



FAA Design Competition for Universities
Airport Management and Planning Design Challenge

**Developing an integrated web-based tool to enhance
Safety Management System (SMS) planning and
management for airports**

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Executive Summary

This report addresses the Airport Management and Planning Challenge of the FAA Design Competition for Universities, 2008 – 2009 academic year. The research and proposed technology presented in this report focuses on helping airport managers improve safety by developing an integrated web-based tool to enhance safety management systems (SMS) planning at airports. SMS is currently being promoted by the Federal Aviation Administration as a key element to reducing accidents and incidents, and mitigating hazards at airports.

A research team of one undergraduate student majoring in aviation and one graduate student majoring in computer science at The Ohio State University performed extensive literature based research on the development of SMS and spent a considerable amount of time at The Ohio State University Don Scott Airport, an active FAR Part 139 certified reliever airport, learning about airport operations, safety, and the airport's current work in developing an SMS. The team found that while the airport has a number of safety policies among its many departments, the lines of communication between departments is very informal. Furthermore, there is no current program to formally record, analyze, and distribute records of accidents, incidents, hazards, and other safety-related risks. Based on these findings, the team decided to create a technology that formalized safety record keeping and analysis while also helping to formalize communications throughout the airport. The team created their prototype system using SQL, web developer and database development software. The system was designed to be easily integrated into the airport's current IT infrastructure.

It is believed that such a system would be most helpful in helping to reach many of the goals to be met by SMS. While it became evident that more time and resources would be required to develop a fully marketable system, it was also clear that the prototype system could be an important component to improving the safety of airports with relatively little effort. It is hoped that further development of this technology would help more airport managers as they plan for improving safety through the development of SMS.

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1. Introduction / Problem Statement

This report describes research performed in response to the Federal Aviation Administration's "Airport Design Competition for Universities" call for proposals for the 2008-2009 academic year. The research conducted for this proposal was performed by a team of students at The Ohio State University; Subhalakshmi Lakshminarayanan, a junior majoring in aviation, and Santhosh Kalimuthu, a master's student majoring in computer science. The faculty advisor for this project was Dr. Seth Young, Associate Professor in The Ohio State University Department of Aviation.

The focus of this research falls under the "Airport Management and Planning Challenges" competition category with a focus on improving the overall management of safety within the airport environment. Specifically, this proposal describes the potential for improving overall safety at an airport by introducing a web-enabled information systems platform into a newly integrated airport Safety Management System (SMS). As this proposal describes, the results of this research provide a solid foundation supporting the group's hypothesis that effective formalized methods of communication between various operating departments at an airport would significantly contribute to an enhanced atmosphere of safety and reduced accidents on and near the airport's airfield and facilities.

This proposal begins with a literature review that describes airport safety management systems. The proposal then describes the potential of integrating IT into SMS at airports through an interviews and research conducted at The Ohio State University Don Scott Airport. The findings

of this research reveal that such systems may significantly improve safety at the airport by facilitating more formal means of communication, data collection, and analysis, in a cost effective manner.

2. Background / Literature Review

The first step in performing the research for this competition involved the team doing an extensive literature review on Safety Management Systems (SMS) at airports. The team was motivated to research this topic because The Ohio State University Airport is in the process of developing an SMS as part of the FAA SMS pilot program. The team felt like they could contribute to this process by developing a technology that would help plan for and manage safety at the airport under a new SMS program.

2.1 Safety Management Systems (SMS)

Since its inception, the primary mission of the FAA in the United States has been to ensure the safety of those traveling within the nation's aviation system. The FAA has always been concerned with the policies and practices associated with safe airport operations. Those airports that serve commercial air carriers must comply with Federal Aviation Regulations Part 139 – Certification of Airports, under which, airports are required to develop and operate under an approved Airport Certification Manual (ACM) (1). The ACM describes the practices to be performed by the airport to ensure a sufficient level of safety for aircraft operations. These practices range from maintaining sufficiently sized and hazard free areas around runways and

taxiways to maintaining proper administrative records. ACM's and their associated documents may be thought of as key elements of an airport's operating policies.

The policies described under FAR Part 139 have been in existence for many years. More recently, though, the FAA has begun to introduce more formal Safety Management Systems (SMS) programs to address a deeper safety-oriented philosophy to the entire airport environment. While relatively new to airports in the United States, SMS programs have been applied internationally and are mentioned in several ICAO policy documents. One of the primary documents reviewed by the team was "Safety Management Systems for Airports", written as part of the National Academies Transportation Research Board Airports Cooperative Research Program (ACRP). (2) This report provides a clear description about Safety Management Systems and a quick introduction of SMS to airport directors and other officials working in the airport. This document is considered as a resource for the US airport executives, managers and safety officials. The overview of SMS in the document clearly explains how a system approach to safety management will benefit both the safety and business aspects of airport operations. It describes the essential components of SMS and also introduces the International Civil Aviation Organization (ICAO) mandate and anticipated Federal Aviation Administration policy for Airport SMS. This document describes the reason for the Safety Management Systems as well as the benefits of SMS policies and Safety promotion, safety risk management, safety assurance and SMS in other industries. It also describes the rules and procedures for the implementation of the SMS at airports. According to this report SMS indicates that safety efforts are most effective when made a fully integrated part of the business operation. It also explains that Safety Management is based on the premise that there will always

be safety hazards and human errors. System safety is the application of engineering and management principles, criteria, and techniques to achieve an acceptable level throughout all phases of the system. Achieving this definition of system safety is the primary objective of SMS.

SMS includes several key system safety principles as shown: Management commitment to safety, Proactive identification of hazards, Actions taken to manage risks, Evaluation of safety actions. The report clearly explains the components of SMS as Safety Policy, Safety Promotion, Safety Risk Management and Safety Assurance. This report helped the team in understanding the purpose of safety management systems and a SMS for airports.

The International Civil Aviation Organization (ICAO) has also published Safety Management Manual that provides a comprehensive guide to developing SMS at its member airports. **(3)** This manual considers safety as the overriding considerations in all aviation activities. This manual includes a conceptual framework for managing safety and establishing SMS as well as some of the systematic processes and activities used to meet the objectives of an airport's safety program.

The ICAO manual is all about safety which includes concept of safety, need for safety management, ICAO requirements, approaches to safety management, responsibility for managing safety, state safety program, understanding safety, basics of safety management, risk management, hazard and incident reporting, safety investigation, safety analysis and safety studies, safety performance monitoring, emergency response planning, establishing a safety management system, safety assessments, safety auditing, considerations for operating a safety management system, aircraft operations, air traffic services, aerodrome operations, and aircraft maintenance. This report explains that effective safety management requires a systems approach to the development of safety policies, procedures and practices to allow the organization to

achieve its safety objectives. Similar to other management functions, safety management requires planning, organizing, communicating and providing directions. Safety management integrates diverse activities into a coherent environment.

With explanation and examples, the ICAO manual provides a report on performing an “SMS Gap Analysis” for service providers. The report explains the Gap Analysis as a process by which an airport conducts an analysis of its system to determine which components and elements of SMS are currently in place and which components and elements must be added or modified. The research team applied this method towards finding a way to improve SMS at The Ohio State Airport. As part of this method, an SMS GAP analysis questionnaire was applied. The questionnaire may be referred in Appendix G-1.

SMS is said to include several key principles: management commitment to safety, proactive identification of hazards, action taken to manage risks, and evaluation of safety actions. To address these principles the FAA has developed four key components of SMS: safety policy, safety risk management (SRM), safety assurance, and safety promotion.

Safety Policy describes the written and oral procedures to be followed by staff and users of the airport to maintain a safe environment. Safety policy also includes a safety mission and vision statement that describes the safety culture of the airport. Safety policy is created and managed by the leadership of the airport and communicated to the staff and users of the airport in an effective manner.

Safety Risk Management is the practice of identifying and estimating the degree of safety risk for different areas of the airport. Safety risks range from major hazards such as the potential for

accidents which may cause significant injury or death, to minor risks such as small occupational hazards. Each potential risk is assessed based on its frequency of occurrence and the potential severity of results.

Safety Promotion is the practice of making sure that safety policies and programs are understood by airport employees, users, and other visitors. Safety promotion typically includes such activities as training methods, two-way-communication programs, and the use of promotional materials and activities.

