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# SMS education in accredited undergraduate collegiate aviation programs

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A Safety Management System (SMS) provides a top-down, methodical approach to safety. According to the Federal Aviation Administration (FAA), SMS emphasizes pre-emptive and data-driven management of hazards and risks, which sets it apart from a traditional reactionary approach to safety (FAA, 2008). The International Civil Aviation Organization (ICAO) describes SMS as an organizational approach to managing safety (ICAO, 2009). The four components of SMS are: 1) Safety Policy, 2) Risk Management, 3) Safety Assurance, and 4) Safety Promotion. Current safety practices demonstrate that agencies, such as the FAA and ICAO, are encouraging the implementation of SMS for many aviation components, to include airports, air carriers, and air traffic control (Kirsch, 2011). With Advisory Circular 120-92, the FAA added a new SMS goal for air operators in 2006, which includes the introduction of SMS to air transportation service providers (Lu, C-t., Bos, P., & Caldwell, W., 2007). On October 7, 2010, the FAA proposed a Notice of Proposed Rulemaking (NPRM) extending SMS from airlines to certificated airports, including 14 CFR 139 Class IV airports (Lu, Schreckengast, & Jia, 2011). In addition, the Office of Airports has been working on a rule requiring SMS for all certified airports (Shacklette, 2013). To expand SMS further in the aviation community, the FAA claims that SMS would also be valuable to collegiate aviation (Adjekum, 2014). Being ready for change of this magnitude requires the aviation community formally educate its people, from the most inexperienced to most experienced. Aviation education begins at the most basic level, in the classroom. The purpose of this research was to determine whether or not SMS is being taught in undergraduate programs accredited by the Aviation Accreditation Board International (AABI).

## Significance of the Study

SMS is a growing item in aviation. Having flexible and manageable SMS guidance in aviation curriculum may be a new focus item in industry due to the current shift in safety thinking. Through undergraduate SMS education, it is possible for future aviation leaders to enter the workforce more prepared and ready to face safety challenges inherent in many aspects of aviation operations. Due to the aviation sector's impact on a country's economy, employment rate, transportation, and tourism, enhancing and ensuring aviation safety through academia may be a fruitful investment. Operational demands require exceptional safety situational awareness that is built from a very early stage of training, such as the classroom.

Educational timelines are critical in academia, particularly for students. Goals and timelines serve as road maps for students. The completion of each class is sometimes a huge milestone for undergraduate students; it is

sometimes a stepping-stone to the next course. Before enrolling into a class, students investigate the course. One of the readily available and reliable sources for students and faculty to rely on when exploring a class is the course description. Analyzing course descriptions provide valuable insight to the volume of SMS education taught in aviation academia.

## Review of Literature

ICAO implemented SMS in all aviation organizations in the early 2000s, when the system safety concept was first established (Bayuk, 2008). SMS is the "first major effort to bring structure to safety programs in a standardized way" and is an "umbrella overarching the many existing safety programs of a typical airline" (Flight Safety Foundation, 2005, p. 3). The aviation industry has been using elements associated with safety management. For years, airlines have benefited from Flight Operations Quality Assurance (FOQA) programs that monitor aircraft parameters and increase safety through analysis of recorded quantitative data. FOQA is one of many safety tools within the SMS toolbox. In a 2007 newsletter published by AABI, suggestions were made to future professionals; those who expect to function successfully in an industry where flight data monitoring is the norm should become familiar with (SMS) safety tools, such as FOQA, at the university level (Swinney, 2013). Swinney states that "by developing and maintaining a FOQA program, a university can train its students in flight data monitoring techniques and expose them to the data mining process" (2013, p. 124).

Future professional pilots, air traffic controllers, maintenance technicians, and aviation managers could all benefit from early exposure to SMS tools: "with FOQA, aviation managers can track trends, conduct statistical analysis, and quantify the areas of pilot performance that require additional safety training or a change to the company's standard operating procedures" (Swinney, 2013, p. 123). These objectives are goals of aviation SMS training and education. AABI accredits programs such as flight education, air traffic control, aviation management, and maintenance in collegiate aviation institutions. AABI guidelines require SMS for accredited aviation programs.

