel	See §139.301—Records
§139.305	Paved areas	Self-inspection and maintenance records
§139.307	Unpaved areas	Self-inspection and maintenance records
§139.309	Safety areas	Planning and design documentation, self-inspection, and maintenance records
§139.311	Marking, signs, and lighting	Marking, sign, and lighting system designs, Airport Sign and Marking Plan, self-inspection and maintenance records, including preventive maintenance programs
§139.313	Snow and ice control	Snow and ice control plan, including instructions and procedures, NOTAMS, snow event practice sessions and debriefs, accident or incident reports (if any), and deicing permits
§139.319	Aircraft rescue and firefighting: Operational requirements	ARFF staff training records, fuel inspection records, live fire-drill records, and Airport Emergency Plan (AEP)
§139.321	Handling and storing of hazardous substances and materials	Training records, inspection records, corrective action records, AEP
§139.325	Airport emergency plan	AEP, contact lists, inventories, procedures, emergency plan exercises and debriefs
§139.327	Self-inspection program, FOD	Inspection reports collected during regular operations, unusual conditions, such as construction activities or meteorological conditions, or after an accident or incident. Staff training, NOTAMs, discrepancy reports, wildlife reports, corrective actions, FOD collection reports, self-inspection records, tenant reports, other FOD program documentation
§139.329	Pedestrians and ground vehicles	Staff training and noncompliance procedures, vehicle or escort procedures, accidents or incidents in the movement areas and safety areas involving air carrier aircraft, ground vehicle, or pedestrian, Vehicle/Pedestrian Deviation (VPD) reports
§139.331	Obstructions	Form 7460 Notice of Proposed Construction or Alteration
§139.333	Protection of NAVAIDS	Form 7460 Notice of Proposed Construction or Alteration
§139.337	Wildlife hazard management	Wildlife Hazard Management Plan; wildlife strike reports (during self-inspections and from tenants or airlines); wildlife observations, hazard assessments, and monitoring reports; snarge collection kits and content identification; depredation permits and reports; wildlife reduction recommendations and actions; wildlife hazard control measures; procedures to review and evaluate the wildlife hazard management plan; and training program and records
§139.339	Airport condition reporting	Airport condition information to air carriers through use the NOTAM system
§139.341	Identifying, marking, and lighting construction and other unserviceable areas; construction safety	Construction Safety Phasing Plan (CSPP), construction management and oversight, self-inspection reports, FOD reports
§139.343	Noncomplying conditions	Reports and records of noncomplying conditions

Record retention and management is a requirement of Part 139 and is periodically reviewed by the FAA during certification inspections.

format. The norm, according to the study findings, is a tendency toward paper-based checklists, reports, and binders or stand-alone software programs that are rarely integrated. Multiple questions were asked of interviewees regarding Part 139 information collecting and reporting tools; the findings are presented and discussed later in this chapter.

PART 139 DATA COLLECTION TOOLS

Airports collect data through a variety of mechanisms to track and demonstrate compliance with FAA's reporting requirement. These means include purchased or custom-developed software programs; electronic documents organized within file servers; mobile devices (e.g., tablets, rugged laptops, and handheld devices); and hard copy forms compiled in three-ring binders. At many airports, self-inspections are conducted using paper forms and the results subsequently entered into a software program or converted to electronic format for storage and future reporting. Many of the required documents are maintained in separate offices, file servers, or software programs. For example, ARFF inspections often are housed within the Fire Department, and NOTAM are filed and managed as part of the airport operations division safety oversight.

PART 139 AND VOLUNTARY DATA COLLECTION PROGRAMS

Airport representatives were asked what types of systems were used to collect all manner of safety data, including Part 139 and voluntary safety data programs such as SMS. Regarding voluntary data collection, airport respondents described various programs, including implementation of formal SMS programs and reporting tools and voluntary safety reporting through meetings, phone lines, staff representatives, comment boxes, and websites. When airport staff interviewed did not have voluntary reporting tools or programs, the discussion focused on mandatory reporting; when airport representatives had both systems, key differences or similarities were documented.

Various choices were presented for selection, including paper, software, website, drop box, phone, verbal reports, e-mail, meetings, and "other," as summarized in Table 6.

The most frequently cited means for recording self-inspection data, regardless of airport size, was paper. Of the 35 airport staff interviewed, 28 use paper as a means to conduct Part 139 self-inspections. However, multiple airport representatives indicated that the paper-based checklists were subsequently entered into a software system or the checklist was scanned as a Portable Document Format file and stored electronically on a file server for easier review, retrieval, and distribution to other departments, such as maintenance. It was noted that the Portable Document Format files are not searchable, so there is no means for using the electronic copy for trending or conducting specific queries (e.g., activities, data types) or for automated reporting purposes. The use of tools and reporting formats varies; one interviewee stated that the FAA ACSI preferred paper as part of the certification inspection review process. To effectively manage the process, the airport operations staff maintains

TABLE 6
SAFETY REPORTS BY COLLECTION METHOD

Safety Reports Received by Method	Software	Website	Hard Copy	Phone	E-mail	Meetings	Verbal	Other
Respondent count of reports received by method	16	21	17	32	29	30	32	2
Respondent percent of reports received by method	46	60	49	91	83	86	91	6

3 shaded cells = top 3 highest percentages.

a three-ring notebook with all relevant documentation in a hardcopy format. Another means of collecting self-inspection data included the airport operations staff reporting discrepancies by phone or radio; these were immediately entered into a software program shared by maintenance for work order initiation, tracking, and management.

Regardless of airport size, paper is the most frequently used means for recording self-inspections.

SOFTWARE SYSTEMS

Airport representatives using software programs or systems for recording self-inspections stated they typically used a tablet or a vehicle-mounted rugged laptop to collect information in the field. If no in-field wireless network (WiFi) existed, the data were synchronized through the WiFi network once the representative was back in the office or manually uploaded through a software program interface. A representative of a large hub airport commented that the inspection software system was custom developed by the airport's in-house information technology (IT) department staff. The software program was designed for multiple inspections to be conducted, approved, aggregated, and published on a daily basis. In addition, the software program publishes inspection reports, allows for key word searches and comments, and presents a list of open discrepancies for management oversight and reporting. Numerous commercially available self-inspection software programs offer various technologies and platforms, such as hosted or nonhosted options, price points, technical support, and integrative solutions (see Appendix B for an overview of IT concepts and systems).

20 of the 35 airports surveyed have an SMS program in place; 13 of the 20 have implemented software.

Airports reported information regarding purchased or in-house electronic solutions used to collect self-inspection, maintenance, and voluntary safety data records. Table 7 presents a summary of electronic programs by functional type and includes whether the representative airport has an SMS program in place for determining if airports had implemented SMS software programs in conjunction with their formal SMS programs.

Thirteen of the 20 airports (65%) reported they had purchased or developed software programs to support the SMS. The most frequently reported (65%) type of software for all hub-size airports related to maintenance tracking and work order management, with all large hubs reporting the use of maintenance software. Only 48% of the airports surveyed used electronic means to manage Part 139

TABLE 7
SOFTWARE SYSTEM TYPES BY AIRPORT NPIAS CATEGORY

35 Airports in Survey Group	Formal SMS Program?	SMS Software Count	Part 139 Software Count	Maintenance Software Count	Average No. of Systems
10 Large hub airports	Yes, 7	3	2	5	2
	No, 3	1	4	5	
9 Medium hub airports	Yes, 6	3	3	5	1.77
	No, 3	0	3	2	
5 Small hub airports	Yes, 0	0	0	0	.06
	No, 5	0	1	2	
9 Nonhub airports	Yes, 5	3	2	2	1.33
	No, 4	1	2	2	
2 airports 1 NA–GA 1 NA–Reliever	Yes, 2	2	0	0	1
	No, 0	0	0	0	
Total count by program type	20	13	17	23	

inspections. An average of systems, as measured by hub size, appears in the last column of Table 7 and shows large hubs with the most systems at 2, medium hubs at 1.77, nonhubs at 1.33, the general aviation (GA) and reliever airports at 1 (both SMS systems), and small hub airports at 0.06, the lowest average. Of the systems reported, five respondents indicated that some portions of the software were integrated and automated (specifically airport duty logs with Part 139 self-inspections and self-inspections with maintenance work orders).

More than one-third of the airports (34%) surveyed reported that all or some aspects of the software system were customized by the software developer/vendor or by the airport staff. More than half (54%) of the systems were hosted in house (on servers within the organization), 51% were reportedly web-based solutions, 46% were client server systems (such as MS Access), and 3% were unknown (see Figure 3).

When asked about system, recurring maintenance, or other custom development costs, the majority of survey respondents replied they "did not know." Typically at airports (many managed by city, county, or authority), the purchase of software is managed through a separate department, such as procurement or IT. Thus, the lack of information available to the interviewees (primarily airport operations staff) was not unanticipated. Regarding software costs in general, multiple aspects are often considered when selecting a software program, such as number and type of licenses, hosting solutions, ongoing level and type of technical support, and customization. A brief overview of cost decision aspects can be found in Appendix B.

Four airports surveyed use Microsoft Access as a tool to collect and manage airport data.

Two nonhub and two medium hub airport interviewees reported they had built software systems using MS Access as a means to customize the information needed for inspections and tracking maintenance work orders and to reduce costs associated with purchasing commercial software programs. The systems are accessible by staff via the airport network for data entry, tracking, trending, and reporting. Concerns with data integrity and continuity were addressed through the use of pulldown menus at one airport; open-ended comment fields for data entry at another airport resulted in reduced quality of data, misspellings, and inconsistencies. These issues were corrected through staff training and management review. MS Access data at the airports were backed up through the airport's network management and security programs ensuring no risk of data loss. One small hub airport representative reported that MS Access was being used to track maintenance records.

A crucial component of the Part 139 inspection process is the ability for airport operations and management to report deficiencies to maintenance departments. FAA Advisory Circular (AC) 150/5200-18C Airport Safety Self-Inspection states, "An effective safety self-inspection program includes procedures for reporting and correcting deficiencies. This means that the airport operator

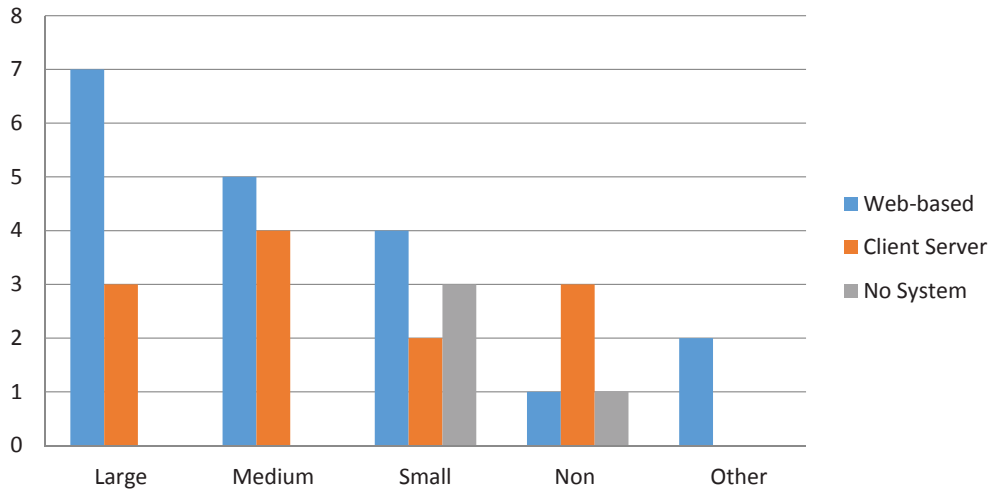

FIGURE 3 Software solution type by airport NPIAS category size.

should have a work order system in place so that deficiencies can be corrected in an expeditious manner" (FAA 2004).

Few airport representatives have integrated software programs to manage safety concerns; most use manual processes to reconcile information.

Two airport representatives interviewed reported that their Part 139 inspection program automatically interfaced with their maintenance management software system. Typically, operations and maintenance staff work in separate departments or functional groups and are obligated to manually enter and update deficiency status from one software or paper-based system to another using work order numbers or other key information, such as deficiency date and location. Airports that reported lack of integration also reported cumbersome, time-consuming, and manual reconciliation of disparate systems among departments to accurately report on the status of discrepancy resolution.

REPORTING AND COLLECTION METHODS

In addition to Part 139 self-inspection data, airport representatives were queried whether other types of data were collected, such as accident or incident reports, emergency medical responses, police dispatches, hazards or maintenance concerns, and wildlife strikes. Table 8 provides an overview of the types of data collected. Part 139 data are collected by all airport operations staff interviewed for airport certification compliance; other data collected are facility damage, slips, trips, and falls for insurance claims and cost-recovery purposes. Respondents commented that claims typically are managed through the city, county, or other divisions outside the airport operations groups; however, reports often are initiated by the operations staff as part of incident and accident response.

Respondents were asked what methods were used to receive or gather information or reports. All except one of the airport staff interviewed noted that one or more dedicated phone lines were the primary means of obtaining safety-related reports from staff, tenants, and in some cases the public. Phone lines were reported as often managed by the operations department, a centralized dispatch service (911), or a combination of the two. For airports with 24/7 operations, phone lines were available at all times; for others, phone calls were forwarded to an assigned airport duty manager or a backup dispatch 911 service. In all cases, the phone line allowed for verbal reporting of safety concerns or issues; however, not all information received was documented or collected in a formal manner.

A national FAA-hosted FOD program provides a centralized location to report and manage FOD. http://fod.faa.gov/SubmitReport.aspx

When asked if paper-based systems were used to acquire safety reports, seven of the respondents reported that comment slips or drop boxes were used to collect safety suggestions; however, three

TABLE 8
DATA TYPES COLLECTED

Data Type Collected	Part 139	Voluntary Safety Program (SMS or Other)	Staff Accident or Incident (non vehicle)	Tenant Accident or Incident (non vehicle)	Vehicle Accident or Incident	Facility Damage	Health and Safety/OSHA	Near Miss/Near Hit	Slip Trip Fall	Medical Run (Ambulance) Dispatch	Medical Run (Ambulance) Transport	First Responder Dispatch	Emergency Operations Center	Hazard or Risk Data
Respondent count by data type	35	21	33	31	34	35	33	14	34	33	31	33	28	26
Respondent percent by data type	100	60	94	89	97	100	94	40	97	94	89	94	80	74

3 shaded cells = 3 highest percentages.

of the respondents indicated they were likely to phase out the boxes and use a web-based program because of the need to manually collect and check boxes for comment slips. Most boxes (70%) were located within the terminal, with only 30% installed in break rooms adjacent to ramp area operations for tenants and ground handlers. Respondents frequently reported that public suggestions initially were collected through public affairs or public outreach functions and, if relevant to airfield or safety concerns, were routed to the appropriate department.

Safety concerns from tenants are most frequently reported verbally, regardless of airport size.

Interviewees were asked if tenants, staff, or other stakeholders verbally communicated safety reports and concerns, and only two of the respondents reported "no." Regardless of airport size or operation, 94% of respondents received safety-related reports verbally. The survey expectation was that small airports with fewer safety staff (airports reported as few as two and as many as 300+ airport operations, police, fire, and emergency response staff) would be more likely to receive verbal reports as a result of smaller facilities and greater familiarity with the limited airport staff; however, this was not the case. It appears that verbal reports are a key means of raising safety concerns at all airports. In addition, even within large hub airport operations, airport representatives are recognized as resources to raise safety concerns. Airport representatives indicated that the verbal reports were often subsequently called in or reported using the established phone lines to record the concern; in other cases, safety issues were not formally tracked or logged, consequently limiting the ability to track or report on the safety outcome or status.

All airport representatives surveyed reported that e-mail was used either as a means to receive an initial safety concern or to collaborate and communicate with other team members to resolve safety issues. Although individuals reporting safety concerns did not necessarily have direct access to individual staff e-mail addresses, group or shared e-mail accounts were most often used to receive and manage safety concerns or reports.

Only three (9%) of the 35 airport staff surveyed reported they do not lead or participate in standing safety-related meetings with staff or tenants. All respondents participating in safety meetings reported that the meetings were used to identify and discuss safety concerns. In most cases, safety meetings included participation from airlines, ground handlers, fuelers, and fixed base operators (FBOs). In some cases, airport representatives attended airline-facilitated meetings, and in other instances airport staff managed the meetings. Frequency of safety meetings ranged widely from monthly meetings to quarterly gatherings. Similar to verbal report processes, airport respondents confirmed that safety concerns were not always formally tracked, and in some cases, issues were managed through meeting agendas and not within reporting or safety tracking software.

32 of the 35 airport respondents participate in safety-related meetings with staff and/or tenants.

CHAPTER THREE

AIRPORT SAFETY DATA COLLECTION

To gain a better understanding of who within the airport organization submits safety reports, a series of questions was asked to ascertain what divisions, departments, tenants, and stakeholders submit what types of reports and through what methods. The reporting was further categorized into mandatory and voluntary segments to assess whether compatibilities, similarities, or differences existed.

SAFETY DATA REPORTING ENTITIES

The following groups or stakeholders were discussed:

- Airport departments and staff
- Police and fire (including ARFF)
- Tenants, airlines, and ground service providers (GSPs)
- FBOs and fuelers
- FAA departments and staff
- Passengers, the flying public, and communities
- Pilots
- Third parties (such as construction contractors)
- Other stakeholders mentioned by the interviewees.