Safety Assurance is the practice of ensuring that safety policies and actions are effectively communicated and applied. In addition, the goal of safety assurance is to evaluate the effectiveness of safety management systems, through data analysis and user feedback.

As part of the research for this project, a number of the above references were thoroughly read. In addition, an example SMS program document, for the Bangalore International Airport (BIAL) in Bangalore, India, was analyzed (4). BIAL is considered by ICAO to have a model SMS program and its program documents are available for public review. Because BIAL is such a large airport, its SMS program is highly formalized, with very specific policies with respect to incident reporting, record keeping, and formal lines of communication internally and with ICAO representatives. BIAL in fact employs dedicated staff for SMS. The highest authority in BIAL is the CEO who is accountable for the BIAL Management Board for safe management of the airport and the services provided by BIAL. The BIAL report identifies seven steps process to carry out a safety risk assessment. BIAL has made it mandatory to report all incidents, accidents or hazards that occur at the airport, runway or anywhere in the nearby location. Specifically,

BIAL made it mandatory to report any accident involving an unsafe, or potentially unsafe, occurrence or condition, irrespective of whether it involves injury or property damage or not. The airport also has safety incident recall meetings and conducts investigations with respect to the report submitted. BIAL also has safety auditing. It explains audits as one of the principle methods for fulfilling the safety and quality performance monitoring functions. BIAL also established Runway safety committee and Aerodrome Apron Safety committee. In the report it is explained that safety education and safety communications is required for an effective SMS. All this information helped the team to create a proper and effective SMS tool for the OSU Airport.

While such formal programs like that at BIAL would be appropriate for very large commercial service airports, smaller airports might not be able to afford full-time staff and other formal investments for SMS. This led the research team to start looking for ways a smaller airport can have some of the benefits of a more formal SMS without an extraordinary amount of investment, perhaps take advantage of a new technology rather than a large administrative and labor investment.

In 2007, the FAA office of airports began an Airport Safety program to develop SMS specifically for airports. As part of this effort, a guidebook on SMS for airports was created and an Advisory Circular introducing SMS to airports was published. (5, 6). Also in 2007, the FAA worked with than 20 large and medium sized commercial service airports to develop draft SMS programs. (7) In 2008, the FAA began working with 10 additional airports to develop SMS programs for smaller facilities. One of those airports was the Ohio State University Don Scott Airport.

2.2 The Ohio State University Don Scott Airport

The Ohio State University Don Scott Airport is an active general aviation airport located in Columbus, Ohio. The airport is owned and operated by The Ohio State University, a state of Ohio Land Grant University. The airport is certified under FAR Part 139 as a Class IV airport, certified to accommodate unscheduled air carrier operations on aircraft with greater than 9 seats, including those aircraft with 31 or more passenger seats. As a FAR Part 139 certified airport, Don Scott Airport has an approved Airport Certification Manual (ACM), and a number of standard operating procedures for its airfield operations, aircraft line-service, fixed base operations, aircraft repair station, and flight education program, as well as an emergency response program.

The Don Scott airport is home for 230 aircraft, including single and multiple engine, piston and turbine engine aircraft and rotorcraft. The airport oversees an estimated 100,000 operations per year, including corporate activity, student training, and pleasure flying. By operations, the OSU airport ranks in the top five airports in Ohio.

The airport is operated by a small administrative staff of approximately 10 managers and 25 full time staff. In addition there are a number of part-time and student employees at the airport performing in various departments of airport administration. The organization chart for the airport is illustrated in Figure 1.

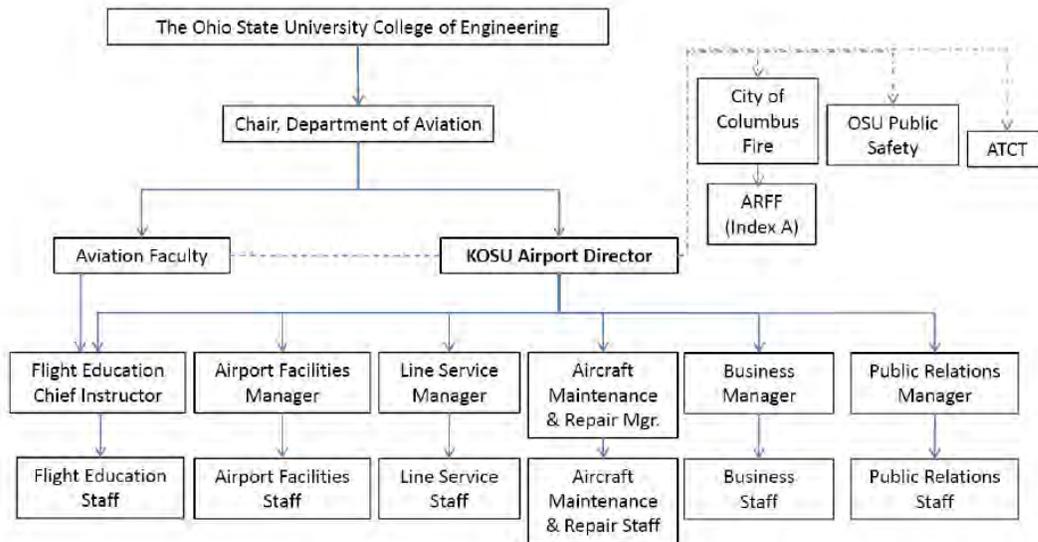


Figure 1: The Ohio State University Airport, Organizational Chart

The team for this project spent a considerable amount of time at the airport, observing operations and management functions. It was observed that the airport functions very much like a small business, with a lot of informal communication between departments. Everyone knows everyone else at the airport, unlike perhaps at much larger commercial service airports. Because all airport functions are operated by airport staff, including aircraft maintenance, line service, customer service, and even flight education. The airport manager and the rest of the staff seem to know pretty well what's going on in all the various departments, although no formal records of many activities seem to be distributed.

The team reviewed a number of operations manuals for each of the departments at the OSU airport. (Within these manuals appropriate safety measures for the people of the department are described. The Line Service manual (7) is published for the staff working with line service. This manual is written for the purpose of making the line service employees aware of the employee

policies and procedures, training, safety, communications, equipment, fueling operations, emergency and accident reporting, and security. This manual was designed to provide aircraft attendants employed by The Ohio State University Airport with basic guidelines for performing their duties. Accompanying the line service manual, line service staff take computer-based training using the National Air Transport Association (NATA) Professional Line Service Training (PLST) program. The manual and program explains that safety is everyone's responsibility. It says that one way to foster a safe work environment is to understand how the airport operates, the types of problems and the safety hazards that may occur and any special rules that the airport may have. The manual describes safety measures for personal health/safety, drugs/alcohol, equipment failure, aircraft hazards, ramp hazards, ground vehicle operations and fire safety. This manual adequately supported the team's research project as the team got to know about the safety measures that are currently in action at the airport for the line service.

The airport's repair station manual **(8)** consists of sections which explain safety policies and procedures for the airport's FAR Part 145 repair station, which is owned and operated by the airport itself. The Quality control manual consists of the manual revision process, Proficiency of inspection personnel, Maintaining current technical data, Inspection system, Records and Record keeping, Calibration of Measuring and Test Equipment and Corrective Action. This manual explains about the duties and responsibilities of the repair station staff and contains a floor plan of the repair station with a section for all the records and record keeping. The repair station's quality control manual specifically contains the airport's aircraft inspection system in which it explains explicitly about the Incoming inspection, Preliminary inspection, Hidden damage inspection, In-progress inspection, Final inspection. The Forms manual contains all the forms

like parts accountability sheet, altimeter card, altimeter test report, malfunction and defect report, tags, stamps, shift turnover log, training form and discrepancy form. This report helped us to know the issues in repair station concerning safety and also about the records and maintaining of records.

The airport's customer service manual (9) also helped the team in how SMS would be applied at the airport. The Customer service manual clearly explains the employee policies and procedures, the OSU airport, customer services, security, and provides information about managing airport concessions, such as the rental car services. This manual acts as a source in determining the how to respond to various situations, which happen so frequently in the absence of the experienced supervisor. The policies that are listed in the customer service manual are personnel policy, student employees, work schedule and uniforms. The responsibilities of the people working in customer service as explained by the manual are service requests, dispatching and paging phraseology, familiarization with fuel, oil brands and grades, early pull out procedures, ice machine/catering and coffee, fork lift request, building maintenance or inoperable equipment, vending machine problems, distribution of information about customers and employees and calls from media. The customer service manual served the team by providing information regarding the policies and also about the responsibilities of each position with respect to safety.