> To foster an effective safety culture, the institution MUST have and use a verifiable formal aviation safety program that involves students, faculty and staff for operations involving flight, maintenance, avionics and other aviation laboratories. The institution's aviation safety program MUST incorporate SMS key components appropriate to its national regulators'

> guidance and institution size and scope, and SHOULD be coordinated with the institution's overall safety program. (AABI, 2013, p.19)

While AABI focuses on aviation academia, the FAA regulates Part 141 flight schools, corporate aviation, and other aviation components. Though the FAA has not yet assigned SMS for General Aviation (GA), six of the 593 Part 141 schools currently participate in it (FAA, 2014). This is likely due to the growing emphasis that regulatory agencies place on SMS. The GA sector of the aviation industry is slowly moving towards a safety environment more heavily focused on SMS. Determining which critical aviation safety items fit into these specific safety objectives is a work in progress for both industry and academia.

According to Lee's (2000) research, which highlights the significance of aviation safety in education, there is no consensus as to what topics a collegiate aviation safety course includes. One purpose of Lee's study was to identify topics aviation representatives would like discussed in an aviation safety course. Lee's study indicates that the ideal safety course should include topics such as: aircraft accident analysis (case studies), accident prevention, human factors, and aviation safety programs. Of those surveyed, 75% agreed or strongly agreed that accident prevention technology and risk management should be part of an aviation safety course. Coincidentally, risk management is one of the topics within SMS, while the use of technology (from safety programs) to prevent accidents is one of the most important objectives of SMS. Additionally, 66% said there is a need for instruction in management of safety data including data collection, data selection, and statistical analysis. The results, by Lee (2000), point toward an increased need to incorporate aviation safety in aviation education.

The impact aviation safety has on undergraduate students can be interpreted in several ways. In response to the benefits SMS provides, a number of pilot projects are being hosted by university aviation programs (Ulrich, 2012). Adjekum (2014) assessed the University of North Dakota's safety culture after a phased SMS implementation approach was conducted at the university. Adjekum (2014) found that students who had been at the university longer, such as juniors and seniors, had more exposure to SMS, and consequently, a better perception of safety culture than those recently admitted. Adjekum's (2014) study helps demonstrate the effectiveness of SMS at the collegiate level. In addition to university SMS developments, Adjekum briefly mentioned a variety of pilot projects under the oversight of the FAA.

The FAA conducted experimental studies to evaluate internal SMS efforts (FAA, 2013b). Approximately 25 airports (almost half of them are international

airports) actively prepared for the integration of SMS, and this is apparent through the FAA pilot studies (FAA, 2013b). The FAA also included SMS implementation activities in its Airport Improvement Plan (AIP) for future developments (FAA, 2013a). AIPs are three to five year funding plans for airport projects and support the nation's airport infrastructure (FAA, 2007). The National Priority Rating (NPR) for SMS inclusion at airports is 78 (FAA, 2013a). Based off the NPR scale of 0 to 100, the higher the rating, the higher the priority a project receives (FAA, 2007). This score, of 78 for SMS implementation, may be indicative of future SMS endeavors. SMS pilot projects in the aviation environment continue to evolve as safety becomes a growing concern in industry.

Rodrigues and Cusick (2012) predict aviation safety will improve. SMS programs will "continue to employ new methods using empowerment and positive safety culture techniques to obtain safety levels never before achieved in commercial aviation" (p. 342). They anticipate SMS will usher a new era of global cooperation and employment opportunities (2012). Their outlook illustrates a promising future for aviation safety professionals. Lee (2000) points out that Robert Francis, Jr., then Vice Chairman of the National Transportation Safety Board, also emphasized the importance of safety education:

> The final frontier here is education. Airline executives, government regulators and legislators, tort lawyers, the media, and the traveling public all need to understand that this is a critical component of enhanced aviation safety. And one of the most important pieces of that education effort is to ensure proper use of the data only to enhance aviation safety. We must proceed to a new era of trust, cooperation, and volunteerism to improve safe transportation worldwide. (Francis, Jr., as cited in Lee, 2000, p. 22)