Airport Departments and Staff

For all airports surveyed, mandatory reporting took place through the various forms of Part 139 compliance, health and safety reporting for staff, and various accident and incident claims, including facility and vehicle damage. Multiple routes and formats typically exist for staff to report safety concerns either directly to management or through human relations (HR) or health and safety departments for various state, city, or county health and safety programs similar to the national OSHA reporting program. Note that "[s]tate and local government workers are excluded from Federal coverage under the Occupational Safety and Health Act of 1970 (the 'OSH Act'). However, states operating their own state workplace safety and health programs under plans approved by the U.S. Department of Labor cover most private sector workers and are also required to extend their coverage to public sector (state and local government) workers in the state. Section 2 (11) of the OSH Act encourages states to develop and operate their own state OSH programs" (OSHA 2014).

Police and Fire (Including ARFF)

According to the *ACRP Legal Research Digest 7: Airport Governance and Ownership*, "There are over 4,000 [NPIAS] airports in the country and most of these airports are owned by governments." A 2003 survey conducted by ACI-NA concluded that city ownership accounts for 38%, followed by regional airports at 25%, single county at 17%, and multijurisdictional at 9% (Bannard 2013). The various ownership and management of airports include staffing for law enforcement officers, fire fighters, and emergency medical technicians (EMTs) and paramedic response services.

Airports managed under city, county, or authorities often provide law enforcement, fire, and EMT services through the governmental organizations, with staff either directly assigned to airport duties

Law enforcement and dispatch systems are often separate from Part 139 airport operations. Each collects safety data separately.

or rotated through individual airport assignments (including law enforcement support of TSA) operations. Because of the city- or county-wide dispatch and management of these services, often separate communication, technology, and data recording and reporting programs are established to manage staff dispatch; incident, fire, and police reports; and citations or tickets. These systems are rarely integrated with airport operations systems, thus resulting in duplicate reports and the need for departments to cross reference information, such as police reports related to accidents and incidents; EMT reports for trips, slips, and falls; and ARFF reports for fire and rescue.

As documented in the *ACRP Report 13: Integrating Airport Information Systems*, "The Airside division of Operations is responsible for ensuring that all aspects of the aircraft movement area remain in an airworthy and safe condition. . . . The Airside Duty Officer coordinates the joint responses of police, fire, medical, and airfield emergency operations and understands that safety is the most important responsibility. The Airside division also delivers reports to the appropriate agencies, files reports in the form of NOTAM, maintains the facility in a safe condition, and closes any unsafe areas" (Stocking et al. 2009).

The intent of the survey question "Who or what entities submit reports" relating to fire and police safety data (mandatory and voluntary) was to assess whether airport processes or systems integrated dispatch or reporting efforts to more effectively manage safety-related response from multiple departments or divisions. All airport respondents indicated that both fire and police submit mandatory reports as part of their required enforcement and oversight practices. In two cases, law enforcement, ARFF, EMT and operations all reported to a single airport department, thus facilitating information sharing. Two other airports commented that both operations and ARFF staff reported to a single department; however, the majority (88%) reported that a combination of city, county, or separate airport departments existed to support law enforcement, fire, and EMT services. In most cases (except for shared dispatch), all data tracking systems were separate and data were not shared on a regular basis. At a medium hub airport, dispatch calls include operations, ARFF, and police staff, with coordination occurring immediately for type of response required; police assist operations by securing the scene and coordinating with operations for information collection, reporting, and citations. Most often respondents indicated that data sharing was in support of an accident or incident requiring formal insurance or risk department claims processing. At one airport, the interviewee reported that State Police refused to share their reports, indicating a lack of airport operations staff jurisdiction for the information and thus requiring duplicate efforts from multiple departments for all incidents and accidents.

ARFF, EMT, police, and operations all collect safety data, but the data are rarely compiled in the same database or department.

Tenants represent the largest group of voluntary reporting entities at airports; rules and regulations often call out tenant reporting requirements.

Tenants, Airlines, and GSPs

As described, of the 35 staff interviewed, 60% of the airports employed some type of voluntary reporting program either through SMS (49%) or other reporting programs (11%). Tenants represent the largest and most comprehensive group of potential voluntary reporting entities at airports. Surveyed airport staff were asked, "Are tenants required to report through any of the following agreements," which included lease agreements, licenses, rules and regulations, contracts, municipality or city ordinances, and other. The most frequently used means to require tenants to report resulted in rules and regulations and lease agreements (see Table 9). Some airport rules and regulations specifically call out safety reporting requirements for FOD, accident and incident reports, and wildlife strikes. Many tenant leases establish 20- or 30-year terms and agreements that are difficult to update or modify. At some airports, rules and regulations serve as the only means to manage tenant safety behaviors, including smoking, speed limits, infractions, citations, and badge removal.

At a medium hub airport, the lease language requires tenants to notify the airport if changes are made to the leased ramp area that could affect maintenance. One large hub airport commented that safety reporting has been added to the airport ordinance as a requirement, and another large hub airport stated that tenants are required to follow and comply with the airport's directives through state

TABLE 9
AIRPORT SAFETY REPORTING ENFORCEMENT MECHANISMS

Enforcement Type	Lease Agreements	Licenses	Rules and Regulations	Contracts	Municipality or City Ordinances	Other
Respondent count by enforcement type	13	1	16	8	7	4
Respondent percent by enforcement type	37	3	46	23	20	11

3 shaded cells = 3 highest percentages.

codes of regulations. A large hub airport respondent mentioned that although the airport rules and regulations specifically call out the tenant requirement to report on all accidents and incidents, few reports are made unless the event is observed and reported by airport staff. Incidents and accidents involving a tenant's staff are rarely reported unless facility, equipment damage, or injuries occur. A medium hub airport representative with an SMS program under way shared that the airport was in the process of developing and distributing an airline user agreement that would include verbiage to require accident, incident, and hazard reporting from all tenants.

FBOs and Fuelers

In many cases, FBOs are considered one of the many airport tenants, and in other cases the airport management and staff can serve as the FBO. At many U.S. airports, commercial and GA fueling are provided by a single fueling/FBO service provider. The safety data survey specifically listed FBOs/fuelers as a separate entity (tenant) to assess whether safety reporting practices were similar for the group and other tenants or if different oversight and reporting were present. One of the key safety oversight responsibilities for airports is the formal fueling inspection required under Part 139. Specifically, the FAA requires "Inspection of fuel farm and mobile fuelers; check[ing] airport files for documentation of their quarterly inspections of the fueling facility; review[ing] certification from each tenant fueling agent about completion of fire safety training" (FAA 2014).

One of the key safety oversight responsibilities for airports is the formal fueling inspection required under Part 139.

Airport staff conducts fueling operations inspections of the FBO/fueler and collects reports for compliance with Part 139 requirements. All airport representatives indicated an FBO/fueler managed fueling or other duties at the airport; all stated that collection of mandatory safety data is accomplished through inspections. Because of the inspection oversight of the fueling operation, the airport operator has numerous opportunities to review operations and discuss safety concerns, which often leads to a more direct and frequently used communication route with FBO/fuelers regarding safety.

FAA Departments and Staff

The most frequently cited type of FAA communication at an airport was the interaction between the local air traffic control tower (ATCT) staff and the airport operations team. Most often, such communication related to airfield closures, Part 139 inspections, maintenance activities, FOD reports, wildlife sightings, and construction closures. Operations staff typically use radio or phones to communicate with FAA controllers for immediate communication (radio) or coordination (phone) of taxiway or runway closures. ARFF and the operations department use of crash phones, as documented in the Aircraft Rescue and Fire Fighting Communications AC 150/5210-7D, serves as "The initial notification method [alarm, dedicated telephone line (crash phone), two-way non-ATC radio, pager, dispatch service, etc.]" for ARFF response and coordination with ATCT. AC 150/5210-7D also states the "Communication between primary responders and the following: Airport controlling agencies, ATCT (Tower, Ground Control, Approach/Departure Control, [Flight Safety Standards] FSS), and Airport Operations" (FAA 2008).

Airport operations staff and FAA ATCT constantly communicate safety-related activities on the airfield, such as closures, FOD, and wildlife.

Passengers, the Flying Public, and Communities

Most safety concerns reported from the public were routed through onsite staff (for the most part staff located in the terminal or landside), such as police, customer service agents, custodians, or any badged airport staff. At some airports, interviewees reported that customers can report safety concerns, including those related to all aspects of airport operations, through a public website. One airport representative indicated a safety concern relating to ramp operations was reported through the public website by a person observing a safety infraction (speeding) from a gate area window. In another case, a terminal safety concern was reported using the airport's courtesy phone and was subsequently routed to the police. Interviewees generally commented that many public reports are often related to maintenance repair concerns, not safety issues.

Pilots

Typically, pilots report safety concerns directly to the air traffic controller (ATC); if such concerns are relevant, they are communicated to airport operations staff by the means described in the FAA departments and staff section. The most frequent types of pilot reports include FOD, wildlife strikes, and weather-related issues, such as surface conditions. They are reported through formal Pilot Reports (PIREPS), which are pilot reports of actual weather conditions that are reported by radio to ATC and shared with airport operations staff as needed, such as for runway surface and braking action conditions. At some airports, chief pilots or pilot safety representatives attend airline and airport safety meetings to report pilot-related safety concerns. Most often, critical issues are reported immediately to the ATC and resolved with the appropriate airport operations or maintenance staff.

PIREPs are a means for pilots to report surface and weather conditions to FAA and subsequently to airport operations for airfield safety management.

Third Parties (Such as Construction Contractors)

Construction on airfields requires a great deal of communication and coordination among multiple departments and functions. Airport operations staff work directly with airside construction managers and the ATCT to ensure airfield closures are communicated through NOTAM. Typically operations, the construction manager, the ATCT staff, and the construction team meet frequently to discuss safety concerns. In addition to construction inspections, airport operations staff conduct safety inspections to assess construction-related safety aspects, as outlined in FAA Part 139. Various items to be inspected include FOD, open trenches airfield lighting and signage, marking and lighting of closed pavement, construction staging areas and stockpiled materials, the marking and lighting of construction areas, construction barricades, and NOTAM.

Other Stakeholders Introduced by the Interviewees

Most often, communication with the TSA for security coordination and the wildlife management staff for wildlife strikes were reported as "other" airport communication groups. For one airport, outreach to its large GA community was considered a high priority to ensure GA pilots were provided with multiple means to report safety concerns.

METHODS TO COLLECT AND ANALYZE INFORMATION

Airport interviewees were asked numerous questions for each of the data collection and management steps presented in Figure 4 (A through K). Information was collected to document types of follow-up activities requiring response, investigation, tracking, documentation, and distribution of safety report details focusing on accident and incident investigations, mitigations, and trending.

The questions posed to the airport respondents were organized in a progressive manner to document airport processes and responses to safety reports. Each table (Tables 10 through 20) provides a summary of replies with the top three highest percentages highlighted. Note that Table 10 is a duplicate of Table 6 (as presented in chapter two); the question was intentionally repeated to provide

(text continues on page 24)

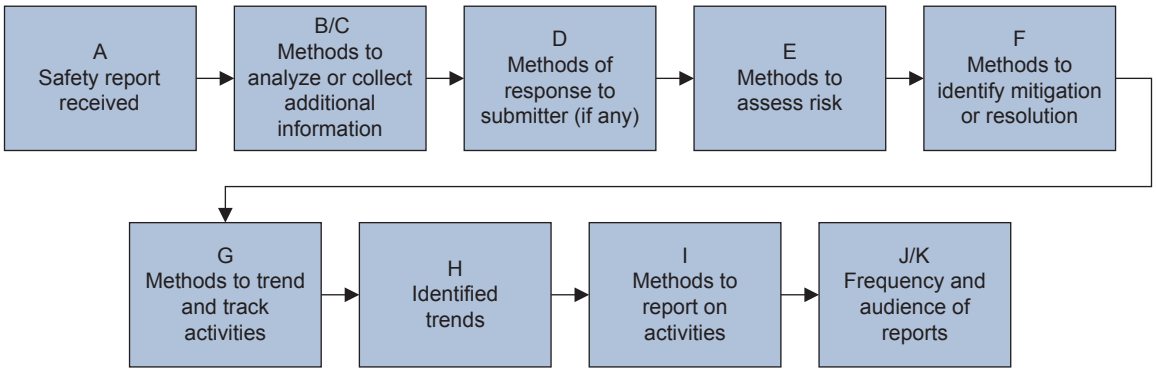

FIGURE 4 Sequential data collection and management steps relating to safety report processes.

TABLE 10
SAFETY REPORTS BY COLLECTION METHOD

Safety Reports Received by Method	Software	Website	Hard Copy	Phone	E-mail	Meetings	Verbal	Other
Count of reports received by method	16	21	17	32	29	30	32	2
Percentage of reports received by method	46	60	49	91	83	86	91	6

3 shaded cells = 3 highest percentages.

TABLE 11
DATA COLLECTION—ADDITIONAL INFORMATION COLLECTION METHODS

Means to Collect Additional Information	E-mail	Phone	Inspection	Assignment	Further Analysis	Interview/ Meetings	External Validation/ Experts	Personal Follow-up	Other
Count of means to collect additional information	20	19	35	34	29	24	6	27	4
Percentage of means to collect additional information	57	54	100	97	83	69	17	77	11

3 shaded cells = 3 highest percentages.

TABLE 12
DATA COLLECTION—ADDITIONAL INFORMATION ANALYSIS METHODS

Information Analysis Methods	E-mail	Phone	Inspection	Investigation	Further Analysis	Interview/Meetings	Other
Respondent count of information analysis methods	15	17	26	30	29	28	3
Respondent percent of information analysis methods	43	49	74	86	83	80	9

3 shaded cells = 3 highest percentages.

TABLE 13
DATA COLLECTION—SAFETY REPORT SUBMITTER RESPONSE METHODS

Response Method to Safety Report Submitter	Website	Meetings	Phone	E-mail	Face-to-Face	Bulletin Board	Other
Count of response method to submitter	1	16	25	30	25	0	4
Percent of response method to submitter	3	46	71	86	71	0	11

3 shaded cells = 3 highest percentages.

TABLE 14
DATA COLLECTION—RISK ANALYSIS METHODS

Risk Analysis Method(s)	Initial Triage/ Response	Risk Matrix for SRA	Risk Guide for SRA	Risk Definitions for SRA	Formal SRA	Formal Meeting (not SRA)	Individual/ Small Team Decision	Other
Respondent count of risk analysis method(s)	34	26	17	25	12	20	30	2
Respondent percent of risk analysis method(s)	97	74[a]	49[a]	71[a]	34	57	86	6

3 shaded cells = 3 highest percentages.
[a]Relates only to formal SRAs as part of SMS or compliance with FAA SRM processes.

TABLE 15
DATA COLLECTION—METHODS USED TO IDENTIFY MITIGATIONS OR SOLUTIONS

Mitigation Solution Identification Methods	As Part of SRA	Initial Triage/ Response	Formal Meeting	Management Decision (escalation)	Brainstorming	Risk Parameters or Thresholds	Regulatory or Safety Guidance	Individual/ Small Team Decision	Other
Respondent count of mitigation solution identification methods	20	30	26	19	26	10	33	29	2
Respondent percent of mitigation solution identification methods	57	86	74	54	74	29	94	83	6

3 shaded cells = 3 highest percentages.

TABLE 16
DATA COLLECTION—ACTIVITY TRACKING METHODS

Safety Tracking Methods	Software	Website	Excel	Manual Review	Meeting	Other
Respondent count for safety tracking methods	17	1	8	28	19	2
Respondent percent for safety tracking methods	49	3	23	80	54	6

3 shaded cells = 3 highest percentages.

TABLE 17
DATA COLLECTION—TRENDS IDENTIFIED THUS FAR

	Fewer Reports	Incomplete Reports	More Anonymous Reports	Fewer Accidents and Incidents	Better Quality Reports	More Complete Reports	Other
Respondent count of trend types	3	1	0	1	6	2	4
Respondent percent of trend types	9	3	0	3	17	6	11

3 shaded cells = 3 highest percentages.

TABLE 18
DATA COLLECTION—METHODS USED TO PRESENT STATUS AND STATISTICS

Methods to Present Information	Posters	Website	Bulletin Board	Meetings	Training Briefings	Verbal Reports	E-mail	Other
Respondent count of methods to present information	0	4	1	30	7	10	14	5
Respondent percent of methods to present information	0	11	3	86	23	29	37	14

3 shaded cells = 3 highest percentages.

TABLE 19
DATA COLLECTION—FREQUENCY OF STATUS REPORTS

Frequency of Status Reporting	As They Occur or Are Needed	Daily	Weekly	Monthly	Quarterly	Biannually	Annually	Other
Respondent count of status report frequency	27	17	10	25	8	2	5	2
Respondent percent of status report frequency	77	49	26	71	26	6	14	6

3 shaded cells = 3 highest percentages.

TABLE 20
DATA COLLECTION—STATUS AND STATISTICS PRESENTED, BY AUDIENCE

Information Presented to What Audience	Staff	Tenants	Management	Community/ Public	Regulatory FAA/NTSB	Other
Respondent count of presented to what audience	32	24	31	3	35	4
Respondent percent of presented to what audience	91	69	89	9	100	11

3 shaded cells = 3 highest percentages.

a start-to-finish series of questions. As noted previously, most safety reports are received by phone, meetings, and verbally through an airport representative. Many of the airport staff interviewed indicated a dedicated phone line exists with qualified staff that receive and triage calls for dispatch of relevant staff, such as police, fire, operations, maintenance, or a combination of staff as required by the type of report.