The dispatcher and standard operating procedures (SOP) manual (10) also helped the team in understanding important aircraft operating safety procedures applied at the OSU airport. The dispatcher manual's foremost thought is the safe dispatch of all the aircraft. The manual explains certain procedures for dispatching aircrafts followed by procedures for totaling invoices, aircraft scheduling, aircraft maintenance, and emergency procedures. There are also dispatcher duties in

the manual. This manual in helped the team in understanding the safety measures that were involved in dispatching an aircraft.

Another manual reviewed by the team was the Cold Weather Operations manual **(11)** which explains procedures and safety measures for the pilots while operating during cold weather conditions. The manual explicitly describes the weather minimums/conditions, preflight, engine starting, taxi considerations, takeoff and landings, flight maneuvers and miscellaneous. Some of the common safety measures that are explained in the manual are the dress code (to wear proper winter dress when operating in cold weather) and shoes and gloves etc. This manual particularly helped the team in understanding the importance of dress code and keeping flights in hangars as well as takeoffs and landings with respect to safety measures.

The Procedure manual for the Ohio State University Flight Education Program **(12)** contains information regarding General operations, Aircraft operations, Complex procedures, Instrument procedures, Multi-Engine procedures and Cold Weather Operations. The manual contains a section called safety in which safety measures like not to smoke in hangars or on the airfield, to stay off from parking areas and landing areas, to treat all aircraft as though the ignition system is ON, never assume an aircraft to be airworthy, never exit airplane when engine is ON, dress appropriately for the season, and a series of reports such as a Foreign Object Report, Near Mid air collision report, Bird Strike report, Operational Hazards report, Loss of communication capability, loss of positional awareness, and runway. These safety measures in the manual helped us to know about the measures that were in action and encouraged the team to think about the measures that need to be implemented in order to have an SMS.

The airport does not yet have a formal safety management system, but is working on developing one at this time. One of the concerns of the airport in developing an SMS is that such a system must be manageable for a small staff and not overwhelmingly expensive or time consuming to manage. This point became very important as the team thought about a good design project to help the airport in improving overall safety.

Between the general published literature on safety management systems for airports and the operations manuals published for the Ohio State University Airport, the team gained a great background knowledge of what it would take to implement SMS at the university's airport. The challenge for the team, then, was to develop a problem solving approach towards finding exactly how a contribution may be made to the airport as it attempts to develop SMS.

3. Team's Problem Solving Approach to the Design Challenge

For this project, the team was able to work directly with the faculty of The Ohio State University, Department of Aviation, and the staff of The Ohio State University Airport as they develop a Safety Management System for the airport. The airport's SMS development project is sponsored by the Federal Aviation Administration as part of their SMS pilot airport study program.

As part of this project, a GAP analysis was performed by the team. The purpose of the GAP analysis was to evaluate the current policies and practices with respect to safety that exist at the airport, in comparison to what a more formal SMS would include. These policies were revealed

through an analysis of published airport documents, including the airport's FAR Part 139 ACM and emergency response plan. In addition, a series of interviews with the airport director, Douglas Hammon, and senior airport management staff were conducted, including: Tony Barrell, Aircraft service Manager; Candi Roby, Chief Flight Instructor; Susan Riggs, Customer Service Manager; Dale Gelter, Facilities Manager; and Ashley Webb, Assistant Flight Instructor. A summary of these questions used in the interview process may be found in **Appendix G-1**.

The information collected from the documents and interviews were analyzed to identify how formally the airport addressed the four basic elements of SMS (policy, promotion, risk management, and assurance). What was found was that the airport does address each element, but does so in a very informal manner.

From the research conducted at the airport, it was determined that safety policies and practices are for the most part established and communicated informally on a person-by-person basis. These informal policies seem to be sufficient given the fact that the airport is operated by a small group of personnel who communicate well with one-another. However, the informality does lead to a number of drawbacks:

- There is a great potential for lack of communication, especially of urgent important issues
- There is no formal record keeping of communicated safety issues

For this competition, this research team's goal was to design a technology that would formalize, facilitate, and communicate safety policies and issues at the airport.

3.1 Proposed Solution: On-line web-based SMS data information system

The solution designed by the research team fulfills the need to formally communicate, record, and analyze safety related events at a relatively minimal expense, using an infrastructure that already exists at the airport. This solution was to design an on-line web-based safety management system data information system. This system is designed to allow any airport employee to anonymously enter the occurrence of a safety related incident or hazard, or simply to distribute formal announcements regarding safety. This system also records all entries so that the frequency or cause of certain safety related events may be analyzed.

3.1.1. Technical Description

The OSU Airport currently supports its own IP based internal information system network. On this network is both an internal and external web interface. The external web interface provides the general public with information about the airport, including information on current weather conditions, notices about airport activity, and contact information. A screenshot of the airports external website home page is illustrated in Figure 2.

The airport's internal web site is primarily used as an internal intranet e-mail system, but also has functionality for staff to "clock-in" and "clock-out" during work days. In conclusion, it was found that the airport's IT network is capable of doing a lot more with recording safety incident data but at this time the functionality hasn't been implemented. This research develops that interface.

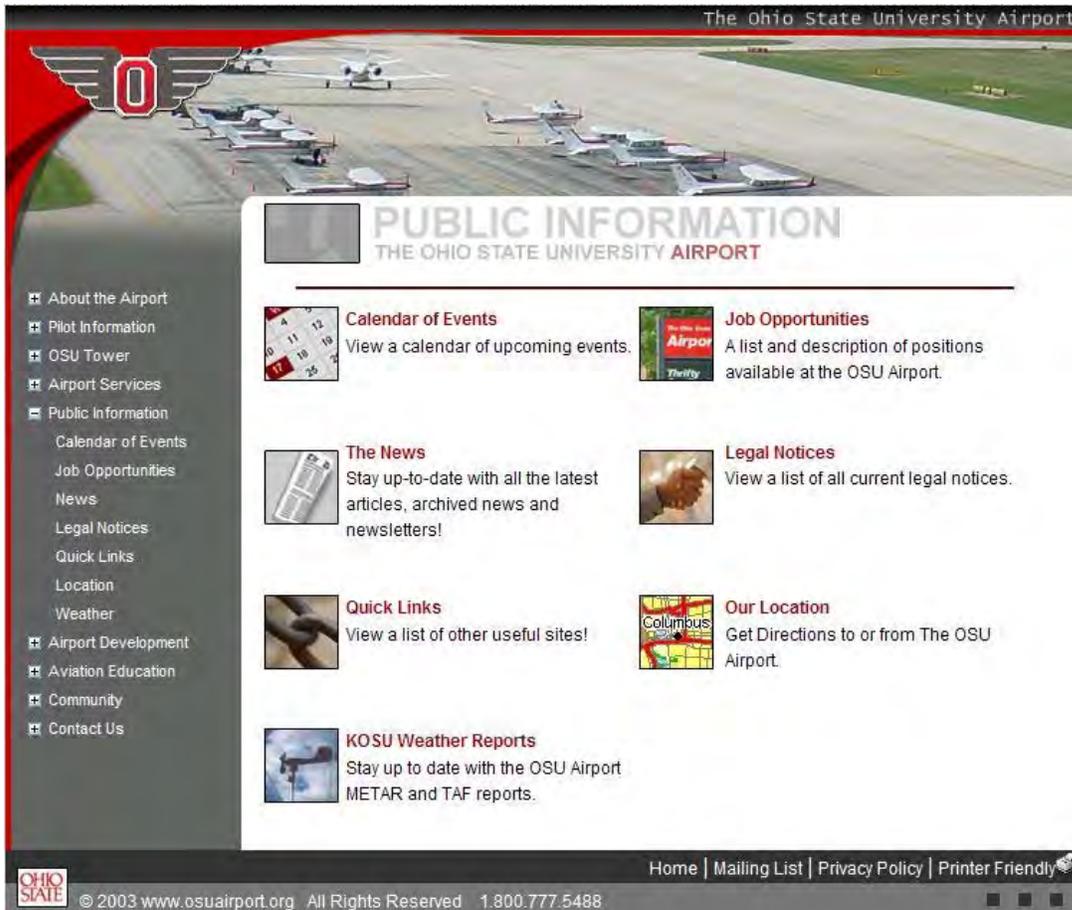


Figure 2: The Ohio State University Airport External Web Site.