## Purpose of the Study

Since AABI requires accredited aviation programs incorporate a formal safety management plan that includes SMS key components (AABI, 2013), there should be a comparable number of SMS topics covered in aviation curriculum. The purpose of this study was to determine whether undergraduate AABI-accredited programs are incorporating SMS in their education curriculum. This task was accomplished by reviewing AABI-accredited collegiate aviation programs. The total population of 30 institutions offering more than 70 AABI-accredited collegiate aviation programs (e.g., flight, aviation management, and air traffic control) was evaluated. Some institutions, such as Embry-Riddle Aeronautical University (ERAU) and Southeastern Oklahoma State University,

have more than one campus with duplicate programs. Therefore, only one program from these campuses was surveyed. The review consisted of aviation safety course descriptions found in university catalogs. This study examined whether or not undergraduate collegiate aviation programs are preparing future aviation professionals in SMS. The study was guided by the following research questions:

- Do undergraduate AABI-accredited programs prepare future aviation professionals in SMS and related concepts?
- What content is currently being presented in the aviation safety courses of AABI-accredited programs?

## Delimitations

The number and scope of institutional programs under review are the main delimitations of the study. Since AABI requires accredited aviation programs establish a formal safety management program, only accredited organizations were examined for this study. Non-accredited aviation institutions were not reviewed. Additionally, it was assumed that specific aviation safety or safety related courses would reference SMS concepts or topics, if at all. Other non-safety related courses were not considered.

## Research Methodology

Table 1 lists the institutions examined in this study. These programs were accredited by AABI and publicly shown in their website by June of 2014. The archival research methodology of gathering numerical records, documents, or visual artifacts was used (Vogt, Gardner, & Haeffele, 2012). Aviation safety course descriptions (or equivalent) were compiled from current course catalogs available on each institution's official web site. Undergraduate aviation safety course descriptions and details of course credit hours were gathered. A content analysis was performed by searching for key words and phrases to identify the frequency with which common topics appeared in the course descriptions. This type of analysis is primarily a coding operation; different forms of communication are coded or classified according to some theoretical framework (Babbie, 2010). Finally, all of the relevant information from these sources were separated and entered individually into a computer-aided qualitative data analysis software called QSR NVivo. The use of such qualitative analysis software allowed the researchers to explore common topics.

Table 1
*Institutions with AABI programs and selected Aviation Safety courses*

| University | Aviation Safety Courses |
|---|---|
| Arizona State University | Aviation Safety and Human Factors |
| Auburn University | Transportation Safety Management |
| Bridgewater State University | Aviation Safety |
| Dowling College | Aviation Safety |
| Embry Riddle Aeronautical University – Daytona Beach[a] | Introduction to Aerospace Safety |
| Florida Institute of Technology | Aviation Safety |
| Hampton University | Aviation Safety |
| Inter-American University of Puerto Rico | Flight Safety and Security |
| Jacksonville University | No standalone aviation safety course found |
| Kansas State University – Salina[a] | Aviation Safety |
| Kent State University | Aviation Safety Theory |
| Louisiana Tech University | Aviation Safety |
| Mercer County Community College | No standalone aviation safety course found |
| Middle Tennessee State University | Flight Safety |
| North Shore Community College | Aviation Law and Safety |
| Oklahoma State University[a] | Aviation Safety |
| Purdue University[b] | Aviation Safety Problems |
| Rocky Mountain College | Aviation Safety |
| St. Cloud State University | Aviation Safety and Human Factors |
| St. Louis University | Safety Management Systems |
| Seneca College[c] | Safety Management Systems |
| South Dakota State University | Aviation Safety |
| Southeastern Oklahoma State University | Aviation Safety |
| University of Central Missouri | Aviation Safety |
| University of Dubuque | Aviation Safety Management |
| University of Nebraska-Omaha | Aviation Safety |
| University of North Dakota[c] | Aviation Safety |
| University of Oklahoma | Aviation Safety |
| Western Michigan University | Aviation Safety |
| Westminster College[c] | No standalone aviation safety course found |

*Note.* a = has many other safety courses depending on the aviation area of focus. b = only required for management students. c = students may have the opportunity to receive SMS education in other non-required courses or in a capstone course.