As noted in Table 11, airports apply various methods to collect additional information. The most frequently reported method for collecting additional information was through investigative or follow-up inspections or assessments. Investigations were typically followed by assignment (assigning a staff to assess the investigative report for appropriate actions or response), further analysis such as collecting additional information (often accomplished by dispatch staff receiving the initial call), and an appropriate level of response.

Most respondents indicated that the type of response depended on the criticality of the safety concern reported. For more immediate safety concerns, such as accidents, resources are deployed (police, operations, ARFF, security), and in some cases, citations or accident reports are documented, including photos and, as needed, witness reports. Some airport interviewees reported that, when serious accidents or incidents result in fatalities or airfield closures, numerous alerts are initiated to groups such as maintenance, operations, police, fire, ATC, and subsequently FAA or NTSB, as needed.

Airport representatives were asked to provide information on what methods are typically used to analyze or review additional information after the initial safety concern is reported. The top three responses, as presented in Table 12, include investigation, further analysis, and interview/meetings. For citations or rules and regulation infractions, additional information could be collected by reviewing the staff or tenant history of infractions, pulling or restricting badge access, meeting with the staff or tenant manager, and conducting a formal review of the noncompliant activity through a committee or safety forum. Later in the assessment process, the risk or legal departments may be included to address insurance or legal claims.

Airport respondents all said that providing status updates regarding the reported safety concern is an important aspect to "close the loop" for continued safety reporting protocols and general safety culture. If the report was received through an anonymous route, it was unlikely that the resolution of the safety concern was (or could have been) communicated. At one airport, the SMS communication plan originally included the concept of providing safety updates on a public bulletin board; however, the airport's legal department considered this a potential liability, and the approach was not implemented. Another airport said that all anonymous reports are presented and discussed by airport staff and tenant representatives at the monthly safety meeting.

When the submitter of a safety concern is known, other options, such as e-mail, phone, or face-to-face communication, were reported (see Table 13) as the most effective means for communicating resolution or status. One airport with an electronic reporting program indicated that the safety concerns are logged and all airport staff can review the status of the resolution and report to tenants. Many airport representatives indicated that e-mail provided a record of the date and type of safety concern for quality assurance purposes and to serve as tracking for future correspondence or identification of recurring problems (which typically relied on a manual review process).

Responses to risk analysis methods were divided into two groups: (1) airports that use a formal safety risk assessment (SRA) process as part of their SMS program or procedures relating to the FAA's safety risk management (SRM) processes, and (2) those that have not implemented the use of SRAs. Thus, two sets of responses were tracked for the single question.

As presented in Table 14, most airport respondents without a formal SRA program used the initial report of the safety concern as a means to analyze or categorize the potential risk from the safety concern or report, followed by small teams or individuals empowered with decision-making authority appropriate for the level of required response. Finally, if a complicated safety concern required multiple subject matter experts for the analysis, a formal meeting was convened.

For airports with formal SRA processes in place, 74% used a formal SRA risk matrix to assess risk, 71% assessed risk definitions (or thresholds), and 49% used a documented risk procedure to aid in formal risk analysis. Most respondents indicated a facilitator typically led the SRA, thus precluding the need for a documented risk procedure.

One airport interviewee stated that "most people know how to identify a problem but not a hazard and were able to work out resolutions to solve the problem. The challenge is changing the language and adapting to a more formal process that requires a different level of documentation." Another respondent indicated the airport used a combination of formal and informal processes depending on the level of complexity necessitated by the individual safety concern. For example, a formal SRA is being used for a Part 139 airfield safety enhancement study. A free Excel tool located at www.Thinkreliability.com was mentioned as helping to formalize root cause analyses.

Using formal safety terminology, such as hazard, risk, and mitigation, may require staff training and orientation for better understanding and collaboration.

To further assess how airport staff identified mitigations or solutions to the safety concern or safety report, the response most often reported (94%) was regulatory or safety guidance. As reported in chapter one, the FAA has a wealth of safety guidance materials within advisory circulars. However, many airport respondents indicated that mitigations, solutions, or resolutions were typically determined during the initial phone, e-mail, or verbal receipt of the safety concern by dispatch, operations, fire, police, or maintenance staff. As illustrated in Table 15, when immediate response is not sufficient to resolve safety issues, 83% of the respondents reported that a small team gathers to assess options and provide relevant subject matter expertise. Another aspect relating to mitigations or solutions introduced by several interviewees (more than half) was funding or budgets. In some cases, funding approvals require management approval. Similarly, budget processes typically require additional analysis and justification; and one respondent reported that an internal SRA was being conducted to formalize the safety risks and concerns to support the funding request for mitigation.

Most airport staff interviewed reported that representatives from each department (operations, maintenance, police, fire, etc.) collect and conduct manual reviews of information to track and trend data (see Table 16). Meeting notes, airport operation logs, paper records, e-mails, incident reports, and maintenance work orders were among the types of information most often assessed to track safety activities. Airport representatives with software systems reported that they were beginning to use their programs to log, track, trend, and report on safety activities, but in some cases, use of the system required entering the data from other reporting programs or manually reconciling reports from multiple systems for safety reporting. More than half of the responses indicated meetings were a means to track safety activities.

As presented in Table 7, 13 respondents reported use of SMS software, 17 reported Part 139 software, and 23 indicated use of maintenance software. Table 16 suggests that only a portion of the SMS, Part 139, and maintenance software programs are being used for safety tracking.

Asked whether any safety reporting trends had been observed thus far, most respondents reported that this information was difficult to ascertain, largely because no or little formal tracking of safety reporting had been conducted. A few airports with SMS programs observed a small decline in voluntary safety reports (see Table 17), citing that this may be the result of decreased promotional activities following program launch and noting a likely need to continually promote the program and its use. In some cases, airport representatives commented that better attention to detail on internal reports was noticeable, and staff understood the value of consistent reporting and were making an effort to improve quality of the reports. One airport representative reported that with the initial rollout of the web-based reporting portal, the airport received a number of nonsafety-related concerns but with follow-up and additional training, all recent reports were safety related.

Quality of safety reports improves with staff training and consistent use of the reporting system.

A GA airport respondent reported that "more informative reports are being submitted, better quality reports, including more appropriate types of reports for hazard reporting such as concerns that need to be addressed. The program is working because multiple reports of the same concern are being submitted; this is likely due to a greater awareness for hazards and the promotional campaigns

we are using to inform everyone." A non-hub airport representative indicated that the airport staff are in the process of standardizing information collection, including photos of or detailed description of slips, trips, and falls for insurance claims, which is improving overall quality and the value of the reports.

Meetings are the most used means to report safety concerns, status, and statistics to staff and tenants.

Most respondents (86%) indicated that meetings were the most often used format for presenting status and statistics of safety reports (see Table 18). Either through standing safety meetings or informal exchanges, meetings constitute an easy and efficient way to communicate safety information. One airport representative mentioned that staff was in the process of building a safety dashboard for management review, but while the program was being developed, safety meetings were used to cover the topics. Health and safety or OSHA statistics often were reported as being formally communicated to staff and management through monthly e-mails. Other airport interviewees shared that their staff discuss safety concerns on a daily basis. These data-sharing discussions often are part of the airport's daily staff or shift meetings for operations and maintenance staff. At a medium hub airport, the safety meeting includes both staff and tenants for general safety items. A separate meeting is held by airport managers to review airport staff topics related to health and safety.

In some cases, a verbal report provided directly to the individual who had called in the safety concern was considered the most efficient means for discussing status and presenting the mitigation or corrective action.

With regard to the frequency of safety reporting (see Table 19), most airport interviewees (77%) responded that providing status of a safety concern was fundamentally part of their operations daily routine. In addition to shift notes, staff ensured open safety problems were well documented either as part of a formal software program (most reported using a work order tracking program to update the status of open safety items or discrepancies) or through inspection logs, reports, or face-to-face shift meetings.

As frequently described in responses, safety meetings (which typically occur on a monthly basis) provide a key forum for formal safety reporting. Daily, weekly, and monthly operations and maintenance meetings, including health and safety reporting, were listed most often as the forum for staff safety reporting and communication.

Management either participated at these meetings or served as the means for escalating resolutions to safety concerns, especially when solutions required budget or funding approvals. Although tenants received safety reports at monthly safety meetings, the public or community was rarely informed of specific safety reports. An interviewee said the public is interested in noise concerns, which typically are handled through the public relations office or noise department.

As described in chapter one, airports certificated under Part 139 collect inspection and other types of data, which are made available on request to the FAA (see Table 20). Staff and management ranked next with 89% and 91% reporting, respectively.

CHAPTER FOUR

STAFF RESPONSIBILITIES AND FUNCTIONS

At U.S. airports multiple divisions, departments, and functions support the safe operations of an airport. Some airports participating in the study have begun to implement voluntary safety programs through SMS. All are faced with the ongoing challenge of logistics, coordination, and communication across various internal and external lines of business. To better understand safety data collection and reporting, interviewees were asked to provide figures for the total of staff with safety-related roles, identifying both dedicated and collateral duties to support the data collection, analysis, investigation, and reporting functions.

STAFF-DEDICATED AND COLLATERAL DUTIES

The following summary provides a list of dedicated staff with safety-related and collateral safety duties by the airport's NPIAS category. Many respondents reported that safety roles crossed multiple departments, including operations, maintenance, security, police, ARFF, EMT, dispatch, and SMS and that the collateral duties were integrated into existing duties, such as self-inspections, accident investigations, maintenance repairs, 911 and ARFF response, and medical runs. Few airport representatives indicated that a dedicated staff was assigned the sole duty of safety management, including data collection and analysis. The highest number reported was four staff at a medium hub; however, the interviewee commented that, although staff was managing safety, they are not fully dedicated to SMS. Of the 13 airports reporting the assignment of dedicated staff, most indicated a single staff member was appointed the SMS duty, regardless of the size of the airport operation, and that the other dedicated staff included employee health and safety or emergency response functions. See interviewee comments in Table A1 in Appendix A for additional clarification regarding the groups considered within the collateral safety duties for each airport.

Few airport representatives indicated that dedicated safety staff was assigned a single duty.

Total staff counts (presented in low to high ranges) for both dedicated and collateral are summarized as follows:

Large hub	Dedicated 0 to 2	Collateral 23 to 615
Medium hub	Dedicated 0 to 4	Collateral 15 to 300+
Small hub	Dedicated 0 to 3	Collateral 6 to 30
Nonhub	Dedicated 0 to 3	Collateral 5 to 300
GA/Reliever	Dedicated 0 to 0	Collateral 2 to <10

DEPARTMENT FUNCTIONS AND DATA MANAGEMENT

A series of questions was asked to determine "who does what" relating to safety data management. The purpose of the questions was to investigate how many different departments were performing similar functions related to safety data collection, analysis, and management report development. The anticipated response was that multiple staff and departments used separate systems, manual processes, software programs, and procedures to manage data.

To reflect the various departments and functional areas possibly involved in data management, the respondents were asked, "What staff or departments are responsible for the following: (For

example, Operations, Risk, Maintenance, Corporate)?" The questions were grouped into three types of activities:

A. Safety Data Collection
   1) Data and Safety Report Collection
   2) Safety Report Review and Analysis
   3) Data Scrubbing and Deidentification
B. Assessment and Investigations
   1) Accident/Incident Investigation
   2) Hazard Assessment
C. Analysis and Development
   1) Data Analysis and Trending
   2) Management Reports Development and Distribution

A total number of responses by department participating in each of the three data management functions was collected and compiled into a matrix for analysis. Table 21 reflects the total counts by department and data management function. A summary of the aggregated results is presented in Figure 5, and details for each of the three areas (A, B, and C) are presented in Figures 6, 7, and 8.

As shown in Figure 5, many airport departments perform similar duties relating to data collection, review, analysis, investigation, tracking, trending, and report development, with the majority of data management efforts documented in operations, police, ARFF/fire, and maintenance, followed by risk, and management. Duplication of efforts, redundant data reporting, and silos of information

TABLE 21
TOTAL COUNT OF REPORTING FUNCTION BY DEPARTMENT

Functions	A) Safety Data Collection			B) Assessment and Investigations		C) Analysis and Development	
Departments	Data and Safety Report Collection	Safety Report Review and Analysis	Data Scrubbing and Deidentification	Accident Incident Investigation	Hazard Assessment	Data Analysis and Trending	Management Report Development and Distribution
ARFF/Fire	12	11	1	20	7	8	7
Communications center	2	0	0	0	0	1	0
Construction	0	0	0	0	4	0	0
Customer service	0	1	0	0	0	0	0
EMT	0	0	0	1	0	0	0
Environmental	1	1	0	0	1	1	1
FAA	0	0	1	2	0	0	0
Facility management	1	0	0	0	0	0	0
Health and safety	2	3	0	1	1	2	4
Landside	1	1	0	3	0	1	1
Legal	0	0	0	1	0	0	0
Management	3	5	1	6	8	6	4
Maintenance	16	9	0	3	6	6	3
NTSB	0	0	0	1	0	0	0
Operations	31	25	2	30	25	23	22
Operations wildlife	0	0	1	0	2	1	1
Police	16	11	2	25	6	8	7
Public safety	4	5	1	5	4	0	1
Risk	9	12	4	9	8	11	10
Security	2	2	0	2	1	1	1
SMS	4	5	3	4	4	5	4

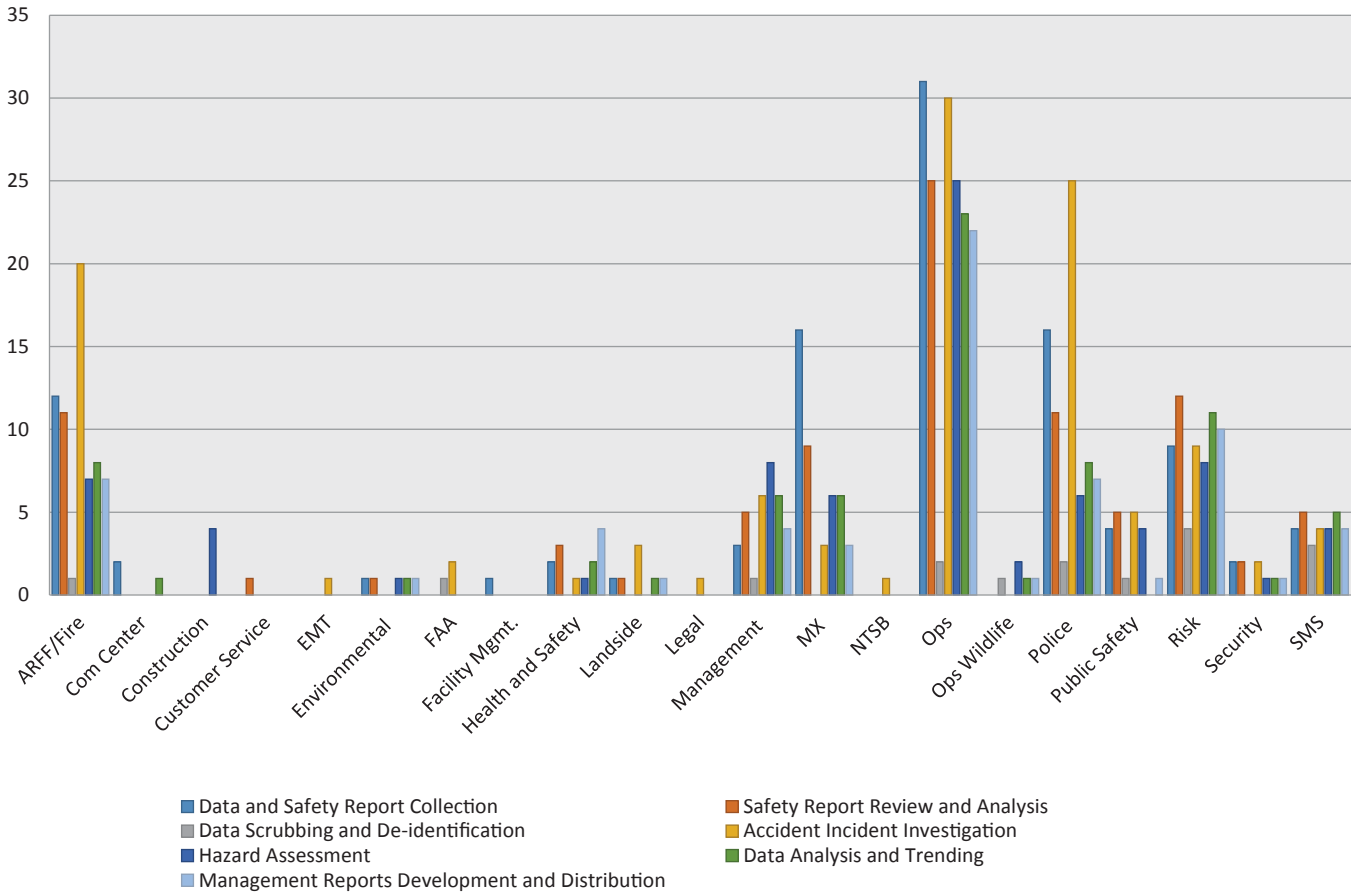

FIGURE 5 Summary of data activities by functions.