The team developed the “front end” user interface using Microsoft’s Visual Web Developer 2008 Express Edition. This program was chosen because of its ease and flexibility of use and the adaptability of web sites created with the program to be easily integrated into existing web-based information systems, such as the one at The Ohio State University Airport.

Initially, the team thought of using HTML (Hyper Text Markup Language) for developing the interface. HTML is a very simple language to work with. During the course of the project, the team came across the Visual Web Developer 2008 Express Edition software, which had a

number of features that would make it easy to develop the interface, and also allows for expansion and further development in the future.

The team quickly became very comfortable using the software. The software was very user friendly. It was easy to create a graphical user interface through which the user can communicate well with the application. The software was very easy to debug. All programming errors that were made were highlighted and so the errors were easily found and fixed. The software easily binds with the back end database. The connection between the front end and the back end was established successfully and data flow between the front end and the back end was smooth.

More advantages using this software will be experienced when development of the interface grows to a larger, more extensive, scale. For this first version of the system, however, the front-end interface was kept very simple. This will allow users to get used to the system. As users become more comfortable with the system, the front end will contain more information. In addition, added graphics will add to the visual aesthetics of the system. An illustration of the home page of this system is illustrated in Figure 3.

As an example of how this system improves communication throughout the airport, the home page of this system displays the latest safety related announcements. This system represents the first time that safety related issues are recorded, and formally communicated to all staff users of the airport.

THE OHIO STATE UNIVERISTY AIRPORT SAFETY MANAGEMENT SYSTEM

TODAY'S ANNOUNCEMENTS

Announcements	Date of announcement	Time
Meeting today at 3.00 pm	4/9/2009	3:16:02 PM
Tomorrow is a holiday	4/9/2009	3:16:21 PM
Important Announcement	4/9/2009	3:16:35 PM



Figure 3: Home page of SMS data informationsystem

The “back end” of this system, which consists of a database for recording safety-related incident, hazards, and announcements, and a “selective query language” for retrieving and analyzing data was created using two popular programming platforms, *SQL Server* and *Microsoft MS Access*.

The code created for this application may be found in Appendix G-2.

Using MS Access, three databases were created.

3.1.2. Announcements database

This database was designed for recording and displaying all safety-related announcements that may be made using this interface. The data table consists simply of four elements: A record

identifier, a text field for the announcement, a date-stamp, and a time-stamp. An illustration of the announcement database and its fields are found in Figure 4.

ID	ann	d_field	t_field
1	Meeting today at 3.00 pm	4/9/2009	3:16:02 PM
2	Tomorrow is a holiday	4/9/2009	3:16:21 PM
3	Important Announcement	4/9/2009	3:16:35 PM

Figure 4: The Announcements database

3.1.3. Accidents / Incidents database:

This database was designed for recording all safety-related accidents and incidents that may occur at the airport. The database was created for anonymous reporting, so that those that reported incidents may not feel responsible for the incidents. Anonymous reporting has become a popular method to encourage people to report incidents, even when they were at fault.

The accident / incident data base consists of the following fields: A record identifier, the reporting date of the accident, the posting date of the report, the time of the report, the weather conditions at the time of the accident, the type of accident, the location of the accident, the alleged cause of the accident, and the action taken in response to the accident / incident. An illustration of the accident/incident database and its fields are found in Figure 5.

ID	Date_of_Accident	d_Field	T_Field	Weather_Condition	Type_of_Accident	Place_of_Accident	Reason_for_Accident	Action_Taken
1	4/6/2009	4/7/2009	11:16:58 PM	Clear	Employee Related	Taxiway	Instrument Error	Inform Customer Service
2	4/4/2009	4/7/2009	11:17:42 PM	Fog	Employee Related	Taxiway	Instrument Error	Inform Customer Service
3	4/1/2009	4/7/2009	11:17:50 PM	Clear	Employee Related	Taxiway	Instrument Error	Inform Customer Service
4	4/7/2009	4/8/2009	11:41:15 AM	Rain	Crew Member	Maintenance Department	Mechanical Error	Call fire Department

Figure 5: The Accident/Incident Database

3.1.4. Hazards database

To report safety related issues that have not resulted in, but have the potential to, lead to accidents or incidents, the interface was designed with a “hazards” database. This database anonymously records found safety related items that should be addressed. The hazards database contains the following fields: A record identifier, the date and time of reported hazard, a description of the hazard, a directive as to what should be done to address the hazard, the location of the hazard, and any immediate action taken. An illustration of the hazard database and its fields is found in Figure 6.

ID	Date_of_Hazard	d_Field	T_Field	Administration	Maintenance	Air_Field	Action_Taken
16	4/1/2009	4/7/2009	11:18:54 PM	Door not working	Not labeled hazard	Driving without beacon	Report on database
17	4/2/2009	4/7/2009	11:19:00 PM	Door not working	Not labeled hazard	Driving without beacon	Report on database
18	4/3/2009	4/7/2009	11:19:05 PM	Door not working	Not labeled hazard	Driving without beacon	Report on database
19	4/4/2009	4/7/2009	11:21:18 PM	Water on floor	Sharp Object	Birds	Self fix

Figure 6: The Hazard Database with all its fields

As illustrated in Figure 3, users of this system can report any accidents, incidents, hazards, or make announcements using the graphical menu found on the home page.

Reporting of these events occurs through a simple user interface. An example of the accident / incident reporting interface is illustrated in Figure 7.

ACCIDENT/INCIDENT REPORT

Date of actual accident/incident

April 2009						
Sun	Mon	Tue	Wed	Thu	Fri	Sat
29	30	31	1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	1	2
3	4	5	6	7	8	9

Weather Conditions

Type of Accident Flight related ▾

Place of Accident Runway ▾

Reason for Accident Operator Error ▾

Action Taken Call 911 ▾

[Home](#)

Figure 7: Accident Reporting Interface

Using the above interface, the user chooses from a set of standard characteristics of the event, including the date, type, and location of the event. A pre-determined selection of choices was developed based on research with the airport, who suggested standard classifications, primarily for analytical purposes. Upon submitting this basic information, the user then has the opportunity to enter a text-based description of the event.

A similar interface is accessed for hazard reporting, as illustrated in Figure 8.

HAZARD REPORT

Date of actual accident

April 2009						
Sun	Mon	Tue	Wed	Thu	Fri	Sat
29	30	31	1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	1	2
3	4	5	6	7	8	9

Administration

Maintenance

Air Field

Actions

[Home](#)

Figure 8: Hazard Reporting Interface

Finally a similar yet simpler interface was created for the entry of any announcements, as illustrated in Figure 9. With this interface, the date and time of the announcement is automatically recorded.

ENTER ANNOUNCEMENTS

Announcement

[Home](#)

Figure 9: Announcement Posting Interface

The front end interface also allows the user to retrieve entered announcements, accident/incident reports, and hazard reports. Selective query language (SQL) was used to allow the user to retrieve records based on one or more criteria. For example, a user can retrieve all announcements, or only those announcements posted in the past day, week, or month, as illustrated in Figure 10. All illustrated in Figure 11 and Figure 12, for accident/incident or hazard reports, users can retrieve, for example, all those events that occurred on a certain taxiway. These features make it very easy to perform analysis on safety related concerns at the airport.