While using NVivo to query the course subjects, various themes became apparent. For consistency, the authors only used those courses listed in Table 1 for the analysis. Where more than one aviation safety course was offered at an institution, the required safety course most common to all accredited programs was used. For example, at the Embry-Riddle Aeronautical University Daytona

Beach campus many safety courses exist (e.g., Flight Safety, Introduction to Health, Occupational, and Transportation Safety). However, the course listed in Table 1 is the most commonly taken course compared to the majority of their accredited programs. Using the course descriptions, the researchers scrutinized course content and looked at key words or phrases to identify the frequency with which different subjects emerged. A total of five main focus areas were discovered. For the subject to be considered a common topic within aviation safety courses, at least two course descriptions had to include it. With some, personal judgment was made when similar topics were presented in different terminology.

## Data Analysis Results and Discussion

The results are provided and shared through figures, tables, and analyses. NVivo is capable of creating visual representations of word frequency inquiries. The first simple analysis was a frequency query for the most common words found in the descriptions of aviation safety courses. Figure 1 shows a word query tag cloud illustrating the recurrence of specific words within the sources analyzed. The larger font sizes are indicative of the most frequently occurring words in the course descriptions. Words such as safety and aviation were removed from the analysis to avoid distraction. The most frequently used words were *accident* (prevention, investigation, etc.), *human factors*, and *management*; thus, these are suggestive of the most commonly taught topics in aviation safety courses.


*Figure 1*. Word frequency query of aviation safety courses.

## Aviation Safety Credit-Hour Analysis

An analysis of available aviation safety courses per university was conducted. This inquiry is represented in Figure 2. There were between 1 and 15 credit hours of safety courses available to undergraduate students at the institutions studied. A few schools offer a minimum of one three-credit hour safety course, while some offer more. Over half (59%) of the programs offer one three-credit hour course in an aviation safety related subject, while one program (3%), from Seneca College, offers five three-credit hours safety courses, totaling 15 credit hours. It is important to clarify that out of the 15 credits offered by Seneca College, only 3 credits are required for completion of a degree. Many programs included a safety related course that was non-SMS specific, while some universities examined in this research, such as Seneca College, include SMS specific courses.

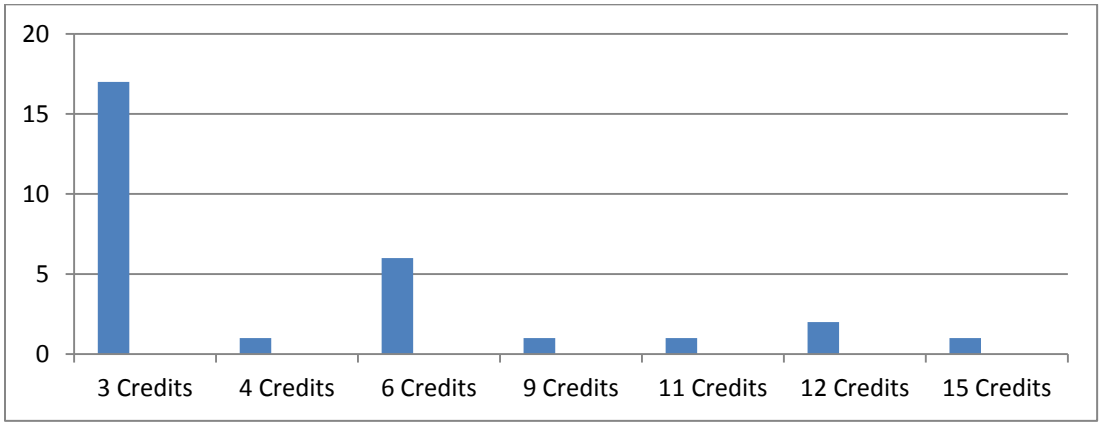


*Figure 2*. Number of programs and safety related courses available by credit hours.