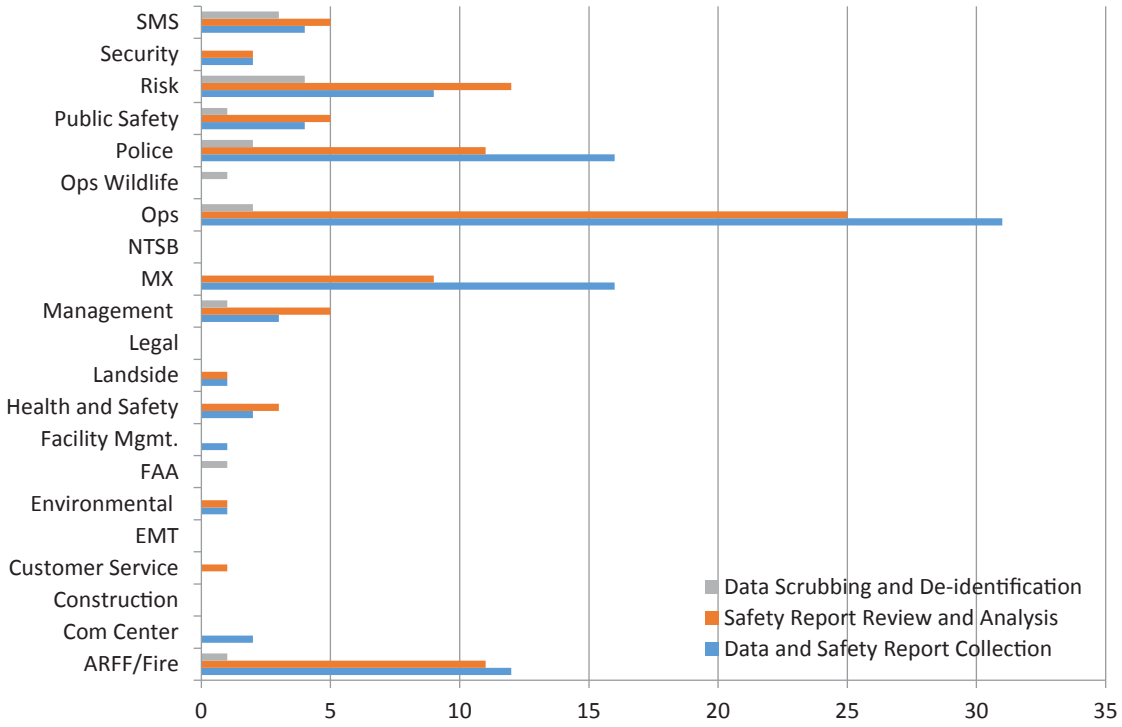

FIGURE 6 Safety data collection.

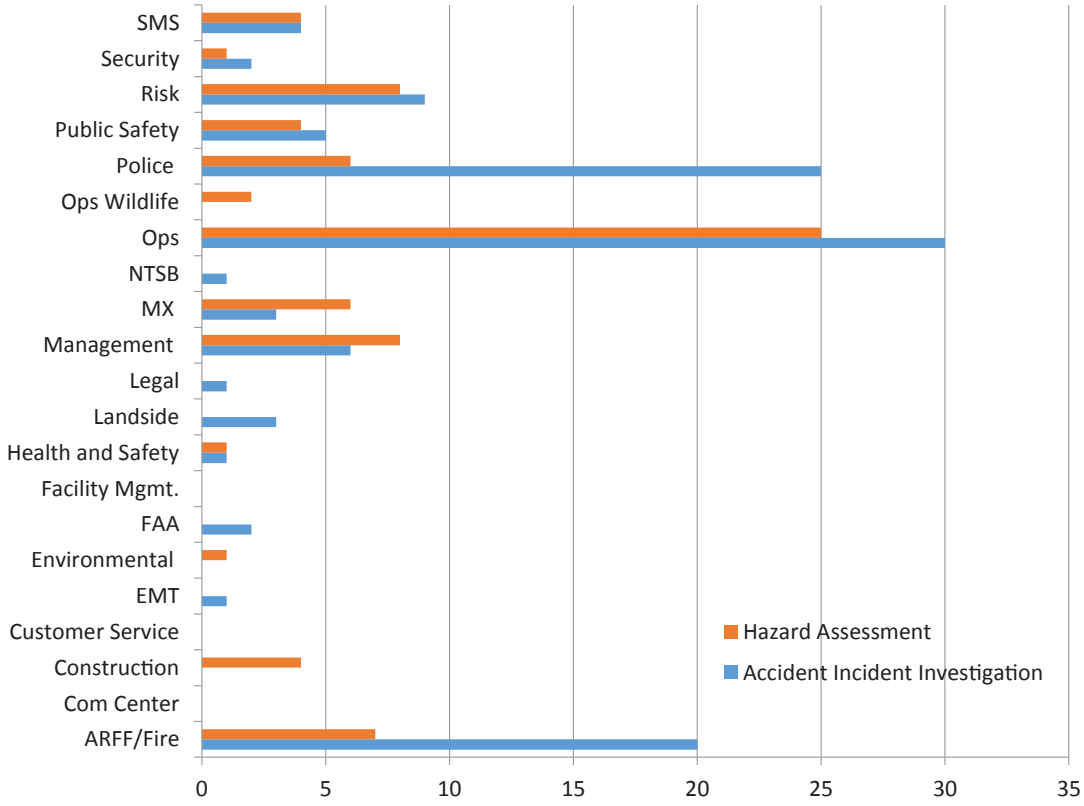

FIGURE 7 Assessment and investigations.

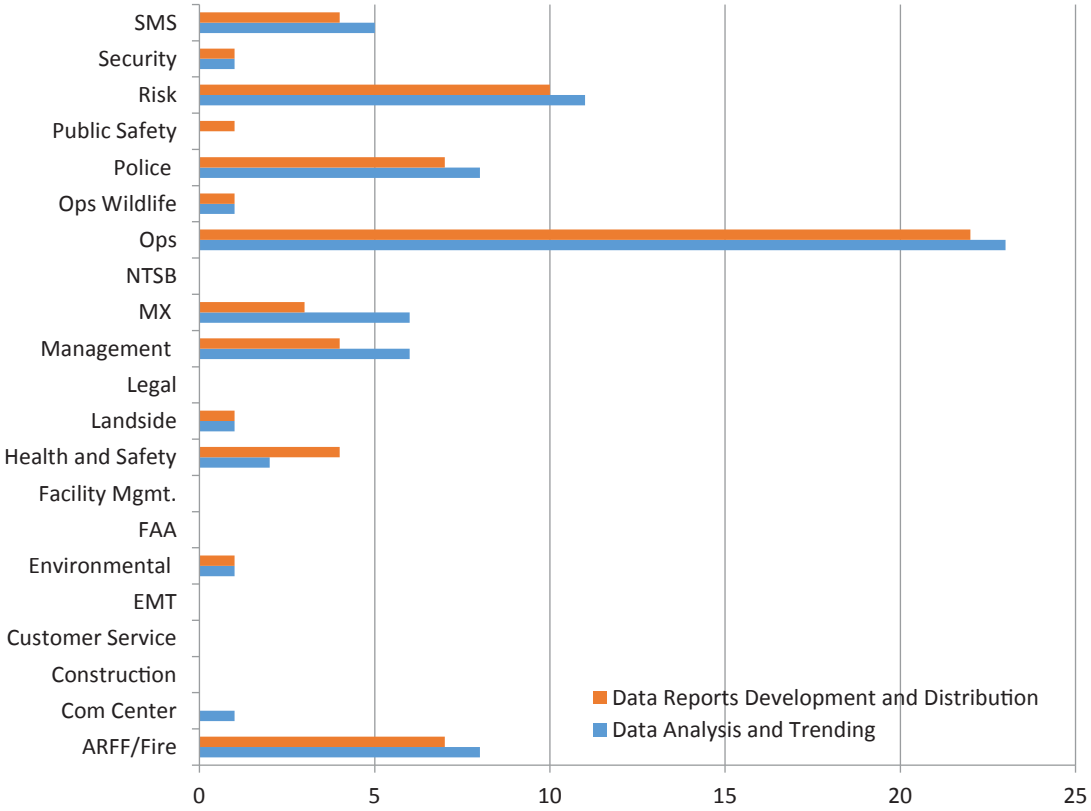

FIGURE 8 Analysis and development.

are possible outcomes of the responses represented; however, Figure 5 demonstrates that multiple departments are collecting, managing, and reporting on a variety of safety data. The potential for data centralization, consolidation, and reporting could result in more efficient and effective data management, analysis, retrieval, and reporting and provide management with a collective view of safety activities throughout the airport.

Figure 6 provides a detail of data collection activities by department. The three areas include data collection, deidentification, report review, and analysis. The three departments with the highest level of data collection activities, as reported by respondents, include operations, police, and maintenance. Safety report review takes place less frequently in these departments; however, in risk, where safety reports typically are collected from others, review of the safety reports has a higher occurrence. With regard to data scrubbing or deidentification, risk, SMS, and police are most likely to perform this activity.

Figure 7 presents a detail of the hazard assessment and accident incident investigation activities by department. As shown, operations, police, and ARFF conduct the most accident and incident investigations, with hazard assessments more frequently performed by operations than either police or fire. Also note that risk, management, maintenance, public safety, and construction departments participate in hazard assessments, which typically are part of incident or accident follow-up. Under construction, respondents reported that hazard assessments were performed as part of FAA's SRM requirements.

Figure 8 illustrates details for data analysis, report development, and distribution. Airport operations was the most likely to perform data analysis and trending, with risk and police completing the top three. ARFF, management, maintenance, and SMS also conduct data analysis and trending as part of their duties. Report development and distribution is highest within airport operations departments, with similar results for risk and police. Of interest is the higher occurrence of analysis activities than report development in all of the top three departments and, indeed, in all of the departments shown with one exception. In health and safety, analysis and trending occur less frequently than do report development and distribution.

CHAPTER FIVE

DATA USE AND SHARING WITH EXTERNAL ENTITIES

As discussed in chapter four, airport departments collect various types of data for each functional area, and the information is commonly stored and managed in separate systems, departmental files, or software programs.

EXTERNAL REPORTING

The study investigated whether airport staff or management provided safety-related data to outside entities, such as state organizations, research institutions, insurance agencies, or health and safety offices. The study purpose was twofold: (1) to assess the types of external organizations that collect airport data and its use and (2) to document how airport operators collect, manage, and deliver data to external entities. Table 22 provides a summary of agencies and types of reporting, including research, health and safety, other organizational reporting, and insurance claims or companies. The most frequently reported external agency types included state department of transportation, city, county, police, state, state legislature, port authority, and department of labor. Reporting to these entities usually is required by statute or regulation. Because most NPIAS airports are owned by public entities, it is not surprising that some level of external reporting to city, county, or state agencies is expected.

Airport representatives indicated frequent reporting to academic (universities), research institutions, or other industry groups, such as ACRP, ACI-NA, AAAE, and the Takeoff/Landing Performance Assessment Aviation Rulemaking Committee. One nonhub airport representative noted that the airport often served as a test bed for local university programs and provided opportunities for collaboration with students and professors to investigate emerging technologies and programs. The airport's particular geography also provided an ideal location for weather studies. With regard to health and safety and insurance claims reporting, airport functions specifically related to health, property, and other formal insurance claims are similar to those of other private or public organizations.

EXTERNAL VOLUNTARY REPORTING PROGRAMS

To understand the feasibility of future voluntary reporting programs for airport operators, despite the known challenge of public disclosure and sunshine laws (see chapter six), one of the study objectives was to assess existing voluntary reporting programs and document the processes, procedures, and possible limitations for the airport operator. Chapter seven provides a review of the value and uses of proactive data with regard to safety management and proactive measures.

Many existing safety voluntary reporting programs are established on the premise of confidentiality and nonpunitive safety reporting.

Multiple voluntary reporting programs currently exist for pilots, airline crew, dispatch personnel, air traffic controllers, airline maintenance staff, charter airlines, and ground handlers. A list of voluntary reporting programs is presented in Table A2 in Appendix A. One of the earliest programs, the ASRS, was established in 1975 as a result of the Study of the National Air Transportation System founded on the Secretary's Task Force on the FAA Safety Mission initiative. ASRS receives nearly 6,000 reports on average per month. Other voluntary reporting programs exist that follow a similar function for receiving, analyzing, and reporting on hazards, accidents, and incidents. The programs are established on the premise of confidentiality and nonpunitive safety reporting. According to the Air Charter Safety Foundation, "[Aviation Safety Action Program] ASAP fosters a voluntary, cooperative, non-punitive environment for the open reporting of safety of flight concerns. Through such reporting, all participants have access

TABLE 22
REPORTING TO EXTERNAL AGENCIES

	Airport Reports to External Agencies	Research	Health and Safety	Other Organizational Required Reporting	Insurance
1.	State Department of Transportation			X	
2.	City for claims			X	X
3.	ACRP	X			
4.	Department of Labor, State Department of Transportation, ACI-NA, AAAE	X	X	X	
5.	County Commission			X	
6.	State			X	
7.	ACI-NA	X			
8.	Takeoff/Landing Performance Assessment Aviation Rulemaking Committee, universities	X			
9.	State Department of Transportation			X	
10.	City, police department			X	
11.	State legislature			X	
12.	University	X			
13.	OSHA, Port Authority		X	X	
14.	State Department of Transportation, county			X	
15.	Port Authority			X	
16.	OSHA		X		
17.	Insurance provider				X

to valuable safety information that might not otherwise be obtainable. This information is analyzed, and corrective action is developed, to help resolve safety issues and possibly eliminate deviations from the federal aviation regulations (FAR). When a report is accepted under ASAP, the FAA will use lesser enforcement action or no enforcement action, depending on whether it is a sole-source report, to address an event involving possible noncompliance with the FARs" (Air Charter Safety Foundation 2014).

The information reported by the aviation professionals results in detailed reports for analysis and trending at many organizations, including the FAA. The ASIAS program consolidates more than 150 separate databases and data sources to provide integrated reports for safety management. One of many ASIAS goals is to "proactively identify and evaluate safety issues through aggregation of data and sharing of analysis capabilities. The aviation community has adopted an [SMS] approach to continuously improve aviation safety, as expected by the public and the U.S. Congress. Analysis and sharing of safety information are considered critical pieces of the SMS approach" (Joint Planning and Development Office 2009).

Today, no centralized repository of safety-related data exists for airport-specific activities. According to the GAO report *Enhanced Oversight and Improved Availability of Risk-Based Data Could Further Improve Safety*, "FAA oversight in the terminal area is currently limited to certain types of incidents, notably runway incursions and certain airborne incidents, and does not include runway overruns or incidents in ramp areas. In addition, the agency lacks data collection processes, risk-based metrics, and assessment frameworks for analyzing other safety incidents such as runway overruns, incidents in ramp areas, or a wider range of airborne errors" (GAO 2011). The GAO further indicated in its 2013 report *FAA Efforts Have Improved Safety, but Challenges Remain in Key Areas* that with regard to runway and ramp safety, "Additional information about surface incidents could help improve safety in the airport terminal area, as data collection is currently limited to certain types

of incidents, notably runway incursions, which involve the incorrect presence of an aircraft, vehicle, or person on a runway and certain airborne incidents, and does not include runway overruns, which occur when an aircraft veers off a runway or incidents in ramp areas, which can involve aircraft and airport vehicles" (GAO 2013).

ICAO's Annex 19 regarding reporting systems indicates that:

> 5.1.1 Each State shall establish a mandatory incident reporting system to facilitate collection of information on actual or potential safety deficiencies.
> 5.1.2 Each State shall establish a voluntary incident reporting system to facilitate collection of information on actual or potential safety deficiencies that may not be captured by the mandatory incident reporting system (ICAO 2013).

How does the FAA propose to increase safety reports from airport staff and tenants to more effectively manage safety through proactive or predictive means? FAA's SMS Supplemental Notice of Proposed Rulemaking, scheduled for release and comment in 2014 and finalization in 2015, could propose a means of achieving a more formal level of data reporting and analysis. However, FAA's SMS Notice of Proposed Rulemaking and the Draft SMS Advisory Circular 150/5200-37A, Safety Management Systems for Airports, includes no specific requirement or process for airport operators to report safety data, voluntary or otherwise, to a national repository.

CHAPTER SIX

LEGAL CONCERNS

This chapter focuses on the questions relating to legal concerns associated with safety data storage and protection. Most, if not all, interviewees represented airport operations departments, and such representatives may have limited information about or participation in legal issues relating to SMS, including public information or sunshine law requests.

DATA PROTECTION: WHAT IS THE ISSUE AND WHY DOES IT MATTER?

The conflict between the benefits of protecting safety data from disclosure and the requirements of state sunshine laws has the potential to fundamentally undermine the goals and effectiveness of SMS. Fundamental to an effective SMS is a robust flow of data that will allow in-depth proactive and predictive analysis. Studies have shown that when safety data are held in confidence, the quality of the content and frequency of the reporting of such information are improved. However, most U.S. airports are owned and operated by governmental entities and are subject to state and local sunshine laws that require disclosure of all public records upon request (Bannard 2013).