VIEW ANNOUNCEMENTS

Announcements made Last one month ▾

Announcements	Date of announcement	Time
Meeting today at 3.00 pm	4/9/2009	3:16:02 PM
Tomorrow is a holiday	4/9/2009	3:16:21 PM
Important Announcement	4/9/2009	3:16:35 PM

Number of records

[Home](#)

Figure 10: Selected Query of Announcements posted within the last month

QUERY DATA ZONE

ACCIDENT/INCIDENT REPORT

Accident/Incident Report - all

Accident/Incident at

Accident/Incident Report at

Accident/Incident reported

Accident/Incident Report by date

Date of accident/incident	Date reported	Time	Weather Condition	Type of Accident	Place of Accident	Reason for Accident	Action Taken
4/6/2009	4/7/2009	11:16:58 PM	good	Employee Related	Taxiway	Instrument Error	Inform Customer Service
4/4/2009	4/7/2009	11:17:42 PM	good	Employee Related	Taxiway	Instrument Error	Inform Customer Service
4/1/2009	4/7/2009	11:17:50 PM	good	Employee Related	Taxiway	Instrument Error	Inform Customer Service

Number of Records

[Home](#)

Figure 11: Selected Query of Accidents/Incidents which reported on the taxiway within the last month.

QUERY DATA ZONE

HAZARD REPORT

Hazard report all

Action taken

Hazard Report by action taken

Hazards reported

Hazard Report by date

Date of hazard	Date reported	Time	Administration	Maintainance	Air Field	Action Taken
4/1/2009	4/7/2009	11:18:54 PM	Door not working	Not labeled hazard	Driving without beacon	Report on database
4/2/2009	4/7/2009	11:19:00 PM	Door not working	Not labeled hazard	Driving without beacon	Report on database
4/3/2009	4/7/2009	11:19:05 PM	Door not working	Not labeled hazard	Driving without beacon	Report on database
4/4/2009	4/7/2009	11:21:18 PM	Water on floor	Sharp Object	Birds	Self fix
4/6/2009	4/8/2009	11:44:09 AM	Door not working	Not labeled hazard	Seatbelts	Self fix
4/3/2009	4/8/2009	2:31:56 PM	Broken Windows	Sharp Object	Broken Signs	Report on database
4/1/2009	4/8/2009	2:37:53 PM	Water on floor	Exposed Wire	Birds	Self fix
4/6/2009	4/9/2009	3:57:45 PM	Door not working	Sharp Object	Broken Signs	Report on database

No of Records

[Home](#)

Figure 12: Query of all Hazards reported

The entire application was designed to be user friendly. This was one of the main reasons to have a simple menu control in the home screen, so that the user can get into any page needed in a click choosing from the tree view menu control. The supply of the home button in each and every webpage helps the user to jump to the home screen at any point in using the application. This kind of design helps the user to get to the required location in just a click away.

3.2 Integrating with the Airport IT system

This application was designed to easily integrate with the airport's current client and a server architecture. The databases created can be stored in the Airport Server system and the front end application can be loaded on the required system. The clients can enter and view data into and from the database. The clients cannot make changes or modify the data in any of the databases as they are stored in the server, This ensures security for the information stored in the databases. The scope of integrating this application with the existing Airport IT system depends on the kind of client – server architecture that is being installed at the Airport IT system.

3.3 Future enhancements

In the course of designing this system, it was revealed early on that many additional features and capabilities would be either necessary or simply wanted by the airport users. Some of these features include:

- Security Information can be added to the application thereby allowing only authorized users to use the application and keeping the application away from unauthorized users.

- Redesigning the system using a relational database, so that safety related data can be related to other databases that the airport may have.
- Enhancing the Graphical User Interface can be improved and the application can be made more user-friendly.

While a fundamentally operational interface has been designed in only a matter of weeks, much more can be done in the course of enhancing this basic system. It is estimated that a full time development staff could have a fully functional system with many extra features within a few months of effort.

3.4 Cost Assessment

The design and programming of this web-based interface was done in a very short amount of time with no external funding. Despite such a lack of funding and time, the team was able to create a functional prototype of a system that will benefit the safety management of The Ohio State University Airport.

Design and programming of a fully functional system that would also be market ready for use at other airports would take a significantly higher amount of effort. It is estimated by the team that a 6 to 12 month development time frame using a small full-time team of programmers and developers would be required. Creation of such a system could cost between ten and twenty-five thousand dollars, followed by several thousand dollars a year for system enhancements and

maintenance. While this may seem like a large investment, it actually may be a small percentage of developing a larger safety management system. This computer system may take away the need for an extra administrative staff person, for example.

In general, of course, the cost of improving safety can be tiny compared to the savings it may bring, especially when lives may be saved because this system was implemented.

4. Safety Risk Assessment

In developing this system, the research team performed a comprehensive safety/risk assessment, to determine how and why such a system would benefit the airport's goal of improving safety management. This assessment addressed issues of concern to the FAA, through literature reviews and interviews and testing with experts in industry and academia. The FAA's Advisory Circular 150/5200-27, Introduction to Safety Management System for Airport Operators, (15), presents a predictive risk matrix to assess the level and impact of risk of incidents. This matrix is illustrated in Figure 13. The matrix identifies two areas that contribute to risk: Likelihood and Severity. As depicted in the matrix, the greater the likelihood of the given event occurring and/or the severity of a hypothetical incident, the greater the risk. "High Risk" includes events with higher likelihoods of occurring, resulting in events of higher severity, while, low risk includes events with less likelihood of occurrence or events with minimal or minor safety effects.

Severity Likelihood	No Safety Effect	Minor	Major	Hazardous	Catastrophic
Frequent	Low Risk	Medium Risk	High Risk	High Risk	High Risk
Probable	Low Risk	Medium Risk	High Risk	High Risk	High Risk
Remote	Low Risk	Low Risk	Medium Risk	High Risk	High Risk
Extremely Remote	Low Risk	Low Risk	Low Risk	Medium Risk	High Risk
Extremely Improbable	Low Risk	Low Risk	Low Risk	Low Risk	Medium Risk

HIGH RISK
MEDIUM RISK
LOW RISK

Figure 13: FAA Risk Assessment Matrix

This analysis revealed that the airport’s safety risks are relatively low, because the frequency of higher severity incidents is very low. However, airport management did acknowledge that the potential for severe accidents may increase as traffic at the airport increases, so the need to ensure the infrequency of occurrences is becoming increasingly important. The staff of the airport was excited to see the development of this system, as they believe that more formal record keeping, incident analysis, and formal lines of communication will help to keep the frequency of incidents low.

5. Summary and Conclusions

The technology proposed in this report was researched and designed in order to facilitate the development of a system to specifically improve safety at airports. The technology was designed to facilitate and formalize the safety communications and records keeping process at The Ohio State University airport. The technology was designed to integrate into the current information technology infrastructure and to be user friendly so that all staff at the airport would embrace the technology. While the system designed for this report was a simple system, it was recognized by airport management that such systems can be very helpful in developing SMS and improving safety at the airport. The team is very excited to continue developing this web-based system. It is hoped that such a system may be beneficial not only to The Ohio State University Airports, but all airports in general, large and small.

As this development effort continues, the team plans to implement the system in a beta-test format, to get real-life feedback for the system. The team knows that there are a lot of features that may be requested by airport staff. It is also expected that the airport staff will want to find different ways to analyze entered accident/incident and hazard data, so that they may find which risks to safety are becoming more evident, why they are occurring, and possibly what can be done to mitigate these risks.

The team very much enjoyed working on this project. A lot was learned about airports, airport safety management systems, and how web-based technologies may be used to contribute to airport safety.

Appendix A: Contact Information

Faculty Advisor: Dr. Seth Young
Associate Professor, Dept. of
Aviation College of Engineering
The Ohio State University
e-mail: young.1460@osu.edu

Student Team: Subhalaskmhi Lakshminarayanan
e-mail: Lakshminarayanan.6@osu.edu

Santhosh Kalimuthu
e-mail: kalimuthu.1@osu.edu

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Appendix B: Description of University

The Ohio State University (OSU), located in Columbus, Ohio is a public land-grant university supported by the State of Ohio Board of Regents. Founded in 1870, OSU is currently the largest single-campus university in the United States with more than 60,000 undergraduate and graduate students. Ohio State is ranked among the top 20 public universities in the United States according to U.S. News & World Report. The university offers more than 160 academic programs, through 20 colleges and schools.

Ohio State is considered to be one of the most comprehensive and diverse research institutions in the United States. In 2007, OSU ranked 7th of all public universities in research expenditures with more than \$650 million in funded research. Ohio State University ranked 10th in engineering research in 2006, according to the U.S. News and World Report.