## Analysis of Aviation Safety courses merged with other topics

Many aviation safety courses are fused with other topics; some more correlated with SMS and/or safety than others (see figure 3). Results indicate:

- 63% include courses that are strictly safety related
- 13% include safety courses that merge with other topics, such as human factors, security, etc.
- 10% lack evidence suggesting an aviation safety or SMS course is available
- 7% are specifically SMS courses
- 7% are specifically aviation safety management courses

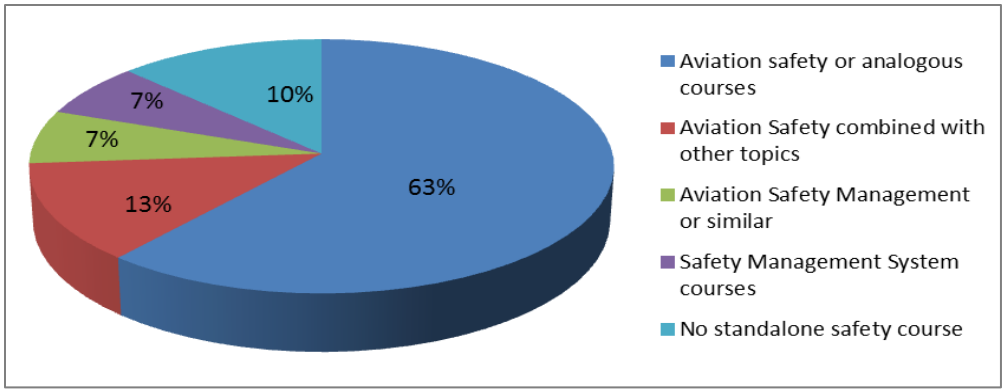


*Figure 3.* Distribution of aviation safety courses.

**Course-subject analysis**

Table 2 shows the wide-ranging topics and concepts included in the aviation safety courses at the time of data collection. Similarities exist between the information displayed in Figure 1 and Table 2. Like Figure 1, the information provided in Table 2 highlights the same top two major topics found in safety courses: accident (prevention, investigation, etc.) and human factors.

Table 2
*Common topic areas in aviation safety (or equivalent) courses*

| Topic | Examples of related concepts |
|---|---|
| Accidents/incidents | Accident investigation; case studies of accidents and incidents; accident prevention/analysis/causation; accident/incident reports. |
| Human Factors | Decision-making, judgment; human-centered accidents; human-machine interaction, human-computer interaction, psychology. |
| Organizations | National Transportation Safety Board; Federal Aviation Administration; International Civil Aviation Organization |
| SMS related concepts | Risk management; hazard identification; safety assurance; safety promotion; safety programs; safety culture; system safety; data analysis; safety management |
| Other safety-related concepts | Aviation safety promotion; development & analysis of aviation safety programs/organizations, physiology/psychology; weather; aircraft technologies; |

## Analysis of SMS courses

As previously indicated, only two institutions (7%) require SMS courses for all majors. In addition, only two other aviation safety course descriptions specifically include SMS. Table 3 lists all institutions that include SMS in the course title and/or description. Seneca College offers the greatest number of SMS courses. Students at Seneca College are required to take one SMS course, and may take up to four additional SMS-related courses, for a total of five courses.

## Limitations of the study

This study examined the education of SMS at the undergraduate level, and just course descriptions were analyzed. Furthermore, only AABI-accredited programs were examined. Therefore, results of this study provide a broad overview, rather than a detailed one, of whether or not undergraduate collegiate aviation programs teach SMS. Course descriptions vary in length; some are more detailed and more helpful, while others are brief. Consequently, a course may be SMS in nature since it has all the components of SMS, even though the course title and/or description indicate otherwise.

As opposed to other safety programs, such as Crew Resource Management, SMS is still undergoing acceptance in the aviation industry (Velazquez & Bier, 2015). For that reason, even though safety permeates many aviation activities, no attempt was made to look into other courses with possible safety or SMS related topics (e.g., weather, airport operations). Nevertheless, this study provides a preliminary outlook of SMS education offered at the undergraduate collegiate aviation level.

# Conclusions of the Study

Volumes have been written about SMS implementation, while much less is written about SMS preparation (Kirsch, 2011). The purpose of this study was to discover whether or not undergraduate collegiate aviation programs are preparing future aviation professionals in SMS. This was accomplished by examining current educational practices in undergraduate aviation safety courses. This study reveals that SMS education is limited in undergraduate AABI-accredited programs.