The Flight Safety Foundation has estimated that nearly 98% of the aviation safety information obtained from voluntary disclosure programs would no longer be available if participants were subject to prosecution and penalties (Flight Safety Foundation 2008). Eurocontrol undertook a study to determine what impediments exist to reporting and sharing safety information across countries in the European Union (EU) and found that freedom of information laws and national laws allowing prosecution of individuals involved in the aviation industry directly led to underreporting. Respondents to the safety data survey undertaken as part of this synthesis reported that at six of the 35 airports, some tenants refused to participate in voluntarily providing SMS data. Primary reasons included concern with public disclosure and the added burden of dual reporting.

Different countries have differing approaches to the treatment of safety data. In Canada, unlike the United States, airports are generally operated by private, not-for-profit, nonstock corporations that are not subject to governmental sunshine laws. As a result, Canadian airports have been able to implement SMS programs that expressly provide for confidentiality. Furthermore, the Canadian Aviation Regulations applicable to SMS require that SMS programs include conditions under which immunity from disciplinary action will be granted. Transport Canada's guidance regarding SMS states that among the essential elements of a safety culture are a "reporting culture," where "people are prepared and encouraged to report their errors and near misses," and a "just culture" that "establishes an atmosphere of trust where reporting is encouraged and where a line is drawn between acceptable and unacceptable behaviours" (Transport Canada 2012).

> How data are collected, maintained, and used may significantly affect the quantity and quality of safety data.

In contrast, various EU countries' laws relating to data protection run the full gamut, from permitting safety data to be fully protected from disclosure to constitutional provisions that require all public information to be made available, subject to certain minimal exceptions. This contrast has discouraged many member states from reporting and sharing aviation safety information with the EU's central depository. At a recent EU safety conference, experts and trade groups called upon the EU and its countries to enact legislation that would protect safety data from disclosure and permit the sharing of such information among member states (Bannard 2013).

What does this mean for U.S. airports that are seeking to implement safety reporting systems, and why should they care? Because how data are collected, maintained, and used may significantly affect the quantity and quality of safety data that an airport will be able to obtain pursuant to its SMS program. Described here is a summary of the legal issues that give rise to data disclosure, the legal aspects of several other FAA safety data collection programs and how these programs protect against data disclosure, and a brief analysis of specific safety data survey results administered at the 35 participating airports.

STATE SUNSHINE ACT LAWS: WHY DATA MAY BE SUBJECT TO DISCLOSURE

In addition to the federal freedom of information act, known as FOIA, most states and many municipalities have enacted "sunshine laws." Similar to FOIA, these laws provide that, with limited exceptions, any public record must be disclosed if a person makes a request for such record. Under most state sunshine laws, any information, data, documents, and other materials in the possession of a governmental entity are considered public records and are subject to disclosure upon request, unless such data are subject to an exception set forth in the law. In most states, safety data are not currently subject to a statutory exception that permits safety data to be withheld from disclosure. Furthermore, many states interpret their sunshine laws quite liberally and interpret exceptions quite narrowly. Some states, such as Florida, have written their sunshine laws into the state constitution, leading judges to refuse to create any exceptions to the disclosure requirements not expressly stated in the law.

State sunshine laws (like the federal FOIA) provide that any public record must be disclosed if a person makes a request for such records.

The federal FOIA, in contrast, includes two separate exceptions for aviation safety data. One such exception permits the FAA to withhold safety or security information provided voluntarily from disclosure if the FAA determines that is consistent with the FAA's safety and security responsibilities (see 49 U.S.C. §40123 and 14 C.F.R. Part 193). This exception to FOIA is at the heart of the FAA's ASAP program, discussed here and in chapter five. In addition, the 2012 act that reauthorized the FAA expanded the scope of aviation safety data that are exempt from disclosure under FOIA to include "reports, data, or other information produced or collected for the purposes of developing and implementing a safety management system acceptable to the Administrator [of the FAA]." However, this limitation on disclosure relates only to information provided voluntarily. It applies only if reports, data, or other information "is submitted to the Federal Aviation Administration voluntarily and is not required to be submitted to the Administrator under any other provision of law" (see 49 U.S.C. §44735). Nevertheless, these two federal exceptions do not modify the various state and local sunshine laws applicable to airports owned and operated by state or local governments and authorities.

As part of the synthesis survey, airport staff was asked, "Have any sunshine law/FOIA requests for safety related data been received? If so, how were these addressed?" Few responded in the positive (see Figure 9); however, it is possible the interviewees were not aware of such requests, which typically are made through legal departments.

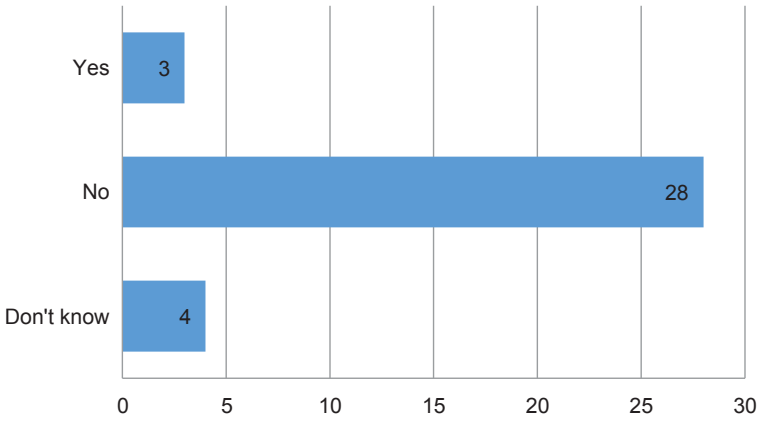

FIGURE 9 Safety data and FOIA requests.

Thus, although federal law protects safety data voluntarily provided to the FAA from disclosure under federal FOIA, there is no protection from disclosure of such data under many, if not most, state and local sunshine laws.

It is also important to note that even safety data that are not subject to disclosure under FOIA have been found to be subject to discovery in litigation. For example, in litigation arising from the crash of a commercial aircraft at Blue Grass Airport in Kentucky, the court found that the plain language of the Section 40123 did not require that data gathered under the ASAP program be protected from discovery in litigation. Thus, even if safety data can be protected under FOIA from disclosure upon request, it is likely that the data must be made available to counsel in the event of litigation.

LEGAL ASPECTS OF OTHER FAA DATA COLLECTION PROGRAMS

Several successful federal aviation safety data programs directly rely on the federal statutory exception from FOIA for voluntarily provided safety data. Among the programs that have been in operation for many years are ASAP, maintained by FAA, and ASRS, maintained by NASA. Although differences exist between these two programs, both programs gather data regarding air safety from multiple sources on a confidential basis and analyze that data to seek precursors of aircraft accidents. Both programs include protections for persons who report to the program, but each also exempts from these protections persons whose actions were deliberate; who were involved in a criminal offense; are frequent violators of norms; or fail to promptly report the accident or incident. ASRS makes its reports available publicly, but deidentifies, or strips out, data that could identify the persons reporting an incident as well as the parties involved in the incident. On the other hand, ASAP reports are not deidentified but are protected from public disclosure under the exception to federal FOIA set forth in 49 U.S.C. §40123.

The U.S. GAO noted that "the data that the FAA obtains through voluntary reporting programs afford insights into safety events that are not available from other sources and are critical to improving aviation safety." However, the GAO has also found that "participation in these [voluntary reporting] programs has been limited by concerns about the impact of disclosure and, especially in the case of small [air] carriers, by cost considerations" (GAO 2011). Per the GAO report, it would appear that confidential, voluntary programs have helped increase aviation safety, and the protection of these data from disclosure and deidentification of publicly released data are important to the success of these programs.

Two factors distinguish ASRS and ASAP from reporting systems under SMS undertaken by U.S. airports. The first is that the data and other information gathered at the corporate level before they are submitted to the FAA's ASAP program are not subject to any state or local sunshine laws, and once such data are submitted to the FAA, they are protected by the statutory exception from FOIA. (However, as noted previously, such data may not be exempt from discovery in litigation.) Similarly, data in public reports issued under ASRS are gathered directly from individuals in the aviation system who are not subject to state sunshine laws, including pilots, air traffic controllers, flight attendants, and maintenance personnel. Such data are protected from disclosure when reported to NASA and are deidentified when the reports are issued. Thus, under these two programs, safety data are protected from disclosure from the time they are gathered through their compilation, analysis, and publication.

The second distinguishing factor is that the FAA enters into memoranda of understanding with the various participants in the ASAP program that set forth various protections for the persons reporting to the program, including limiting disciplinary action, except in cases of criminal activity, substance and alcohol abuse, or intentional falsification of reports. Because the persons involved in an incident or "near miss" often are the ones most knowledgeable about the incident and its causes, proponents of SMS are also often strong supporters of "just culture." Just culture is defined as a corporate culture in which persons reporting errors that do not rise to a specified level or arise from prohibited actions (such as criminal behavior, deliberate conduct, or the involvement of prohibited activities including as substance abuse) are actively protected from punishment for their errors.

In contrast, once an airport has gathered safety data pursuant to its SMS program, such data generally constitute a public record subject to the requirements of the applicable state and local sunshine

laws. Airports thus lose the ability to protect such information from disclosure under state sunshine laws as soon as the airport collects such data. Furthermore, establishing "just culture" at an airport can not only pose cultural difficulties, but also may run counter to local law or require amendment of union contracts or employee handbooks.

ANALYSIS OF THE SURVEY DATA

Several of the questions in the survey that was administered to the 35 airports touch on these issues, including the ability to voluntarily or anonymously provide information to the program and whether airports are receiving any voluntary reports; whether reporting of SMS data are required of tenants and other stakeholders; whether airports have data protection practices and procedures in place; and whether airports are finding that stakeholders are refusing to provide SMS data voluntarily.

Many airports with an SMS program have established voluntary, confidential reporting programs, but most of these airports are not receiving many, if any, voluntarily provided reports. Of the 35 airports that responded to the survey, 20 (57%) (see Table 4) reported that they have established a voluntary reporting program independently or as part of their SMS. When asked whether third parties voluntarily provide safety data, 11 of the interviewees reported that third parties had a mechanism to report safety-related information, and the remaining 24 reported they had not yet established or were in the process of developing a third-party reporting program. The airports that stated they received voluntary reports generally indicated few reports per month, and only one airport found that more than 20% of its voluntary reports were anonymous. One medium hub airport representative commented that most individuals reporting safety concerns preferred to provide contact information, despite the option for anonymity.

Airports with voluntary, confidential reporting programs are not receiving many reports.

More than half (60%) of the airports surveyed have established one or more legal mechanisms designed to require tenants and other third parties to report safety data, including one or more of the following: rules and regulations (46%), lease agreements (37%), contracts (23%), and municipal ordinances (7%). Given the difficulty of negotiating a new provision into a lease, nearly half of the airports (46%) stated that they had adopted such a requirement in the airport's rules and regulations, and of these airports, 11 include this requirement in both leases and rules and regulations. As noted earlier, many of the airports that adopted one of these methods of requiring tenants and other airport stakeholders to report safety information have adopted multiple mechanisms to compel such reporting. Nevertheless, 21 (60%) of the airports surveyed had adopted some method intended to require reporting by tenants.

Although it may be the result of the relatively short period of time that SMS has been in operation at airports in the United States, only three airports reported that they had received a FOIA or sunshine law request for safety data, and the same number (albeit different airports) reported providing safety information to the community. Twice as many airports (six) reported that one or more stakeholders, generally air carriers, had refused to participate in their SMS program, which may indicate some level of discomfort by third parties at providing sensitive safety data to a public entity, and only eight airports reported having established any deidentification or "scrubbing" processes. The deidentification was reportedly completed by the following departments: risk management (four), public safety (three) and the SMS administrator (three) (including some duplication of duties).

Although most airports have only recently established their SMS programs, three (9%) reported that safety status and statistics are presented to the community, whereas most reported such safety information to management (89%), staff (91%), regulators (the FAA or NTSB) (100%), and tenants (69%) (see Table 20).

CHAPTER SEVEN

SPECIAL CONCERNS

In previous chapters, information gathered from airport respondents demonstrated that safety data are collected from multiple departments, are often manually compiled and analyzed, and are rarely integrated with more than one airport functional area. This chapter presents findings related to preventive uses of safety data, including the value and types of data trending for proactive safety management and the possible future SMS requirement that could improve safety data management and reporting.

DATA AND PREVENTIVE USES

According to ICAO's *Safety Management Manual* Document 9859, various methodologies for identifying hazards (safety concerns) include both reactive and proactive approaches, for which a reactive approach relies on "analysis of past outcomes or events [where] [h]azards are identified through investigation of safety occurrences [and] . . . [i]ncidents and accidents are clear indicators of systems' deficiencies" (ICAO 2013).

Airport staff are collecting information that can be used for preventive measures.

The progression of airport data collection and analysis through use of the reactive analysis methodology, based on assessment of collected data, can ultimately lead to a proactive hazard analysis. Specifically, "This new approach is based on routine collection and analysis of data using proactive as well as reactive methodologies to monitor known safety risks and detect emerging safety issues. These enhancements formulate the rationale for moving towards a safety management approach" (ICAO 2013).

As a means to investigate whether the assumed reactive data collection approach at surveyed airports might be used for more proactive measures, airport staff was asked, "Has [collected] Data Been used for Preventive Measures"; 28 reported "yes," and seven reported "no," resulting in 80% stating that some of the data currently collected are or have been used for preventive measures.

Respondents were next asked to provide examples or areas that benefited from the preventive data collected and analyzed. Responses included wildlife hazard management; ground handling procedures; lessons learned from accident reports; trip, slip, and fall root cause analysis and resolutions; preventive maintenance programs; ground vehicle and pedestrian incident and accident review; FOD reduction; erosion control; installation of stop signs as a result of a formal risk review; ARFF truck maintenance management; compressed air standard operating procedures; and general improvements in construction safety through formal SRAs by SRM panels. Specific comments by function (construction, operations, risk) can be found in Appendix A, Table A3.

SAFETY MANAGEMENT SYSTEM, VOLUNTARY REPORTING, AND IMPROVED DATA ANALYSIS

The trend to implement electronic voluntary reporting programs in conjunction with airport SMS programs was also derived from the interviews. As presented in Table 7, of the 20 airports (65%) with formal SMS programs, 13 reported they were installing SMS software, and 49% of all interviewees indicated they were using software as part of safety tracking (see Table 16). As noted previously, within the ICAO *Safety Management Manual* one of the core tenets of SMS is the shift from reactive to proactive decision making. The use of safety data and reporting as a proactive safety tool plays a significant role in SMS implementation.

One of the airport representatives surveyed stated that the implementation of an independent ramp audit, a voluntary program, created a collaborative relationship (not contentious) by focusing on the shared safety goals and objectives.

All U.S. airports certificated under Part 139 face a possible future requirement to develop and implement an SMS, which includes a requirement for safety data collection. If additional data collection and trending is a future requirement under SMS, it may serve as an opportunity for airport operators to begin a more formal review (or trending practice) of existing data collected. As reported by survey participants, current information may require manual collection, compilation, and review; however, it offers opportunities to contribute to preventive safety activities and more effective safety management through data analysis, trending, and reporting.

ICAO provides additional rationale in support of collecting safety data by stating "Data-based decision making is one of the most important facets of any management system. The type of safety data to be collected may include accidents and incidents, events, non-conformance or deviations and hazard reports. The quality of the data that is used to enable effective decision making must be considered throughout [State Safety Program] SSP and SMS development and implementation" (ICAO 2013).

Despite the concerns with data protection discussed in chapter six and difficulties in overseeing voluntary data collection programs, airport operators can begin analyzing existing data sources, such as accident, incident, facility damage, health and safety, police, ARFF, EMT, and other safety-related reports, to begin the practice of proactive data review. Initially, especially through a manual review process, the assessment may be difficult or cumbersome. But as data sources and owners are identified and safety information is shared, the review process can be streamlined and incorporated into current operations and could serve as the foundation for future SMS data collection and record-keeping processes.

The SMS requirement may serve as an opportunity for airport staff to begin analyzing existing safety data for trending and reporting.

DATA TRENDING AND PERFORMANCE MEASUREMENTS

Considering the future use of data in a more formal, proactive practice, respondents were asked how much or how long data would need to be collected to be able to serve in a meaningful way and were asked, "What amount of data (how long of a collection period) was needed to be able to accurately assess trends?" Note that the question was limited to duration and did not include details regarding data retention.

As presented in Table 23, a variety of durations were suggested, ranging from 30 days to more than 5 years. Because trending and performance monitoring is a unique science of statistical analysis, the response "it depends" may most accurately reflect the basis of trend analysis in airports. In some cases, only a short period is needed to make observation (e.g., within escalator operations, associated slips, trips, falls can be assessed immediately if a high number or increased number of falls occur). For more complicated or complex operations, longer durations and more data may be needed to establish trends. Specific responses by airport interviewees regarding data collection durations and types of activities measured are located in Appendix A, Table A4.