The Ohio State University College of Engineering supports an academic department in Aviation. The OSU Department of Aviation offers undergraduate programs in aircraft systems (flight education) and aviation management. The department also works across the College of Engineering to foster graduate research. OSU Aviation operates an FAR Part 141 Flight School and The Ohio State University Don Scott Airport, and associated fixed based operations and FAR Part 145 Repair Station.

The Ohio State University is accredited by the Higher Learning Commission (HLC) of the North Central Association of Colleges and Schools (NCA).

Appendix C: Description of Non-University Partners

No partners outside of The Ohio State University and The OSU Airport were actively engaged in this project.

APPENDIX E

Evaluation of Educational Experience

Subhalakshmi Lakshminarayanan

During my work on this project I learned some valuable information about safety management system and the safety issues in an airport. One of the important element I learned through this project is that how to create an SMS with all the safety measures and the also learned about the importance of SMS for an airport. After knowing about the need of SMS I realized that informal communication in our airport is the basic cause of all the safety issues. I also realized that some sort of manual and reporting system must be designed in order to reduce accidents and incidents in the airport. As we started to do research with the safety measures in the airport we understood that there were several safety measures which were all informally communicated among the officials and he public. This issue or complain paved a way for us to think about having an SMS for our airport with the safety measures that are already in place and the safety measures we developed in order to reduce risk assessment. When the paper reports also had some complains and issues we started to think in the technical way and decide to create a website or database for reporting incident, accident and hazards. We also decided to include announcements which could be viewed and entered by the public and the airport officials. Thus, we understood that applying technology in everything make life easier for the people. I was pleased to work in this project as it thought me about safety management system, and the ways to create SMS and also the importance of reporting system and applying technology in submitting the reports. Even though

the incidents or accidents or the hazards many be small reporting them in the database would help the airport and the public to know more about it which would then lead the airport authorities to find solution for the problem that has been reported.

Santhosh Kalimuthu

At the initial stage of the project, I was not aware of how an Airport Safety Management System should look like and all I knew was to create this application using HTML. But later on, during the course of this project I learned about a new software called Visual Web Developer 2008 Express Edition and it was very helpful in designing and implementing the required application. I am now aware of how an Airport Safety Management System looks like and what the information is required to be taken care of for the Airport to function at its best. I had a wonderful experience with Seth B. Young, Associate Professor, Department of Aviation, College of Engineering at The Ohio State University. He guided me well through the different phases of the project. The scope of learning was well defined in this project and the learning curve was shooting up as the project moved to different phases. This project was a very good experience working and I was able to adapt myself to the changes made in the requirements through the course of the project. This project made me flexible and confident enough to handle any given project.

Dr. Seth Young
Faculty Advisor

The motivation for this project came about through work for a funded research project with the Federal Aviation Administration in the development and establishment of Safety Management Systems (SMS) for airports. Specifically, The Ohio State University was selected to act as a pilot developer for an SMS at their FAR Part 139 airport. As the principal investigator for this project, I was fortunate to have Subhalakshmi Lakshminarayanan working with me as an undergraduate assistant. Ms. Lakshminarayanan was originally an undergraduate aerospace engineering major with little prior knowledge of airport operations and management. Her excitement for the project has motivated her to change her major to aviation, focusing on the management of safety at airports.

As we developed the concept for designing and implementing a computer-based information system to enhance SMS development at the airport, Ms. Lakshminarayanan recruited a colleague of hers, Santhosh Kalimuthu, a graduate student majoring in computer science. Mr. Kalimuthu had even less knowledge of airport operations and management prior to participating in this project. His expertise lies within the area of software development of IT systems. As such, there was a significant, but well accepted learning curve in understanding how such systems could be used to benefit in improving airport safety.

The mere fact that an aerospace engineering student can partner with a computer science student to work together in improving the safety of their university's airport, and aviation in general, speaks volumes to the benefit of this competition. These two students worked voluntarily,

outside of any of their normal course obligations, to learn more about airport operations and safety, speak directly with airport staff, and produce a technology in a relatively short amount of time. In the process the students not only learned new technical knowledge, but also what it takes to manage a large scale project.

One of the great challenges to this project was in fact the learning curve. Neither members of the team had any prior knowledge of airports, safety systems in general, empirical research, or large project development. Further, as this was the first time anyone from The Ohio State University had participated in this competition, the students were completely reliant on their advisor to guide them in project development and refer to previous year entries as templates for project submission.

One suggestion for this competition would be for the competition sponsors to provide some fundamental sources of literature whereby students with no prior knowledge of the airport environment could be brought up to speed. Further, if the competition sponsors can provide a specific list of contacts that may be used as project-industry liaisons, the students would have another avenue of guidance as they develop solutions to solve the airport industries safety related issues.

I am once again grateful to the FAA and the Virginia Space Grant Consortium for the opportunity for our students to participate in such a worthy competition.

APPENDIX F - References

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Appendix G

Appendix G-1: SMS GAP Analysis Questionnaires

ICAO reference	Aspects to be analyzed or question to be answered	Answer	Status of implementation
Component 2 – SAFETY RISK MANAGEMENT			
Element 2.1 – Hazard Identification process			
	Does the service provider have a formal safety data collection and processing system (SDCPS) of effectively collecting information about hazards in operations?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Limited to airport
	Does the service provider SDCPS include a combination of reactive, proactive and predictive methods of safety data collection?	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	Reactive methods of safety data collection
	Does the service provider have reactive processes that provides for the capture of information relevant to safety and risk management?	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	Have a self inspection checklist
	Has the service provider developed training relevant to reactive methods of safety data collection?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Only written documents
	Has the service provider developed communication relevant to reactive methods of safety data collection?	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	Informal communication
	Is reactive reporting simple, accessible and commensurate with the size of the service provider?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	The checklist commensurate to the size of airport
	Are reactive reports reviewed at the appropriate level of management?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	It is reviewed by airport Director
	Is there a feedback process to notify contributors that their reports have been received and to share the results of the analysis?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	
	Does the service provider have proactive processes that actively look for the identification of safety risks through the analysis of the organization's activities?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	
	Is there training relevant to proactive methods of safety data collection?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Informal training on an as needed basis
	Has the service provider developed communication relevant to proactive methods of safety data collection?	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	Informal communication



ICAO reference	Aspects to be analyzed or question to be answered	Answer	Status of implementation
	Is proactive reporting simple, accessible and commensurate with the size of the service provider?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	
	Does the service provider have predictive processes that provide the capture of system performance as it happens in real-time normal operations?	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	
	Is there training relevant to predictive methods of safety data collection?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
	Has the service provider developed communication relevant to predictive methods of safety data collection?	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	
	Is the predictive safety data capture process simple, accessible and commensurate with the size of the service provider?	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	
Element 2.2 – Risk assessment and mitigation process			
	Does the service provider SMS documentation clearly articulate the relationship between hazards, consequences and risks?	<input type="checkbox"/> Yes <input type="checkbox"/> No	The SMS document is yet to be prepared.
	Is there a structured process for the analysis of the risk associated to the consequences of identified hazards, expressed in terms of probability and severity of occurrences?	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	
	Are there criteria for assessing risks and establishing risk tolerability (i.e., the acceptable level of risk the organization is willing to accept)?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	There are criteria for the airport given by FAA
	Does the service provider have risk mitigation strategies that include corrective/preventive action plans to prevent recurrence of reported occurrences and deficiencies?	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	

