The Auditor of the City and County of Denver is independently elected by the citizens of Denver. He is responsible for examining and evaluating the operations of City agencies for the purpose of ensuring the proper and efficient use of City resources and providing other audit services and information to City Council, the Mayor and the public to improve all aspects of Denver’s government. He also chairs the City’s Audit Committee and oversees the City’s Comprehensive Annual Financial Report (CAFR).

The Audit Committee is chaired by the Auditor and consists of seven members. The Audit Committee assists the Auditor in his oversight responsibilities of the integrity of the City’s finances and operations, including the integrity of the City’s financial statements. The Audit Committee is structured in a manner that ensures the independent oversight of City operations, thereby enhancing citizen confidence and avoiding any appearance of a conflict of interest.

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Kim Day, Manager
Department of Aviation
City and County of Denver

Dear Ms. Day:

Attached is the Auditor’s Office Audit Services Division’s report of its audit of workplace safety for the Department of Aviation (Aviation). The purpose of the audit was to assess whether Aviation has demonstrated key facets necessary to create a successful safety culture.

In response to a tragic accident at the airport, Aviation has begun an initiative to review and enhance its safety programs. Audit work noted that the safety initiative includes an evaluation team comprising senior management, and has resulted in several recommendations for improving safety, including eliciting feedback from employees regarding their perception of workplace safety. In addition, Aviation has some key safety features already in place, including a Risk and Safety management office and an employee safety committee.

Based on research and discussion with subject matter experts, my auditors determined that Aviation could take additional steps to enhance its approach to workplace safety. Primarily, Aviation’s senior team must embrace a long-term commitment to developing and maintaining a culture that prizes safety. This audit raises concern that the airport’s primary mission, to quickly and efficiently move airplanes and passengers, creates the potential of conflict with safe operations. This conflict should be continually balanced and managed. Aviation management must also recognize the value of collaborating with employees to ensure organizational buy-in to safety initiatives and to implement effective safety improvements. Employees are often the best source of safety ideas, and ignoring employee input is a good way to undermine efforts to develop safety culture. Finally, Aviation executives should evaluate ways to improve the collection and dissemination of safety-related information. The audit report discusses several areas where improvements can be made, such as collecting data on potential accidents that were narrowly avoided. This near-miss data can illuminate safety problems before they become statistics. In this environment, being close is not good enough. We must strive for perfection.

If you have any questions, please call Kip Memmott, Director of Audit Services, at 720-913-5029.

Sincerely,

Dennis Gallagher
Auditor

August 19, 2010
To promote open, accountable, efficient and effective government by performing impartial reviews and other audit services that provide objective and useful information to improve decision making by management and the people. We will monitor and report on recommendations and progress towards their implementation.

cc: Honorable John Hickenlooper, Mayor
Honorable Members of City Council
Members of Audit Committee
Ms. Roxane White, Chief of Staff
Mr. Claude Pumilia, Chief Financial Officer
Mr. David T. Roberts, Chief Services Officer
Mr. David Fine, City Attorney
Mr. L. Michael Henry, Staff Director, Board of Ethics
Ms. Lauri Dannemiller, City Council Executive Staff Director
Ms. Beth Machann, Controller
Mr. Patrick Heck, Department of Aviation Chief Financial Officer
AUDITOR’S REPORT

We have completed an audit of the Department of Aviation’s (Aviation’s) efforts to ensure passenger and employee safety at Denver International Airport (DIA). The purpose of the audit was to determine whether Aviation maintains an effective safety culture.

This performance audit is authorized pursuant to the City and County of Denver Charter, Article V, Part 2, Section 1, General Powers and Duties of Auditor, and was conducted in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

The audit found that Aviation management has several elements or initiatives in place to create an effective safety culture, including the formation of a Safety Evaluation Team, issuing an employee perception survey, establishing an employee safety committee, developing safety policies, and maintaining a safety office and staff.

However, audit work also determined Aviation management can take additional steps to demonstrate its long-term commitment towards building a successful and effective safety culture. In addition, Aviation management should work to obtain better employee buy-in for safety programs. Finally, Aviation management should enhance the communication and safety reporting activities within the organization.