TABLE 23
COLLECTION DURATION FOR TRENDING

Duration of Data Collection Needed for Trending	It Depends	30 Days	6 Months	1 Year	2 Years	2 to 3 Years	2 to 5 Years	3 Years	3 to 5 Years	4 Years	5 Years	More Than 5 Years	Don't Know
Respondent count by duration	6	4	2	6	2	3	1	1	1	1	1	1	6
Respondent percent by duration	17	11	6	17	6	9	3	3	3	3	3	3	17
Summary of durations	17%	34%			20%				11%				17%

Interviewees with existing safety data programs were asked if any trends had been observed to date. Most said they had no identified trends yet from the software programs and were developing metrics based on the information collected. In *ACRP Report 19: Developing an Airport Performance-Measurement System*, the authors state, "Performance management moves organizations from a process in which measurement and analytics are used to discover long-term trends to a process that must quickly reveal performance shortfalls and provide corrective action. . . . Modern . . . applications allow information to be presented in whatever timeframe is appropriate (daily, weekly, monthly, and so forth) and to be accessible to the proper personnel, directors, and/or managers so that they not only have an up-to-date view of the current situation, but they can also make data-driven decisions on the latest and most accurate information" (Infrastructure Management Group, Inc. 2010).

Recommendations from *ACRP Report 19* include the following advice for airport management to begin the process of formal trending: "Start by identifying a baseline, where you are today. Look at trends. For instance, has on-time performance been improving or is it getting worse? Have security violations been declining as well as airfield violations? . . . Then set your long range target to reflect the improvement you plan to make based on your plans, programs, and budgets. Make the targets challenging, but realistic . . . Then work back toward the present to set interim targets for key dates in the interim, for example, the end of each fiscal year. If you are not meeting interim targets, you are less likely to meet long-term targets" (Infrastructure Management Group, Inc. 2010).

In the companion guide to *ACRP Report 19*, *ACRP Report 19a: Resource Guide to Airport Performance Indicators*, offers a detailed list of performance measurements organized by airport department and also listed as an alphabetical index of airport performance indicators. For example, within airfield operations, key indicators presented include closures for adverse weather, FOD (number of items found per inspection), practical hourly capacity, runway clearing time (average for snow/ice), and wildlife/bird strikes. Related indicators include SRM, specifically runway incursions and aircraft accidents and incidents (Hazel et al. 2011).

Data collection sources can be found from all areas of the airport operations.

For example, collecting security-related data from an infrared system can also be used for wildlife management when cameras identify deer within the perimeter fence.

CHAPTER EIGHT

CONCLUSIONS

The literature review and interviews provided information that has been presented in various formats within this synthesis study report. Airport representatives offered their insights and described their processes of collecting, managing, and reporting both mandatory and voluntary safety data at their airports. As a means to conclude the interviews, airport respondents were asked to state their most significant benefit and most significant challenge relating to safety data management. A summary of these responses is presented here, and specified respondent comments are included in Appendix A, Tables A5 and A6.

MOST SIGNIFICANT BENEFIT

Airport staff surveyed appears to agree that benefits *do* exist in data collection and management. Interviewees reported that higher awareness as a result of data collection and trending could lead to better safety management oversight and prevention. In addition, the ability to plan ahead or be proactive with regard to data analysis could assist with preventing incidents and accidents. Decisions based on better data could lead to better quality results and outcomes, including hazard and accident prevention. Respondents also reported that data management helps accurately reflect current operations and safety concerns, and that the ability to analyze trends provides a higher level of safety awareness and improves overall safety culture, including hazard prevention. Reducing accidents and incidents through safety data was also reported as means to forecast and implement preventive measures and controls. Detailed comments from interviewees can be found in Appendix A, Table A5.

Data collection and trending assist in forecasting potential hazards and mitigating them before accidents and incidents occur.

MOST SIGNIFICANT CHALLENGE

Airport representatives were also asked to provide the most significant challenge regarding safety data collection and management. Challenges included:

Data collection challenges range from concerns regarding data quality to management oversight and ability to select the right data to collect and trend.

- Getting staff and tenants to report;
- Having access to tenant data without a national mandate and protection from disclosure;
- Establishing the safety reporting culture;
- Maintaining the quality, consistency, and accuracy of data reported requires that airports shoulder the burden of sorting through useless data;
- Not having an electronic system and the effort needed to acquire funding;
- The effort of managing the system once it is in place, from a staffing and labor hour perspective;
- Data trending once the information is in place;
- Knowing what to track when there is such a large volume of data collected; and
- Managing the manual process until an electronic system is in place.

Detailed comments from interviewees can be found in Appendix A, Table A6.

FINAL INTERVIEWEE COMMENTS

At the conclusion of the survey, respondents were asked if they had any final comments or statement they wished to be included in the synthesis study report. Table A7 in Appendix A provides a list of the comments by airport hub size. Note that respondents' discussion of additional challenges in response

to final comments or statements were not aggregated with the information collected in Table A6 because the focus of that question was on the "most significant" challenges.

SUMMARY OF FINDINGS

A summary of the findings from the airport representatives surveyed and the associated study is presented here:

I. Internal airport use of safety data
   a. Of the 35 airports surveyed, 60% had established a voluntary reporting program either with or without the formal implementation of a safety management system (SMS).
   b. Multiple means, methods, formats, and processes are used at airports to receive safety concerns from all stakeholders, specifically staff and tenants. Although the same infrastructure exists for mandatory and voluntary reporting (phone lines, safety meetings, etc.), voluntary and mandatory data typically are reported through different systems or software programs.
   c. Paper-based systems are the method most frequently used to collect and report on Part 139 self-inspection data.
   d. Software programs, regardless of airport size, are rarely integrated across departments and/or functions. Manual reconciliation is often required to analyze and trend safety concerns.
   e. Airport staff members are skilled at assessment and deployment of safety response based on the type of safety report received. Strong coordination exists among responding departments to resolve safety problems.
   f. Follow-through on safety concerns is infrequently documented in a single repository or program; multiple silos of safety reports exist in departments such as operations, police, and fire. As a result, airport management has limited holistic understanding of the number, type, and resolution of safety concerns.
   g. Informal methods are most often used to identify mitigations or solutions to safety issues.
   h. Data collected through existing programs can serve as a foundation for future integrated safety-related reporting and management.
   i. The value of data trending and performance measurements goes beyond safety; it contributes to airport management's overall business decisions.
   j. Even for airports with formal SMS programs in place, few have dedicated staff assigned to safety data management and oversight.

II. Collective state, regional, or multiairport management sharing and reporting of safety information
   a. Few airport management staff report outside of the airport to other agencies; typical challenges include lack of requested data, the need to manually compile the data, and the ability to compile specific data from numerous departments.
   b. For state-managed airports, interviewees indicated that most of their external reporting related to budget planning and staffing and was not safety-related.
   c. In addition, at state-managed airports, respondents replied that Part 139 reporting typically resides with each airport's management oversight, not at a centralized state-managed office.

III. External airport safety data reporting to agencies
   a. All airports within the survey report to agencies such as FAA, NTSB, and health and safety organizations, such as the Occupational Safety and Health Administration (OSHA).
   b. Many airport interviewees reported that they or their wildlife management teams used the national FAA Wildlife Strike Database to log wildlife strike reports.
   c. Airports surveyed stated that, with regard to outside agencies, they often report to academic and industry agencies, such as universities, and technical or management surveys for the ACRP, ACI-NA, and AAAE.

ADDITIONAL RESEARCH PROPOSED

The importance of mandatory and voluntary reporting programs within the realm of safety management was highlighted as part of this report. With no clear regulatory path identified to protect safety data at U.S. airports and the mandate as part of ICAO's Annex 19 for member states to establish both voluntary and mandatory

Continuing to assess safety data programs as part of future research activities would benefit the aviation community.

safety collection programs, additional research and analysis are suggested to aid airports and the aviation industry in defining a means to implement a compliant, usable, and beneficial safety data reporting program.

Additional research is suggested to study increases in voluntary data collection at U.S. airports, either as a result of SMS program implementation or through safety data collection initiatives. An aspect of this proposed future research would be to investigate whether airports are analyzing voluntary data, and if they are trending data, whether they have used the information to proactively implement new safety measures, programs, or controls.

Another area of future research would include means for airport operators and managers to compile and analyze safety indicators, including sources and opportunities to share the data and, most importantly, ways to assess the data statistically to support safety initiatives and as an overall airport management tool.

One of the most practical future research activities would be to investigate how airport departments might consolidate and share the multiple types of reports and activities from various sources and databases to maximize usefulness.

ACRONYMS

AC	Advisory Circular
ACM	Airport Certification Manual
ACSI	Airport Certification Safety Inspector
AOC	Airport Operating Certificate
ARFF	Aircraft Rescue and Fire Fighting
ASAP	Aviation Safety Action Program
ASIAS	Aviation Safety Information Analysis and Sharing (System)
ASRS	Aviation Safety Reporting System
CFR	Code of Federal Regulations
EMT	Emergency medical technician
FAR	Federal Aviation Regulations
FBO	Fixed base operator
FOD	Foreign object debris/damage
FOIA	Freedom of Information Act
FSS	Flight Safety Standards
GA	General aviation
GAO	Government Accountability Office
ICAO	International Civil Aviation Organization
IT	Information technology
NOTAM	Notices to Airmen
NPIAS	National Plan of Integrated Airport Systems
OSHA	Occupational Safety and Health Administration
SMS	Safety Management System
SRA	Safety risk assessment
SRM	Safety risk management
Wi-Fi	Trademark name and commonly used term for wireless local area network

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APPENDIX A
DETAILED SURVEY RESPONSES

Table A1 provides detailed comments from the 35 airport respondents related to the number of dedicated and collateral duty staff participating in safety-related programs. See the section in chapter four "Staff Dedicated and Collateral Duties" for additional information.

TABLE A1
SAFETY-RELATED STAFF AND DUTIES COMMENTS FROM RESPONDENTS

Hub Size	Number of Dedicated Staff	Number of Collateral Duties Staff	Comments
Large	0	23	Three primary staff, not dedicated and 23 others in Operations
Large	0	71	Sixteen in Operations, 25 in Maintenance, and 30–40 for Police/Fire Dispatch
Large	0	75	Includes a team of 3 total focused on safety; however, not dedicated duties
Large	1	75	A total of 75 Operations staff
Large	0	90	A total of 90 in Operations; many other staff in ARFF, EMT, Police
Large	0	615	A total of 615 Operations, ARFF, Police, and Security staff
Large	0	>200	A total of 80 public safety personnel and more if maintenance is included
Large	1	110+	A total of 110 ARFF police, operations and landside
Large	1	160+	A total of 60 Operations and 100+ Police/Fire
Large	3	Not provided	No collateral duty staff information provided.
Medium	0	15	Each department has an assigned safety committee member; airport-wide there are 15 safety representatives.
Medium	1	31	One person shared among multiple airports for safety-related support
Medium	0	80	Eighty Operations, Police, Fire
Medium	0	103	Twenty Operations, 45 Police, and 38 ARFF
Medium	1	125	Operations, Police, and Fire totaling 125 staff
Medium	1	147	One Dedicated Safety Manager, 12 Operations, 35 Police, 1 Risk Manager, 50 to 60 Maintenance staff, and 50 administrative support staff. Not all dedicated directly to safety but support the airport operation.
Medium	1	300+	One SMS Manager, and approximately 300 Operations, Police, Fire
Medium	4	60+	No staff are dedicated solely for SMS duties; however 4 key staff are managing safety. 60 Operations, Police, ARFF
Medium	0	80 to 85	Approximately 80 to 85 staff including Operations, Police, ARFF, Maintenance, and Dispatch
Small	0	5	Five total staff for safety related operations
Small	3	74	Three primary points of contact relating to safety and 74 employees including Operations, Maintenance, Custodial, and EMS
Small	0	300	No formal safety system; all staff are responsible for safety throughout the airport
Small	2	40 - 50	Includes Operations, Police, Fire
Non	1	2	One staff member is the airport facilities manager who has been assigned the "safety manager" role, and as such is responsible for SMS related activities and issues.
Non	0	6	One SMS Manager and 5 Operations staff to support the effort. Not a dedicated SMS Manager
Non	0	7	A total of 7 staff in Operations including assistance from a regional security officer and a state safety officer
Non	0	8	Eight total staff to operate the airport

TABLE A1
(*continued*)

Hub Size	Number of Dedicated Staff	Number of Collateral Duties Staff	Comments
Non	0	8	One Operations Manager, an FBO Manager, 4 Operations staff, 4 Maintenance Staff, and seasonal workers to operate the airport
Non	1	14	One full time Safety Manager and a total of 15 safety personnel including public safety and operations
Non	0	15	A total of 13 Full time staff and 2 Part time staff for all airport operations.
Non	0	18	A total of 18 airport staff with an increase to 21 for winter operations support
Non	0	30	Thirty Total staff, including 19 Operations and 8 Maintenance staff
NA GA	0	<10	No dedicated Safety Manager, Airport Director is the Accountable Executive and approximately 10 staff to operate the airport
NA Reliever	0	>15	Assigned Safety Manager; however not dedicated and approximately 15 staff to operate the airport

As discussed in chapter five, Table A2 provides a list of existing airline, charter, and maintenance voluntary reporting programs.

TABLE A2
VOLUNTARY REPORTING PROGRAMS

Acronym	System	Primary Audience	Third Party Hosted?	Purpose	Reference(s)	Website Link or Contact Information
ASAP - Commercial Airline	Aviation Safety Action Program	Part 121 or Part 145	*No information found	Prevent accidents and incidents by encouraging employees of certificate holders to voluntarily report safety issues and events. (FAA)	AC 120-66B FAA Order: 8000.82 FAA 8900.1 CHG 0	ASAP hotline (901) 224-5203 ASAP Hotline 855-358-7233 ASAP Reporting Flow Diagram http://www.faa.gov/about/initiatives/asap/policy/media/asap_policy_flow_ac_120-66b.jpg
ASAP - Maintenance	Aviation Safety Action Program	Airline Maintenance	*No information found	A non-punitive error-reporting program intended to encourage reporting of errors made by employee groups so that systemic solutions could be developed and error-inducing conditions could be minimized. (FAA)	See ASAP DOT/ FAA /AR-09/28	www.faa.gov/about/initiatives/asap/reports_presentations/media/Maintenance_ASAP_DOT-FAA-AR-9-28.pdf
ASAP - Charter Airline	Aviation Safety Action Program	Part 135 and Part 135/91K	ACSF	Voluntary, self-reporting program designed to identify and reduce possible flight safety concerns. (ACSF)	See ASAP	http://acsf-safety.wbat.org/
ASIAS is a system that ties together 146 databases from various government sources.	Aviation Safety Information Analysis and Sharing (System)	All interested parties in aviation safety including government, air operators.	MITRE Corporation hosts the air carrier proprietary data only	Consolidated safety data that enables users to perform integrated queries across multiple databases, search an extensive warehouse of safety data, and display pertinent elements in an array of useful formats. (FAA)	See ASIAS	www.asias.faa.gov/pls/apex/f?p=100:1: www.asias.aero/

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TABLE A2
(*continued*)

Acronym	System	Primary Audience	Third Party Hosted?	Purpose	Reference(s)	Website Link or Contact Information
ASRS	Aviation safety reporting system	Pilots, Dispatch, Maintenance, and Cabin Crew (See ATSAP for Air Traffic)	NASA	FAA system that collects voluntarily submitted aviation safety incident / situation reports from pilots, controllers, and others and analyzes and responds to reports to lessen the likelihood of aviation accidents. (NASA)	AC 00-46E FAR 91.25 FAAO JO 7200.20	http://asrs.arc.nasa.gov/index.html
ATSAP	Air Traffic Safety Action Program	Controllers and Other Employees	CSSI	ATSAP is modeled after ASAP and specifically supports the Air Traffic community for voluntary safety reporting.	See ASAP	www.atsapsafety.com
FOQA	Flight Operational Quality Assurance	Part 121 or 135 operators	Airline Specific Flight Data Analysis Program (FDAP)	Voluntary safety program designed to improve aviation safety through the proactive use of flight recorded data. (FAA)	AC 120-82 Part 193 Part 13, Section 13.401	www.faa.gov/about/initiatives/atos/air_carrier/foqa/
NTSB	National Transportation Safety Board	All Transportation	None	Independent agency that investigates significant accidents and develops fact-based records and reports and provides safety recommendations.	49 CFR 830	www.ntsb.gov/doclib/forms/6120_1web_nopwx.pdf
VDRP	Voluntary Disclosure Reporting Program	Parts 21, 107, 108, 109, 121, 125, 129 (security program violations only), 133, 135, 137, 141, 142, 145, and 147	None	FAA believes that the open sharing of apparent violations and a cooperative as well as an advisory approach to solving problems will enhance and promote aviation safety. (FAA)	AC No: 00-58B	https://av-info.faa.gov/vdrp/
WBAT	Web-Based Application Tool	Airline employees	Universal Technical Resource Services, Inc. (UTRS)	WBAT is an open source, secure, web-based software operation designed for Airlines and Operators to enhance their Safety Program including both voluntary and mandatory safety programs. WBAT is also used for data collection, analysis, and report formation associated with SMS. (UTRS)	See ASAP	Each airline has a designated website for reporting with features that send the report to ASAP or to the airline safety group.
GSIP	Ground Safety Improvement Program	Ground Handlers, GSPs	Airline program	Voluntary reporting for GSPs supporting airline operations. Used in conjunction with WBAT programs for GSPs (Specifically called out in Hawaiian airlines)	See ASAP	http://hawaiiansafety.wbat.org/

Sources: All information was retrieved from multiple Internet searches using www.Google.com resulting in the links in the last table column with the month of September 2013.

Table A3 provides a summary of respondent comments by data use for preventive measures, as discussed in chapter seven.