ICAO reference	Aspects to be analyzed or question to be answered	Answer	Status of implementation
	Are corrective and preventive actions generated in response to event analysis?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Informed
Component N° 3 –SAFETY ASSURANCE			
Element 3.1 – Safety performance monitoring and measurement			
	Are regular and periodic planned reviews conducted regarding: Company safety performance? <input type="checkbox"/> Yes <input type="checkbox"/> No Internal audit reviews? <input type="checkbox"/> Yes <input type="checkbox"/> No Hazard identification and occurrence investigations? <input type="checkbox"/> Yes <input type="checkbox"/> No Hazard and occurrence analysis results? <input type="checkbox"/> Yes <input type="checkbox"/> No Internal feedback analysis/results? <input type="checkbox"/> Yes <input type="checkbox"/> No External feedback analysis/results? <input type="checkbox"/> Yes <input type="checkbox"/> No Status of corrective actions? <input type="checkbox"/> Yes <input type="checkbox"/> No Follow-up actions from previous management reviews? <input type="checkbox"/> Yes <input type="checkbox"/> No Changes that could affect safety? <input type="checkbox"/> Yes <input type="checkbox"/> No Recommendations for improvement? <input type="checkbox"/> Yes <input type="checkbox"/> No Sharing of best practices across the organization? <input type="checkbox"/> Yes <input type="checkbox"/> No		
	Is there a process to evaluate the effectiveness of corrective actions?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
	Are safety reports reviewed at the appropriate level of management?	<input type="checkbox"/> Yes <input type="checkbox"/> No	


```

End If

If (ddlannouncement.SelectedItem.Text = "Yesterday") Then
    Dim cmd As OleDb.OleDbCommand
    sql1 = "select * from announcel where (DateDiff(""d"",d_field,'" & Today() & "')) = 1 "
    cmd = New OleDb.OleDbCommand(sql1, conn)
    da = New OleDb.OleDbDataAdapter(sql1, conn)
    dbread = cmd.ExecuteReader()
    view.DataSource = dbread
    view.DataBind()
    sql1 = "select count(*) from announcel where (DateDiff(""d"",d_field,'" & Today() & "')) = 1 "
    cmd = New OleDb.OleDbCommand(sql1, conn)
    txtno_of_records.Text = cmd.ExecuteScalar().ToString
    dbread.Close()
    conn.Close()
End If

If (ddlannouncement.SelectedItem.Text = "Today") Then
    Dim cmd As OleDb.OleDbCommand
    sql1 = "select * from announcel where (DateDiff(""d"",d_field,'" & Today() & "')) = 0 "
    cmd = New OleDb.OleDbCommand(sql1, conn)
    da = New OleDb.OleDbDataAdapter(sql1, conn)
    dbread = cmd.ExecuteReader()
    view.DataSource = dbread
    view.DataBind()
    sql1 = "select count(*) from announcel where (DateDiff(""d"",d_field,'" & Today() & "')) = 0 "
    cmd = New OleDb.OleDbCommand(sql1, conn)
    txtno_of_records.Text = cmd.ExecuteScalar().ToString
    dbread.Close()
    conn.Close()
End If

End Sub

Protected Sub btnview_all_Click(ByVal sender As Object, ByVal e As EventArgs) Handles btnview_all.Click
    Dim conn As OleDb.OleDbConnection = New OleDb.OleDbConnection("Provider=Microsoft.Jet.OLEDB.4.0; _
    & "Data Source=C:\\Users\\Santhosh\\Documents\\Visual
    2008\\Projects\\WebApplication3\\WebApplication3\\announce.mdb")
    conn.Open()
    Dim dbread
    Dim da As OleDb.OleDbDataAdapter
    Dim sql1 As String
    Dim cmd As OleDb.OleDbCommand
    sql1 = "select * from announcel"
    cmd = New OleDb.OleDbCommand(sql1, conn)
    da = New OleDb.OleDbDataAdapter(sql1, conn)
    dbread = cmd.ExecuteReader()
    view.DataSource = dbread
    view.DataBind()
    sql1 = "select count(*) from announcel"
    cmd = New OleDb.OleDbCommand(sql1, conn)
    txtno_of_records.Text = cmd.ExecuteScalar().ToString
    dbread.Close()
    conn.Close()
End Sub
End Class

```

For Report Accident/Incident

accident_or_incident.aspx

```

<%@ Page Language="vb" AutoEventWireup="false" CodeBehind="WebForm3.aspx.vb" Inherits="WebApplication3.WebForm3" %>

<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Transitional//EN" "http://www.w3.org/TR/xhtml1/DTD/xhtml1-transitional.dtd">

<html xmlns="http://www.w3.org/1999/xhtml" >
<head runat="server">
    <title></title>
    <style type="text/css">
        .style1
        {
            font-size: xx-large;
            font-weight: bold;
        }
        .style2
        {
            font-size: xx-large;

```



```

        txtno_of_records.Text = cmd.ExecuteScalar().ToString
        dbread.Close()
        conn.Close()
    End If

    If (ddlbydate.SelectedItem.Text = "Today") Then
        Dim cmd As OleDb.OleDbCommand
        sql1 = "select * from accident1 where (DateDiff("d",d_field,' & Today() & ')) = 0 "
        cmd = New OleDb.OleDbCommand(sql1, conn)
        da = New OleDb.OleDbDataAdapter(sql1, conn)
        dbread = cmd.ExecuteReader()
        rpt_a_o_i_report.DataSource = dbread
        rpt_a_o_i_report.DataBind()
        sql1 = "select count(*) from accident1 where (DateDiff("d",d_field,' & Today() & ')) = 0 "
        cmd = New OleDb.OleDbCommand(sql1, conn)
        txtno_of_records.Text = cmd.ExecuteScalar().ToString
        dbread.Close()
        conn.Close()
    End If
End Sub

Protected Sub btnacc_all_Click(ByVal sender As Object, ByVal e As EventArgs) Handles btnacc_all.Click
    Dim conn As OleDb.OleDbConnection = New OleDb.OleDbConnection("Provider=Microsoft.Jet.OLEDB.4.0;" _
        & "Data Source=C:\\Users\\Santhosh\\Documents\\Visual
2008\\Projects\\WebApplication3\\WebApplication3\\accident.mdb")
    conn.Open()
    Dim dbread
    Dim da As OleDb.OleDbDataAdapter
    Dim sql1 As String

    Dim cmd As OleDb.OleDbCommand
    sql1 = "select * from accident1"
    cmd = New OleDb.OleDbCommand(sql1, conn)
    da = New OleDb.OleDbDataAdapter(sql1, conn)
    dbread = cmd.ExecuteReader()
    rpt_a_o_i_report.DataSource = dbread
    rpt_a_o_i_report.DataBind()
    sql1 = "select count(*) from accident1"
    cmd = New OleDb.OleDbCommand(sql1, conn)
    txtno_of_records.Text = cmd.ExecuteScalar().ToString
    dbread.Close()
    conn.Close()
End Sub

Protected Sub btnacc_all0_Click(ByVal sender As Object, ByVal e As EventArgs) Handles btnacc_due_to.Click
    Dim conn As OleDb.OleDbConnection = New OleDb.OleDbConnection("Provider=Microsoft.Jet.OLEDB.4.0;" _
        & "Data Source=C:\\Users\\Santhosh\\Documents\\Visual
2008\\Projects\\WebApplication3\\WebApplication3\\accident.mdb")
    conn.Open()
    Dim dbread
    Dim da As OleDb.OleDbDataAdapter
    Dim sql1 As String

    Dim cmd As OleDb.OleDbCommand
    sql1 = "select * from accident1 where Place_of_Accident = ' & ddltype_of_accident.SelectedItem.Text & ' "
    cmd = New OleDb.OleDbCommand(sql1, conn)
    da = New OleDb.OleDbDataAdapter(sql1, conn)
    dbread = cmd.ExecuteReader()
    rpt_a_o_i_report.DataSource = dbread
    rpt_a_o_i_report.DataBind()
    sql1 = "select count(*) from accident1 where Place_of_Accident = ' & ddltype_of_accident.SelectedItem.Text & '"
    cmd = New OleDb.OleDbCommand(sql1, conn)
    txtno_of_records.Text = cmd.ExecuteScalar().ToString
    dbread.Close()
    conn.Close()
End Sub

End Class
For Report Hazard

Hazard.aspx
<%@ Page Language="vb" AutoEventWireup="false" CodeBehind="WebForm4.aspx.vb" Inherits="WebApplication3.WebForm4" %>

<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Transitional//EN" "http://www.w3.org/TR/xhtml1/DTD/xhtml1-transitional.dtd">