We extend our appreciation to personnel from the Department of Aviation who assisted and cooperated with us during the audit.
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EXECUTIVE SUMMARY

Safety Is Addressed at DIA in Multiple Ways

The Department of Aviation (Aviation) manages the Denver International Airport (DIA) for the City and County of Denver. As part of its operational oversight, Aviation works to address risks to health and safety in multiple ways. Addressing safety concerns is critical, since threats to safety can result in injuries or even death. For example, in 2008 and 2009, Aviation experienced 200 worker’s compensation claims totaling approximately $884,000 in incurred losses. Aviation’s Risk and Safety section manages the airport’s insurance and worker’s compensation programs, develops safety policies, designs and conducts safety trainings, and performs job hazard analyses and safety inspections of the Aviation units. In addition to the roles performed by Risk and Safety, Aviation has an employee safety committee, in which representatives from various Aviation divisions discuss safety issues. The Manager of Aviation also appointed a Safety Evaluation Team (SET) in early 2010 to look at areas in which Aviation could improve its safety strategy and programs. Finally, Aviation’s Safety Manager chairs the employee safety committee and Risk and Safety personnel are represented on SET.

While Aviation implements various safety provisions at DIA, safety activities at the airport are also overseen by federal agencies including the Federal Aviation Administration (FAA), the Transportation Safety Administration (TSA), and the Occupational Health and Safety Administration (OSHA). FAA conducts detailed inspections of DIA in areas that impact flight safety. TSA provides security services for passengers and cargo flying out of DIA, checking to ensure that no threats exist to the safety of passengers and airline personnel. OSHA inspects various construction activities on the DIA site to ensure that safe working conditions are maintained.

Further Challenges Face Management in Developing Aviation’s Safety Culture

Aviation management has several elements in place to create an effective safety culture, including the formation of the Safety Evaluation Team and issuing an employee safety perception survey. However, management can take some additional steps to demonstrate its long-term commitment to developing safety culture. In addition, audit work found that many Aviation employees may not significantly embrace safety initiatives, and certain steps should be taken to build employee trust in this area. Finally,

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1 An effective safety culture is one that mitigates or overcomes risks to safety and wellness.
communication regarding safety appears to be largely top-down. This scenario can inhibit effective management and employee collaboration regarding safety issues.

**Additional steps are needed to further demonstrate management commitment**—Sincere, long-term management commitment is vital to developing an effective safety culture. Aviation management has implemented initiatives in several areas, indicating it places value on safe operations. These initiatives include maintaining a Risk and Safety section, developing safety policies and procedures, maintaining an employee safety committee, and creating a special Safety Evaluation Team to look at ways to improve safety. Audit research revealed areas where Aviation management should take further steps to intensify its commitment to developing an effective safety culture. First, it should ensure that safety audit findings made by Risk and Safety personnel are immediately corrected, rather than lingering to be re-identified in subsequent audits. Further, Aviation management should ensure that it adequately balances the pressure of ensuring expeditious movement of airplanes and passengers with the need for safe operations.

**Improved employee collaboration would increase buy-in**—Another critical element of an effective safety culture is the establishment of good collaboration between management and employees. Audit work determined that such collaboration may not exist to the optimal extent possible. For example, in 2010, Aviation management queried employees in order to assess their perceptions of safety. Management set an internal goal of a 50 percent response rate, but the actual response rate was 34 percent. While surveying employees is a good start in developing collaboration, auditors’ research suggests that when many employees do not provide feedback they may believe their feedback on safety issues could be used against them or will not result in substantive change.

Management may also develop collaboration by providing employees with an effective safety training program. Aviation policies require safety training, but many employees do not adhere to this requirement. For example, no work unit within the Maintenance Division completed all its required safety training hours for 2009. The Field Maintenance unit had the highest completion percentage, satisfying 57 percent of required training hours. However, audit research into general principles of an effective safety culture suggests that enforcing a mandatory training requirement at a time when employees may lack confidence in management commitment can lead to the perception that training is intended to punish employees. Mandatory training may also lead to employees’ perception that management is simply trying to insulate the organization against liability stemming from safety mistakes. In addition, training programs should be tailored to promote information retention by using employees’ own job functions in the training whenever possible. Aviation management should also ensure that supervisors and other management personnel attend training designed to help them improve their safety leadership skills. Aviation management can also increase collaboration with
employees by ensuring that a management representative with decision-making authority serves on the employee safety committee. Finally, Aviation provides employees with an opportunity for feedback on safety issues through the utilization of safety comment cards. While the follow-up on many of these comments addressed the identified safety issue, some significant complaints could have received more thorough follow-up. For example, one employee complained about dangerously high-noise levels in his work area. The documented follow-up did not indicate any evidence of testing performed to measure noise levels, or to educate management and employees about the potential hazard and methods of reducing this risk.