TABLE A3
DATA USED FOR PREVENTIVE MEASURES, RESPONDENT COMMENTS

Type	Comment
Construction Management	Formal SRAs for construction efforts provided hazard identification
Construction Management	SRA for construction provided safety information
Construction Management	Construction safety and construction safety mitigations were developed as a result of conducting a formal SRA
Construction Management	Construction SRA was performed and safety information was collected and used for construction oversight
Construction Management	SRAs provide preventive data for risk management
Maintenance Management	Preventive maintenance program provides proactive information for maintenance management
Maintenance Management	Preventive maintenance program; data are used to manage maintenance
Maintenance Management	ARFF truck maintenance; information is tracked and used to manage oversight
Operations Management	Ground handling procedures improved through safety data collection and analysis
Operations Management	Standard Operating Procedures (SOPs) for compressed gas help to manage safety
Operations Management	We track key events using a process where the on-duty manager writes an incident report, describing operational impact, key events, and briefly what went well or didn't go well. The information is shared to recommend changes to keep the action from happening again. Staff follows up on action items and are responsible for tracking and trending.
Operations Management	FOD data are trended over seasons to help manage sweepers and other FOD management program activities
Operations Management	Ground vehicles and pedestrian accidents and incidents are being tracked and used to improve markings and operations
Operations Management	Reduction of FOD by 30% through tracking
Operations Management	Erosion control and pavement data are being tracked and trended, especially relating to seasonal impacts
Operations Management	An SRA for the non-movement area provided beneficial safety recommendations for the construction project
Operations Management	Stop signs installed on a parking lot based on safety data reports and trending
Operations Management	Ramp problems are tracked month-by-month; staff patrol the ramp and submit requests for improvements based on observations and inspections
Risk Management	Risk profiling is conducted and tracked to prevent accidents and incidents
Risk Management	Prevented accidents using general oversight of accident and incident information
Risk Management	Improved safety from accident investigations and review
Risk Management	Slip, trip falls have been resolved (mostly in terminal) due to reports and trends that are tracked
Wildlife Management	Discussion among airport groups to resolve wildlife management issues related to a specific season have improved management
Wildlife Management	Wildlife management and related techniques to manage wildlife through counts etc
Wildlife Management	Wildlife trend to manage wildlife issues and be more proactive
Wildlife Management	Wildlife management is based on prior trends that result in more knowledge, which is used as a means to wildlife prevention.

Table A4 provides detailed responses from chapter seven regarding data collection and the duration required to identify trends.

TABLE A4
COMMENTS REGARDING DATA COLLECTION DURATION

1. The duration of data depends on the issue. Regarding slips and falls, three months worth of data may be adequate and lights out on taxi way signs could be trended within a month. However, the longer the amount of data is collected better quality data results.
2. For long-term fixes, such as a security system, additional data would be necessary for better trending.
3. Demonstrating an increase in repair costs over a three-year period would make justifying capital cost increases easier.
4. It depends on what is being trended; five years is a good solid duration for airfield operations but, if construction is underway, it might take longer to get a baseline for normal operations.
5. Trending is relative to what is being collected. For example, with wildlife, if you assess a couple of seasons, at least one or two years of data is decent but two to three years is better to be comfortable with any significant seasonal changes. The most effective is 10 years worth of data to take into account surprise elements such as fall time floods and other anomalies. In the case of wildlife longer data trends is more effective.
6. Data collection duration depends on the airport. For example, at our airport three general aviation mishaps is not considered a trend, because we consider that only one event merits a response for analysis and mitigations.
7. Two years would be a good start, one year to gather information and another year to assess and observe if improvements have been made.
8. A specific duration is difficult to answer; it depends on a location or type of issue, but in about 6 months hopefully we would be able to see some trends in some areas.
9. We would want to establish statistical guidelines but, realistically, data trending can be daily, weekly, or monthly depending on what you are analyzing. For example, regarding employee injuries we have data from 2007 to the present and we can see that certain controls we have implemented are starting to have an effect on the number of injuries through declining points.

A summary of most significant benefits from safety data collection is presented in chapter eight; Table A5 provides a list of comments from the surveyed airports. Note that not all respondents provided comments.

TABLE A5
MOST SIGNIFICANT BENEFIT

Hub Size	Most Significant Benefit
Large	Awareness and prevention
Large	Awareness of safety issues and trends
Large	Better information, better quality results
Large	Forward trend analysis, planning, and schedule more efficiently
Large	Identifies risks and hazards providing a more timely response through analysis and preventing incidents and accidents through forecasts
Large	Identifying hazards before possible accidents occur
Large	Knowledge and awareness, accident prevention
Large	Safety data to share with our aviation community
Large	Use prior events to correct hazards
Medium	Able to analyze trends and identify issues
Medium	Awareness and recognition of safety concerns
Medium	Data helps to shape safety insights and reactions
Medium	Formalized methods of collecting data and managing safety
Medium	Hazard prevention
Medium	Helps to accurately reflect reality through data
Medium	More employees will become aware of SMS and safety through data program
Medium	Understanding where the real concerns are within our operations
Medium	Safety benefit

TABLE A5
(*continued*)

Hub Size	Most Significant Benefit
NA	Increased awareness of hazards
NA	Better safety culture through awareness of hazards
Non	Ability to recognize trends in safety
Non	Identify underlying trends for safety
Non	Promotes safety through safety awareness and concrete safety data
Non	Identifies issues that would otherwise go unnoticed
Non	Improved communications based on safety data and trends
Non	Preventive repairs with cost justification based on data
Small	Reduced claims, accidents, incidents
Small	Forecasts and awareness of safety issues
Small	Fewer incidents and accidents based on trending and tracking safety data
Small	Specific safety related approach to airport management
Small	With data, the information is documented and we can review it. We don't have to rely on memory or institutional knowledge. We can go back into the data get a better perspective on past and current safety related activities providing a resolution to our "operational void".

A summary of most significant challenges from safety data collection is presented in chapter eight; Table A6 provides a list of comments from the surveyed airports. Note that not all respondents provided comments.

TABLE A6
MOST SIGNIFICANT CHALLENGE

Hub Size	Most Significant Challenge
Large	Data sharing of tenant information
Large	Not having an electronic system to collect and query information; it is a manual process and very difficult to see trends
Large	Quality of reports and information within the system
Large	Custom software, breaking culture of bad habits customize the software, hurdles to learning a new program, break the cultural habit associated with change.
Large	Obtaining accurate data
Large	Follow up on reactive monitoring and management
Large	Making senior staff aware of the need for a formal safety system
Large	Consistency and accuracy of data
Large	Getting people to report
Medium	Sorting out useless data
Medium	Waiting for final FAA rule making to move this program forward
Medium	Getting people to report
Medium	Getting accurate and consistent reports
Medium	Getting airlines to participate without a national mandate and data protection
Medium	One of the downsides is there is too much information and none of it is organized so the data is not as valuable as it could be if it were organized in a way we can use it.
Medium	Building the culture of safety reporting is a challenge
Medium	Managing the entire system from collection, analysis, and reporting
Medium	Engaging people in safety culture
NA	High turnover in staff and challenges for keeping everyone trained
NA	Difficulty in collecting data

(*continued on next page*)

TABLE A6
(*continued*)

Hub Size	Most Significant Challenge
Non	FAA Rulemaking delaying the process that is stalling the investment and commitment to begin collecting safety data
Non	Getting people to use system
Non	Getting people to use the system
Non	Paper-based system is difficult to analyze trends
Non	Training and inconsistent data entry
Non	Determining best tracking methods that are useful
Non	Inconsistent inputs and subjective data
Small	Education of lower level employees to understand value of reporting
Small	Not having a software system or electronic program to collect data; we need to collect data on multiple data points, but the solutions are part of the whole, not the whole. We want one system not multiple systems to manage our safety program. Ideally we want a solution that helps with all safety-related functions such as inspections and maintenance work orders with a centralized way to get safety reports.
Small	Getting everyone on board with reporting
Small	Different people are collecting data and each person sees things differently; if data program doesn't allow the individual to hone in on the safety specifics then there is the potential for too much variance and inconclusive reports.
Small	Finding time to report and review safety data throughout day

A summary of final comments from survey respondents is presented in chapter eight; Table A7 provides a list of comments. Note that not all respondents provided comments.

TABLE A7
FINAL AND ADDITIONAL COMMENTS BY RESPONDENTS

Hub Size	Comments
Large	Our software project is critical for SMS integration and data projection.
Large	When is congress or the FAA going to give immunity to ramp personnel for voluntary safety reporting; it needs to be the same as other non-punitive programs. If the FAA going to have a mandatory reporting program for airports they need to protect the people reporting.
Large	So much occurs on the airfield that goes unreported; how to capture that information will help with preventive safety but how to get that information is a huge challenge.
Large	Wildlife management is an interesting perspective on safety data collection; our data collection knowledge is being used a means as prevention.
Large	We have no formal data collection system in place; for a large airport getting a system is going to be expensive and complicated.
Medium	The ability to analyze data needs to be the same at all airports; the program needs to be scalable but comprehensive so the trends can be consistent. This proposed safety data program will need to address the potential transfer of liability and responsibility from the airlines to the airport; this will require assistance at the national level to make it work.
Medium	If safety reporting is going to be required at rural airports, it will be a challenge. We are already short staffed with required Part 139 operations and oversight responsibilities. We need to make sure whatever is implemented doesn't increase our current workload but actually minimizes it.
Medium	Airports could benefit greatly from sharing information with each other to assess trends; how that is implemented is the key challenge.
Medium	There are many data sources, with multiple systems, recipients, and platforms that we need to access for safety. Determining what data I actually need; i.e., what is a new hazard vs. part of our daily safety operations (through Part 139 inspections) that the task of designing a database in-house that captures the data needed, in a useable format, and with the ability to function for both hazard analysis and accident/incident documentation is daunting.

TABLE A7
(*continued*)

Hub Size	Comments
Medium	Despite the fact that Part 139 is reactive, standard mitigations are part of 139 oversight, which ensures we continue to operate safely. Part 139 accomplishes this; so with SMS how will we integrate the two philosophies effectively. I am skeptical that it will actually improve operational safety.
Medium	If we can achieve a set of structured data through regulations such as Part 139 (consider our current wildlife management and centralized database), then with the information we capture and store we can more conversant about safety factors as part of SMS.
Small	Our biggest challenge is getting something approved; getting a budget approved to procure software and to assign staff to begin using data for safety.
Small	We continue to wait on rulemaking; we plan on reassessing software after our current 2-year trial. Employees seem receptive to the program so we anticipate moving forward.
Non	This [SMS] is an unworkable process for small airports, wasting time and money. For what has been spent developing the SMS program the most value we have gained is through the software that could have been procured for less.
Non	Reports and systems should allow for varied airport size and operations; one approach probably won't work for all airport size and operations.
Non	For safety data collection and use to work we need to anticipate a culture shift; we have a vision of information management but getting people to participate has been difficult. Our two most significant challenges are budget and culture.
Non	Regarding FAA what's good for the goose is good for the gander...if FAA wants to talk the talk they need to walk the walk. Protecting data and helping airports manage their tenants is going to be extremely difficult without a national plan or program.

APPENDIX B
INFORMATION TECHNOLOGY PRIMER

PRIMER—INFORMATION TECHNOLOGIES AND SOFTWARE SYSTEM OPTIONS

In today's technology world, several system architecture solutions are available to support data collection, management, and reporting, including stand-alone applications, client-server solutions, and web-based or hosted solutions and various combinations of the above. As with any comparative analysis, pros and cons exist with each system option. Total Cost of Ownership, Technical Support, System Access, Security, and Control are some of the aspects to consider when evaluating architecture and ultimately a safety reporting software or database solution.

APPLICATION ARCHITECTURE

Stand-Alone

A stand-alone application (see Figure B1) is an application that runs on the user's local computer (or tablet). The application (program logic and presentation logic), the data storage, and the data access are all running locally on the device. This solution obviously limits the number of users sharing the process and the data.

Pros and Cons: For safety reporting, which is inherently a multi-function, multi-person effort, a stand-alone application may not provide an adequate solution. The initial cost is typically low and includes the local computer (or tablet) and the software application. Although application updates may or may not include additional costs, updating the program is usually completely controllable by the user. Data backup must be implemented locally otherwise a lost or damaged computer or tablet can result in a complete loss of the application and the associated data. Most local computers do not employ Redundant Array of Independent Disks (RAID) as a storage technology and thus subject local computers to possible single hard drive failures placing the stored data at risk.

Client-Server

Client-server (see Figure B2) describes a type of computer application architecture that designates tasks between clients that make requests and servers that process requests and provide replies. Previously (and in some cases today), both these system resided within a company's network. In current technologies, this client server configuration can include interfaces with the Internet and web browsers; however, for the purposes of this discussion, we will define the client-server paradigm as one with "fat client" applications running on servers, mainframes, or mid-range computer systems connected to local computers acting as "terminals" with user interfaces that are applications running on the local computers. This means that the data storage and data access are on the server side and the user interfaces (forms, data entry, reports, etc.) run on the user's local computers or devices. The application program functions are divided between the server and the client. The server handles data storage and data access. The client handles presentation logic. The program logic may be split between server and client or assigned to one of the two. This is considered a traditional multi-user system that works well; however, deployment of application updates requires a tremendous effort, and hardware maintenance costs are a large factor. Some companies provide client-server software that runs on an Application Service Provider (ASP) or "hosted" model by using either Terminal Services (TS) or Citrix to provide remote and multi-user access from a single deployment architecture. This is a secure system and allows easier updates as there is a single deployment to update; however, performance issues can arise, including user support issues and costs associated with the constraint of accessing the application through TS or Citrix. In this scenario, software is typically paid for up front, and the initial cost of the system can be high.

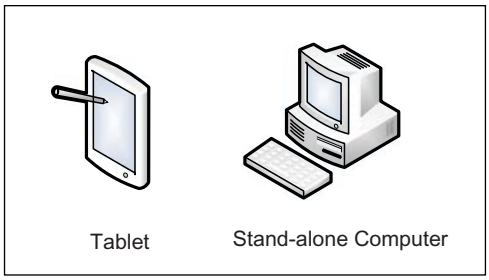

FIGURE B1 Stand-alone system. (*Source:* Chase Stockon, Panther International LLC.)

Pros and Cons: System and application upgrades and database migrations can occur at the system owner's discretion, not on an ASP schedule. As the system owner is in control of the upgrades you can cut ties with the software provider if you are unhappy with newer features, support, or service. Internal staff is in full control of the environment. You can make IT decisions that you believe are most effective for your organization. All costs to purchase, maintain, and upgrade the network are the owner's responsibility. Assigning maintenance and upgrade tasks to an ASP can, at times, save money and gain efficiencies; however, high exposure may exist if the system does not ultimately meet your business needs and a long-term contact has been signed. Additionally, licensing may require a service contract of as much as 20% of the system cost per year, whether support services are used or not.

Hosted (SaaS/ASP)

In a hosted solution (see Figure B3), the server performs all application program functions: data storage, data access, program logic and presentation logic. The client computer merely captures the user's keystrokes and sends them to the server and then receives and displays the response usually through a web browser over the Internet. The application is a web application that "displays" within a browser on the local computer, yet "runs" on the server. In most cases, the solution is hosted by a provider company

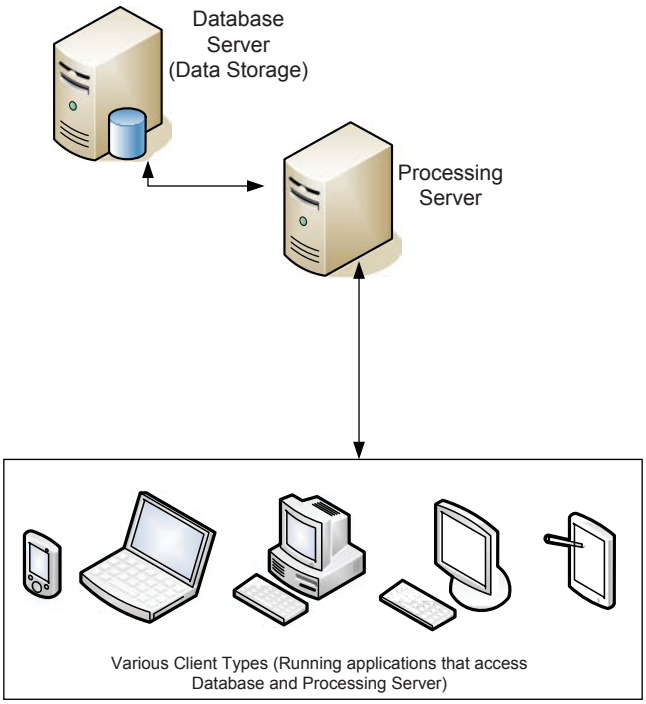

FIGURE B2 Client server system. (*Source:* Chase Stockon, Panther International LLC.)