```

```

<html xmlns="http://www.w3.org/1999/xhtml" >
<head runat="server">
<title></title>
<style type="text/css">
.style1
{
font-size: xx-large;
font-weight: bold;
}
.style2
{
font-size: xx-large;
}
</style>
</head>
<body><form id="form1" runat="server">
<div>

<p>
<span class="style1">HAZARD REPORT</span></div>

<p>
<asp:Label ID="lbldate" runat="server" Text="Date"></asp:Label>
of actual accident
<asp:Calendar ID="Calendar1" runat="server" style="margin-left: 354px"></asp:Calendar>
</p>
<p>
<asp:Label ID="lbladministration" runat="server" Text="Administration"></asp:Label>
<asp:DropDownList ID="ddladministration" runat="server" Height="20px"
Width="120px">
<asp:ListItem>Water on floor</asp:ListItem>
<asp:ListItem>Door not working</asp:ListItem>
<asp:ListItem>Broken Windows</asp:ListItem>
<asp:ListItem>Glass Doors</asp:ListItem>
<asp:ListItem>Exposed Wire</asp:ListItem>
<asp:ListItem>Ceiling light is out</asp:ListItem>
</asp:DropDownList>

<p>
<asp:Label ID="lblmaintainance" runat="server" Text="Maintainance"></asp:Label>
<asp:DropDownList ID="ddlmaintainance" runat="server" Height="19px"
Width="120px">
<asp:ListItem>Exposed Wire</asp:ListItem>
<asp:ListItem>Not labeled hazard</asp:ListItem>
<asp:ListItem>Sharp Object</asp:ListItem>
<asp:ListItem>Hot Object</asp:ListItem>
<asp:ListItem>Cable on floor</asp:ListItem>
<asp:ListItem>Ladder</asp:ListItem>
</asp:DropDownList>
<br />
<br />
<asp:Label ID="lblair_field" runat="server" Text="Air Field"></asp:Label>
<asp:DropDownList ID="ddlair_field" runat="server" Height="19px" Width="120px">
<asp:ListItem>Birds</asp:ListItem>
<asp:ListItem>Broken Signs</asp:ListItem>
<asp:ListItem>Miscommunication</asp:ListItem>
<asp:ListItem>Improper separation of hazards</asp:ListItem>
<asp:ListItem>Running on ramp</asp:ListItem>
<asp:ListItem>Not removing the knots</asp:ListItem>
<asp:ListItem>Improper fueling</asp:ListItem>

```


End Sub

```
Protected Sub btnhazard_date_1_Click(ByVal sender As Object, ByVal e As EventArgs) Handles btnhazard_date_1.Click
    Dim conn As OleDb.OleDbConnection = New OleDb.OleDbConnection("Provider=Microsoft.Jet.OLEDB.4.0;" _
        & "Data Source=C:\\Users\\Santhosh\\Documents\\Visual Studio
2008\\Projects\\WebApplication3\\WebApplication3\\hazard.mdb")
    conn.Open()
    Dim dbread
    Dim da As OleDb.OleDbDataAdapter
    Dim sql1 As String

    If (ddlbydate_hazard.SelectedItem.Text = "Last one month") Then
        Dim cmd As OleDb.OleDbCommand
        sql1 = "select * from hazard1 where (DateDiff(""d"",d_field,'" & Today() & "') < 30 "
        cmd = New OleDb.OleDbCommand(sql1, conn)
        da = New OleDb.OleDbDataAdapter(sql1, conn)
        dbread = cmd.ExecuteReader()
        rpthazard.DataSource = dbread
        rpthazard.DataBind()
        sql1 = "select count(*) from hazard1 where (DateDiff(""d"",d_field,'" & Today() & "') < 30 "
        cmd = New OleDb.OleDbCommand(sql1, conn)
        txtno_of_records1.Text = cmd.ExecuteScalar().ToString
        dbread.Close()
        conn.Close()
    End If

    If (ddlbydate_hazard.SelectedItem.Text = "Last one week") Then
        Dim cmd As OleDb.OleDbCommand
        sql1 = "select * from hazard1 where (DateDiff(""d"",d_field,'" & Today() & "') < 7 "
        cmd = New OleDb.OleDbCommand(sql1, conn)
        da = New OleDb.OleDbDataAdapter(sql1, conn)
        dbread = cmd.ExecuteReader()
        rpthazard.DataSource = dbread
        rpthazard.DataBind()
        sql1 = "select count(*) from hazard1 where (DateDiff(""d"",d_field,'" & Today() & "') < 7 "
        cmd = New OleDb.OleDbCommand(sql1, conn)
        txtno_of_records1.Text = cmd.ExecuteScalar().ToString
        dbread.Close()
        conn.Close()
    End If

    If (ddlbydate_hazard.SelectedItem.Text = "Yesterday") Then
        Dim cmd As OleDb.OleDbCommand
        sql1 = "select * from hazard1 where (DateDiff(""d"",d_field,'" & Today() & "') = 1 "
        cmd = New OleDb.OleDbCommand(sql1, conn)
        da = New OleDb.OleDbDataAdapter(sql1, conn)
        dbread = cmd.ExecuteReader()
        rpthazard.DataSource = dbread
        rpthazard.DataBind()
        sql1 = "select count(*) from hazard1 where (DateDiff(""d"",d_field,'" & Today() & "') = 1 "
        cmd = New OleDb.OleDbCommand(sql1, conn)
        txtno_of_records1.Text = cmd.ExecuteScalar().ToString
        dbread.Close()
        conn.Close()
    End If

    If (ddlbydate_hazard.SelectedItem.Text = "Today") Then
        Dim cmd As OleDb.OleDbCommand
        sql1 = "select * from hazard1 where (DateDiff(""d"",d_field,'" & Today() & "') = 0 "
        cmd = New OleDb.OleDbCommand(sql1, conn)
        da = New OleDb.OleDbDataAdapter(sql1, conn)
        dbread = cmd.ExecuteReader()
        rpthazard.DataSource = dbread
        rpthazard.DataBind()
        sql1 = "select count(*) from hazard1 where (DateDiff(""d"",d_field,'" & Today() & "') = 0 "
        cmd = New OleDb.OleDbCommand(sql1, conn)
        txtno_of_records1.Text = cmd.ExecuteScalar().ToString
        dbread.Close()
        conn.Close()
    End If
End Sub

Protected Sub btnall_Click(ByVal sender As Object, ByVal e As EventArgs) Handles btnall.Click
```

```

    Dim conn As OleDb.OleDbConnection = New OleDb.OleDbConnection("Provider=Microsoft.Jet.OLEDB.4.0;" _
& "Data Source=C:\\Users\\Santhosh\\Documents\\Visual Studio 2008\\Projects\\WebApplication3\\WebApplication3\\hazard.mdb")
    conn.Open()
    Dim dbread
    Dim da As OleDb.OleDbDataAdapter
    Dim sql1 As String
    Dim cmd As OleDb.OleDbCommand
    sql1 = "select * from hazard1 "
    cmd = New OleDb.OleDbCommand(sql1, conn)
    da = New OleDb.OleDbDataAdapter(sql1, conn)
    dbread = cmd.ExecuteReader()
    rpthazard.DataSource = dbread
    rpthazard.DataBind()
    sql1 = "select count(*) from hazard1 "
    cmd = New OleDb.OleDbCommand(sql1, conn)
    txtno_of_records1.Text = cmd.ExecuteScalar().ToString
    dbread.Close()
    conn.Close()
End Sub

Protected Sub btnhazard_datel_Click(ByVal sender As Object, ByVal e As EventArgs) Handles btnhazard_datel.Click
    Dim conn As OleDb.OleDbConnection = New OleDb.OleDbConnection("Provider=Microsoft.Jet.OLEDB.4.0;" _
& "Data Source=C:\\Users\\Santhosh\\Documents\\Visual Studio 2008\\Projects\\WebApplication3\\WebApplication3\\hazard.mdb")
    conn.Open()
    Dim dbread
    Dim da As OleDb.OleDbDataAdapter
    Dim sql1 As String
    Dim cmd As OleDb.OleDbCommand
    sql1 = "select * from hazard1 where Action_Taken= '" & ddlaction.SelectedItem.Text & "' "
    cmd = New OleDb.OleDbCommand(sql1, conn)
    da = New OleDb.OleDbDataAdapter(sql1, conn)
    dbread = cmd.ExecuteReader()
    rpthazard.DataSource = dbread
    rpthazard.DataBind()
    sql1 = "select count(*) from hazard1 where Action_Taken= '" & ddlaction.SelectedItem.Text & "' "
    cmd = New OleDb.OleDbCommand(sql1, conn)
    txtno_of_records1.Text = cmd.ExecuteScalar().ToString
    dbread.Close()
    conn.Close()
End Sub
End Class

```