Table 3
*Courses with SMS in the title and/or description*

| University | Course |
|---|---|
| Inter-American University of Puerto Rico | *AWSC 3600 Flight Safety and Security.* Study of the Safety Management System (SMS) components. Emphasis on the analysis of air accidents. Analysis of the measures and security laws required at airports and airlines to counteract threats and other risks in air transportation. |
| Saint Louis University | *ASCI 195 Safety Management Systems*. Safety Management Systems (SMS) is a standard throughout the worldwide aviation industry. SMS is recognized by the International Civil Aviation Organization (ICAO) as the next step in the evolution of safety in aviation. SMS is a standards based system for the management of safety. Safety Management Systems integrate risk management and safety assurance concepts into repeatable, measurable, proactive systems. |
| Seneca College | *Safety Management Systems (SMS) 600.* SMS600 will educate students in aviation safety management systems (SMS). The concept of quality assurance (QA) will be explored with an introduction to statistical process control and how it can be used in a safety management system. The class will present tools that will aid the students in the roll of safety officer in an aviation organization. The course will build on knowledge from HUM500 and present safety in an organizational context. Students will have the opportunity to do practical exercises to reinforce concepts presented in class. A group project will be completed. There will be a mid-term and final exam as well. |
| University of Dubuque | *AVI 349-Aviation Safety Management.* An introduction to aviation safety and Safety Management Systems (SMS) through the study of aviation accidents. Designed to provide a basic understanding of the contemporary issues faced by the industry and risk mitigation strategies, including the implementation of an SMS program. Accident investigative techniques, reporting methods and lessons learned will also be addressed. |

While many courses cover SMS related concepts, approximately 13% of programs have an SMS course or a course with SMS in its description. This percentage is broken down as such: 6.7% of institutions have an SMS specific course, while 6.7% of institutions simply cover SMS (see Table 3). Of note, Seneca College, located in Toronto, Ontario, Canada, offers a total of five SMS courses. The top two subjects found in the analysis were accident (prevention, investigation, etc.) and human factors. Accident prevention, human factors, and safety are likely areas targeted for growth and improvement in aviation.

All aviation programs may not be able to bear the cost of complete SMS implementation. However, the program size should not necessarily equate to the level of SMS education taught in an aviation safety course. Based off the results of this study, SMS is not adequately covered in aviation academia. Collegiate aviation seems to be moving at an even slower pace compared to the level of progress regulatory agencies have with the implementation of SMS into aviation as a whole. Aviation students have limited exposure to SMS compared to that of industry members. Since SMS found its way into air carrier operations and airports alike, it benefits industry to better prepare for this transformation through aviation academia.

## Recommendations

Aviation standards continually change, with one constant being the continual development of safety since World War II (De Voogt & D'Oliveria, 2012). As with many things operating on a global scale, a common safety language built from the most basic level should be required. In a fast-paced flying environment, with a mixture of workers from different time zones, cultures, and languages, there are enough inherent obstacles facing air travel. Safety, in the form of SMS, is the one shared language that should be taught at the undergraduate collegiate level. SMS is transferable in everyday flight operations on a worldwide scale. The potential benefit is that aviation and aerospace graduates enter their operational occupations with expected SMS principles learned in an academic setting, where lives are not at stake.

Although AABI requires safety education in accredited programs and the establishment of a safety program with SMS principles, there are no requirements to specifically teach SMS at the collegiate level, as opposed to other mandatory topic areas such as aviation law, human factors, and weather. In addition, no guidelines are mandated to include SMS topics in a structured way. The University Aviation Association (UAA) is a nonprofit organization that has a special role in improving degree-granting aviation programs. The UAA collects

and disseminates information to the aviation industry, and it addresses the challenges aviation academia faces. Both organizations, UAA and AABI, could help aviation academia by providing guidance in SMS and overall safety education. This assistance could be in the form of a standardized list of essential aptitudes, or a model curriculum, for aviation safety and SMS courses.

A more detailed analysis is required to explore aviation safety and SMS curricula in AABI programs to reach a more comprehensive conclusion. Course syllabi should be gathered to confirm the results of this study and to confirm whether or not SMS is a topic in respective courses. Other aviation courses, not directly related to safety (e.g., aviation weather, aircraft systems, airport operations), could also be reviewed since safety is a topic common to other aviation subjects. It is possible that institutions with AABI-accredited programs teach students in SMS by exposing them to the compulsory safety management program and its encircling principles such as risk management, hazard reporting, and safety promotion. With SMS being implemented in more aviation operating environments, it may benefit industry if more aviation students receive necessary education in SMS and its safety related concepts. Whether or not SMS should be a separate course or incorporated into other aviation course objectives should be a topic for future research. The aviation community could make SMS education a constant in an intense operational environment where change is usually the only common denominator.