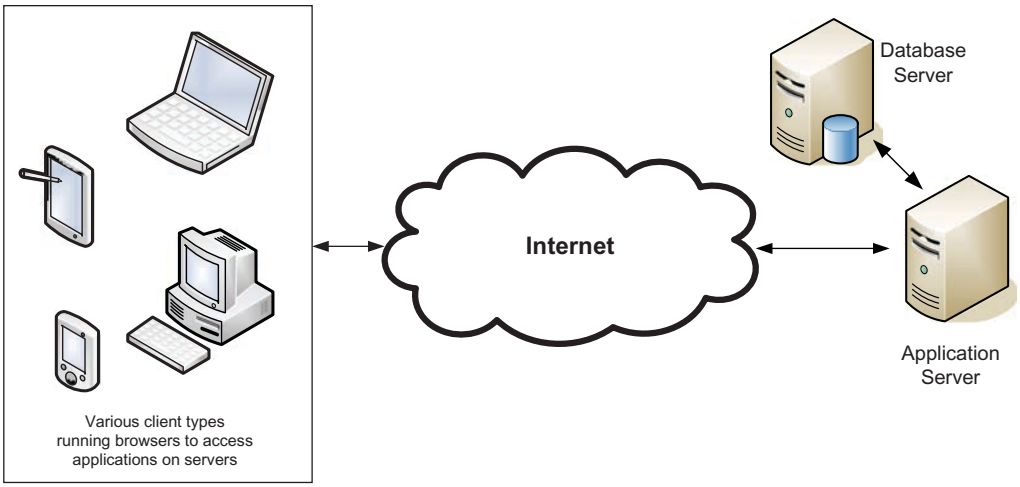

FIGURE B3 Hosted solution. (*Source:* Chase Stockon, Panther International LLC.)

referred to as an ASP and the pricing model is usually called Software as a Service (SaaS) and is paid for as a subscription. This model allows multiple software or system deployments from the same server. Similar to the lease of a car versus the lump sum purchase, the application is never actually owned and the cost is usually lower, but the SaaS payments continue for the life of the system use. The Hosted/SaaS/ASP model is generally safe and if architected properly it works well; however, the application—completed located on the server—is susceptible to bottlenecks, over-subscription, and infrastructure failures. However, all systems require monitoring the application and the database, and the added cost of maintaining the infrastructure. Under a hosted solution, risks and responsibilities are transferred to the ASP. In house IT staff is virtually uninvolved in system or application upgrades, service, support, or database migrations, drastically reducing overhead and exposure. Issues with upgrades are typically managed globally, not on a customer-by-customer basis and hardware, operating system and database software are included in the price of the application. Internal costs to purchase, maintain, or upgrade the network are limited or entirely removed from the cost of ownership and maintenance.

Pros and Cons: A hosted system is typically offered on a subscription or usage basis, allowing control of the costs and the ability for the business to grow into the system without an extensive up-front expense. In some cases, owing to long-term subscriptions over multiple years, the system can appear to cost more than an owned application (though a true cost comparison would have to include many other factors).

IMPORTANT CONSIDERATIONS:

Factors to consider when deciding which architectural model is best suited for you and your organization may include:

Application Updates/Scalability/Flexibility

Do you possess the resources and talent to maintain the software over time? Is the solution flexible and scalable to meet your needs now, in 3 years, and in 5 years?

Availability Requirements

Can the application be hosted externally? Does the user need to access the application when no connection is available? Can you afford to have the system be down for a period of time? Note that should you use an ASP, you would require a solid Service Level Agreement that spells out required availability and acceptable downtime.

Data Integrity

A centralized database is valuable for the entire organization delivered through the network, enabling the database to be used to identify, correct, and reduce repetitive or erroneous data throughout the network. Security, data protection, redundancy, and backups all assist to preserve data integrity and are either provided internally or paid for through an ASP.

Security

Although hosted solutions possibly expose the applications to more users, they also centralize all security to one portal allowing the ASP to focus on the security of the portal, the application and the data.

Risk Mitigation

Data Ownership

Ensure that in every purchase (including hosted systems) the data ownership is maintained by you or your organization. The application may be provided as a Service and owned by the ASP; however, the data belong to you, and you should ensure your continuous access to the data (including frequent backups.)

Code Escrow

A hosted solution brings efficiencies, scalability and some of the other benefits discussed previously. However, with these benefits also come risks. Once you incorporate the application into your daily operations, it is important to mitigate or address possible risks such as vendor legal or financial disasters including bankruptcy, insolvency, business discontinuation, or litigation. Code Escrow requires the vendor to place a copy of the application and the code—which they rightly own—in an escrow account. The escrow agreement then states that should something happen to the vendor, the purchaser assumes ownership and the right to use the application and the code as your own. This is recommended as a suitable protection for protecting your interest from ASP failure.

Total Cost of Ownership

When evaluating the total cost of ownership, employing a 5-year assessment should include hardware, software, updates, support, training, SaaS subscription fees, and internal maintenance personnel labor costs. Hidden costs associated with both the hardware and software such as the lost productivity of staff during downtimes or training should also be considered.

While other factors will also come into play, these comparisons should increase your awareness of the differences between the types of application architectures and help you plan a more educated software selection.

APPENDIX C
SURVEY QUESTIONNAIRE

The following questionnaire was sent to airport representatives prior to scheduling a telephone interview. Five of the thirty-five airports completed the forms prior to the call and two airports did not participate in phone discussion and provided responses by e-mail correspondence.

Interview Questionnaire Worksheet

Interviewer:

Interviewee: _____

Name, *Title,* *Airport or Organization*

Date and Time: **Interview Duration:**

1. Systems Definitions: Discuss mandatory reporting of incidents (accidents, fuel spills etc.) and the voluntary or confidential reporting from tenants. This information will used to identify which reports the airport collects and the various systems used to collect the information. Reports may include hazard, incident, strike, inspections, etc.)
   a) Mandatory System Description: Yes ☐ No ☐

      Comments:

   b) Voluntary/Confidential System Description: Yes ☐ No ☐

      Comments:
2. Are you a CFR Part 139 Certificated Airport? Yes ☐ No ☐

   Comments:
3. Do you have a formal safety program or Safety Management System (SMS) at your airport? Yes ☐ No ☐

   Comments:
4. Data Collection/System Type(s). What types of systems are used to collect data? Select all that apply.

   Comments:

Paper ☐	**Software** ☐	**Drop Box** ☐	**Phone Line** ☐	**Verbal Reports** ☐	**Email** ☐	**Meetings** ☐	**Other** ☐
Excel ☐	*see Q #4 below	Number of Drop Boxes:	Responsible Dept:	Responsible Dept:	Responsible Dept:	Safety Meetings ☐	Describe:
Word ☐		Documentation Type (form):	Dedicated Line? Yes ☐ No ☐	Documentation Tracking:	Documentation Type:	Airline Meetings	
Hardcopy ☐		Types of Locations (airside, landside):	24/7: Yes ☐ No ☐ Biz Hours:	Received Through what means?	Sent to what Dept (s)?	Airport Meetings ☐	
Other ☐		Additional notes:	Additional Notes:	Additional Notes:	Additional Notes:	Other	

5. If a software system is used, please describe the type of system; if a hybrid of the systems presented, indicate all and provide comments:

System (s) Purchased ☐	**Custom Built** ☐	**Hosted by Vendor** ☐	**Hosted in House** ☐	**Web-based Solution** ☐	**Client/Server Solution** ☐	**Combined with other SW** ☐
When: #1 #2 #3	IT Dept: ☐ Vendor: ☐	Same as SW: ☐	IT Dept: ☐	Internal: ☐		SW:
Customized: #1 #2 #3	3rd Party: ☐	Different than SW: ☐		External:		System:
	Combo:			URL:		

Comments:

6. If using a software system, please provide vendor and cost information (if known).

Comments:

Vendor Name	**Software Name**	**Initial Costs**	**Ongoing maintenance/ per year Costs**	**Other costs (training, customization, etc.)**

Comments:

7. Who or what entities submit reports? a) Mandatory and b) Voluntary (Reports = hazard, incident, strike, inspections)

Comments:

Airport (s) ☐	**Police, Fire** ☐	**Tenants: Airlines, GSPs, etc.** ☐	**FBO/ Fuelers** ☐	**FAA** ☐	**Passengers/ Public** ☐	**Pilots** ☐	**Third parties (construction)** ☐	**Other** ☐
Mandatory (a)								
Voluntary (b)								

8. Do all groups submit reports through the same system? Yes ☐ No ☐ Comments:

   a) Mandatory reports include what groups?

   b) Voluntary reports include what groups?

   Comments:

9. Are tenants required to report through any of the following agreements?

Lease Agreements ☐	Licenses ☐	Rules and Regulations ☐	Contracts ☐	Muni or City Ordinance ☐	Other ☐

10. When was/were the system(s) initiated (if multiple list all known)?

11. When the voluntary system was rolled out where any promotional campaigns used?

Posters ☐	Web Site ☐	Meetings ☐	Briefings ☐	Special Event ☐	Memos ☐	Training ☐	Other ☐

Comments:

12. Approximately how many voluntary reports were submitted per month during the initial rollout? /per month

13. Approximately how many voluntary reports are submitted per month a year after rollout? / per month

14. Of the total number of voluntary reports submitted approximately what percentage are anonymous or unidentified?

15. System development strategies; why, when, and what prompted the development or implementation of the voluntary system?

16. What, if any, future strategies are planned? (Integration with other systems, converting paper to software, etc.)

17. Data Collection and Processes. Please describe the processes used to receive, respond, investigate, analyze, assess, trend, and report on safety data collected. Below is an overview of the typical steps, see questions 17a through 17k for specific comments.

a.	b./c.	d.	e.	f.	g.	h.	i.	j./k.
Safety Report Received	Methods to analyze or collect additional Information	Methods of Response to Submitter (if any)	Methods to assess Risk	Methods to identify mitigation or resolution	Methods to trend and track activities	Identified Trends	Methods to report on activities	Frequency and audience of Reports

a. How are voluntary safety reports received?

Software ☐	Website ☐	Hardcopy ☐	Phone ☐	Email ☐	Meetings/Briefings ☐	Verbal ☐	Other ☐

b. What methods are used to collect additional information from the submitter or through investigations?

Email ☐	Phone ☐	Inspection ☐	Assessment or Investigation ☐	Further Analysis ☐	Interview/ Meeting ☐	External Validation (experts hired) ☐	Personal follow up ☐	Other ☐

c. What methods are used to analyze additional information from the submitter or through investigations?

Email ☐	Phone ☐	Inspection ☐	Investigation ☐	Further Analysis ☐	Meetings ☐	Other ☐

d. What methods are used to respond to the submitter (if any)? (Indicate whether anonymous or name provided)

Web site ☐	Meetings ☐	Phone ☐	Email ☐	Personal follow up/ face to face ☐	Bulletin Board ☐	Other ☐

e. What methods (if any) are used to assess risks?

Initial Triage/ Response ☐	Risk Matrix ☐	Risk Guide ☐	Risk Definitions ☐	Formal Safety Risk Assessment (SRA) ☐	Formal Meeting (not SRA) ☐	Individual/Small Team Decision ☐	Other ☐
	Only for SRA? Yes ☐ No ☐						

f. What methods are used to identify mitigations or resolutions?

Initial Triage/ Response ☐	Formal Meeting ☐	Mgmt. Decision (escalation) ☐	Brainstorming ☐	Risk Parameters or Thresholds ☐	Regulatory or Safety Guidance ☐	Individual/Small Team Decision ☐	Other ☐

g. What methods are used to trend and track activities?

Software ☐	Web Site ☐	Excel ☐	Manual Review ☐	Meeting ☐	Other ☐

h. Are there any identified trends that have been observed thus far?

Fewer Reports ☐	Incomplete Reports ☐	More anonymous Reports ☐	Fewer Accidents and Incidents ☐	Better Quality Reports ☐	More complete Reports ☐	Other ☐

i. What methods are used to present status and statistics of reporting activities? (number of reports received, hazards, mitigations, costs, time to resolution, etc.)

Posters ☐	Web Site ☐	Bulletin Boards ☐	Meetings ☐	Training Briefings ☐	Verbal Reports ☐	Email ☐	Other ☐

j. What is the frequency of status and statistics of reporting activities?

As they occur or as needed ☐	Daily ☐	Weekly ☐	Monthly ☐	Quarterly ☐	Bi-annually ☐	Annually ☐	Other ☐

k. Status and statistics of reporting activities are presented to what audiences?

Staff ☐	Tenants ☐	Management ☐	Community/Public ☐	Regulatory (FAA, NTSB) ☐	Other ☐

18. Please provide a list of Key Data Types collected. Comments:

Data Type Collected	**Yes**	
1. Part 139 Reports	☐	
2. Voluntary Safety Reports	☐	
3. Staff Accident or Incident	☐	
4. Tenant Accident or Incident	☐	
5. Vehicle Accident or Incident	☐	
6. Facility Damage	☐	
7. Health and Safety/or OSHA Equivalent Report	☐	
8. Near Miss, Near Hit	☐	
9. Slip, Trip, Fall	☐	
10. Medical Run (Ambulance) Dispatch	☐	
11. Medical Run (Ambulance) Transport	☐	
12. First Responder Dispatch—Police, Fire, EMT, etc.	☐	
13. Emergency Operations Center	☐	
14. Hazard or Formal Risk Data	☐	

19. Staff Responsibilities; provide an overview of the number of staff and responsibilities to support the data collection, analysis, investigation, and reporting functions.

20. Number of Staff full time:

21. Number of Staff collateral duties:

22. What staff or departments are responsible for the following: For example, Operations, Risk, Maintenance, Corporate?

    a. Data and report collection:

    b. Report review and analysis:

    c. Data scrubbing or de-identification:

    d. Accident incident investigation:

    e. Hazard assessment:

    f. Data analysis and trending:

23. Data reports development and distribution:
24. Has the data collected thus far been used for Preventive Measures? Yes ☐ No ☐
    g. Provide examples of successes from safety data trending an analysis (if any).
    h. What amount of data (how long of a collection period) was needed to be able to accurately assess trends?
25. Describe general challenges and benefits of the data collection and reporting program.
    i. Most significant Benefit:
    j. Most significant Challenge:
    k. Have any sunshine law/Freedom of Information Act (FOIA) requests for safety related data been received? If so, how were these addressed?
    l. Have any stakeholders refused to participate in the safety data collection process? Is so, why? What was the airport's response?
    m. Does the airport report to other entities for research or other purposes? If so, to whom and for what purpose?
26. Other comments from Interviewee

APPENDIX D

AIRPORT RESPONDENT INFORMATION

TABLE D1
AIRPORT PARTICIPANT PROFILES

No.	Airport	ID	Part 139 Classifi-cation	Hub	Service Level	State	SMS Pilot Study? (Y/N)	Formal SMS? (Y/N)
1.	Baltimore Washington International, Thurgood Marshall	BWI	I	Large	Primary	MD	Y	N
2.	Dallas/Fort Worth International Airport	DFW	I	Large	Primary	TX	Y	Y
3.	Detroit Metropolitan Airport	DET	I	Large	Primary	MI	Y	Y
4.	Fort Lauderdale–Hollywood International	FLL	I	Large	Primary	FL	N	Y
5.	Hartsfield–Jackson Atlanta International	ATL	I	Large	Primary	GA	Y	Y
6.	Los Angeles International	LAX	I	Large	Primary	CA	N	Y
7.	Minneapolis–Saint Paul International	MSP	I	Large	Primary	MN	N	N
8.	Salt Lake City International	SLC	I	Large	Primary	UT	N	Y
9.	Seattle–Tacoma International	SEA	I	Large	Primary	WA	Y	Y
10.	Washington Dulles International	IAD	I	Large	Primary	VA	N	N
11.	Anchorage International	ANC	I	Medium	Primary	AK	N	N
12.	Boise International	BOI	I	Small	Primary	ID	N	N
13.	Cincinnati/Northern Kentucky International	CVG	I	Medium	Primary	KY	N	Y
14.	Indianapolis International Airport	IND	I	Medium	Primary	IN	Y	Y
15.	Jacksonville International	JAX	I	Medium	Primary	FL	Y	Y
16.	Lambert–St. Louis International	STL	I	Medium	Primary	MO	N	Y
17.	Memphis International	MEM	I	Small	Primary	TN	N	N
18.	Portland International	PDX	I	Medium	Primary	OR	N	Y
19.	Reno–Tahoe International	RNO	I	Medium	Primary	NV	N	N
20.	Southwest Florida International	RSW	I	Medium	Primary	FL	N	Y
21.	Cheyenne Regional	CYS	I	Non	Primary	WY	Y	Y
22.	Dubuque Regional Airport	DBQ	I	Non	Primary	IA	Y	Y
23.	Elmira Corning Regional	ELM	I	Non	Primary	NY	N	N
24.	Evansville Regional	EVV	I	Non	Primary	IL	N	N
25.	Fort Wayne International	FWA	I	Non	Primary	IN	N	Y
26.	South Bend	SBN	I	Non	Primary	IN	Y	Y
27.	Charleston International	CHS	I	Small	Primary	SC	N	N
28.	Fairbanks International	FAI	I	Small	Primary	AK	N	N
29.	Huntsville International Airport	HSV	I	Small	Primary	AL	N	N
30.	Juneau International	JUN	I	Non	Primary	AK	N	N
31.	Ralph Wien Memorial (Kotzebue)	OTZ	I	Non	Primary	AK	N	N
32.	Tucson International	TUS	I	Medium	Primary	AZ	N	N
33.	San Luis Obispo County Regional	SBP	III	Non	Primary	CA	N	Y
34.	Ohio State University	OSU	IV	NA	Reliever	OH	Y	Y
35.	Southern Illinois, Carbondale	MDH	IV	NA	GA	IL	Y	Y

Abbreviations used without definitions in TRB publications:

A4A	Airlines for America
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
MAP-21	Moving Ahead for Progress in the 21st Century Act (2012)
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