## References

Adjekum, D. K. (2014). Safety culture perceptions in a collegiate aviation program: A systematic assessment. *Journal of Aviation Technology and Engineering*: *3*(2). doi: 10.7771/2159-6670.1086

Aviation Accreditation Board International (AABI) (2013). *AABI 201 accreditation criteria.* Retrieved from http://www.aabi.aero

Babbie, E. (2010). *The practice of social research* (12th ed.). Belmont, CA: Wadsworth.

Bayuk, A. J. (2008, March). Aviation safety management systems as a template for aligning with business strategy in other industries. American Society of Safety Engineers. *The business of safety: A matter of success symposium.* Baltimore, MD: ASSE.

De Voogt, A., & D'Oliveira, T. (2012). *Mechanisms in the chain of safety: Research and operational experiences in aviation psychology.* Farnham, Surrey, GBR: Ashgate.

Federal Aviation Administration (FAA). (2007). *Prioritization of airport improvement program funding. Report Number: AV-2008-002*. Retrieved from http://www.oig.dot.gov/sites/dot/files/pdfdocs/WEB_AIP_FINAL_Report.pdf

Federal Aviation Administration (FAA). (2008). *Safety management system guidelines: Order 8000.369*. Washington, D.C.: Author. Retrieved from http://www.faa.gov/documentLibrary/media/Order/8000.369.pdf

Federal Aviation Administration (FAA). (2013a). *AIP program guidance letter 13-06: SMS*. Retrieved from http://www.faa.gov/airports/aip/guidance_letters/media/pgl_13_06_sms.pdf

Federal Aviation Administration (FAA). (Oct 2013b). *SMS for airports*. Retrieved from http://www.faa.gov/airports/airport_safety/safety_management_systems/

Federal Aviation Administration (FAA). (2014). *What's happening with SMS?* Retrieved from http://www.faa.gov/about/office_org/headquarters_offices/avs/offices/afs/afs900/sms/media/sms_newsletter.pdf

Flight Safety Foundation (FSF). (2005). *Unlocking the potential of a SMS.* Retrieved from http://flightsafety.org/fsd/fsd_nov-dec05.pdf

Kirsch, P. (2011, April/May). Ready, set, go: Legal considerations in implementing a safety management system. *Airport Magazine,* 26-28.

Lee, H. (2000). *A study of an aviation safety course for collegiate aviation degree programs: curriculum development and recommendations.* (UMI Microform No. 9979172, Oklahoma State University) ProQuest Dissertations and Theses.

Lu, C-t., Bos, P., & Caldwell, W. (2007). System safety application: Constructing a comprehensive aviation system safety management model (ASSMM), *International Journal of Applied Aviation Studies, 7*(1), 28-35.

Lu, C-t., Schreckengast, S. W., & Jia, J. (2011). Safety risk management, assurance, and promotion: A hazard management system for budget-constrained airports, *Journal of Aviation Technology and Engineering, 11*(1), 2-10. doi: 10.5703/1288284314630

Rodrigues, C. C. & Cusick, S. K. (2012). *Commercial aviation safety* (5th ed.). New York, NY: McGraw-Hill

Shacklette, H. F. (2013). Aviation safety: Additional FAA efforts could enhance safety risk management: GAO – 12-898. Washington, DC: Government Printing Office.

Swinney, J.D. (2013). Optimizing the event set for collegiate aviation FOQA programs. *Collegiate Aviation Review, 31*(2), 122-137.

Ullrich, G. (2012). *Safety management system implementation phases 1 & 2 report*. Grand Forks: University of North Dakota Aviation.

Velazquez, J., & Bier, N. (2015). SMS and CRM: Parallels and opposites in their evolution. *Journal of Aviation/Aerospace Education & Research, 24*(2), 55-78. doi: 10.15394/jaaer.2015.1616

Vogt, W. P., Gardner, D. C., & Haeffele, L. M. (2012). *When to use what research design*. New York, NY: The Guilford Press.