**Better collection and dissemination of information would enhance the safety culture**—Communicating safety policies and risks is a third area critical to developing an effective safety culture. Aviation management communicates safety information to its employees, but can improve the communication processes within its organization by ensuring safety communication does not only occur from the top down. This enhanced communications should occur through improved employee collaboration and participation activities and processes. Aviation management should help employees better understand that they are integral to developing an effective safety culture. In addition, management should encourage employees who narrowly avoid accidents to report these near-misses. Near-miss data can be a rich source of information about threats to safety before these threats result in accidents, lost time, or worker’s compensation claims. Finally, Aviation management should work to break down silos between divisions that can inhibit sharing of information regarding safety.
INTRODUCTION & BACKGROUND

The Department of Aviation Manages Denver International Airport

The City and County of Denver owns and operates Denver International Airport (DIA). Under the City Charter, the management, operation, and control of DIA is delegated to the City’s Department of Aviation (Aviation), directed by the Manager of Aviation. The Manager is appointed by the Mayor.

DIA is the primary airport serving the Denver region. Based on 2008 passenger traffic data, DIA was the fifth busiest airport in the nation and the tenth busiest in the world, serving approximately 51.2 million passengers. The airport site comprises about 53 square miles of land, and has six runways. The passenger complex includes a terminal and three concourses. The terminal accommodates passenger ticketing, baggage claim, concessions, and other facilities. The concourses provide full service jet gates for large aircraft and parking positions for regional or commuter aircraft.

Aviation contains seven major divisions with nearly 1,140 employees. In addition, Aviation reports that it has issued over 30,000 personnel badges for use by federal officers, air carrier staff, contractors, vendors and the airport’s tenants.

Two Aviation divisions, Operations and Maintenance, have duties bearing significant safety risks. The Operations Division is divided into two main operating sections, which deal with airside and landside activities. The airside includes the airfield and its components, such as runways, taxiways, and apron-gate areas. Airport landside includes terminal buildings, access roads, and parking areas provided for users of DIA. Passengers, employees, cargo, and aircraft maintenance activities use Aviation's landside facilities and services. The Maintenance Division oversees maintenance contracts and other activities related to the repair and maintenance of the airport facilities, aeronautical operations areas, and the computerized communications, electrical, and information systems. The Division contains six sections: Facility Maintenance; Field Maintenance; Fleet Maintenance; Life Safety Electrical; Maintenance Services; and Technical Maintenance.

DIA Operations Fall under Multiple Regulatory Jurisdictions

Operations at DIA fall under the oversight of multiple jurisdictions, including the City and federal agencies.

Like other City agencies, Aviation is required to comply with the City’s Executive Order 65 and the accompanying policies related to various aspects of the citywide occupational safety and health program. The Order requires that City agencies develop policies and

programs related to workplace safety. Pursuant to this requirement, Aviation has developed numerous internal policies to implement Executive Order requirements within the DIA environment.

In addition to the City’s rules and regulations, three federal agencies have regulatory jurisdiction over certain aspects of DIA operations.

**Federal Aviation Administration**—The Code of Federal Regulations authorizes the Federal Aviation Administration (FAA) to issue airport operating certificates to DIA. As part of this authority, FAA conducts annual inspections of airport operations to help ensure safe operations. These annual inspections may also be supplemented by surprise inspections if necessary. FAA inspections consist of several steps, such as:

- **Inspecting movement areas**—Inspectors check runway slopes; check the condition of pavement, markings, lighting, signs, abutting shoulders, and safety areas; watch ground vehicle operations; ensure the public is protected against inadvertent entry and jet or propeller blast; and check for the presence of any wildlife, traffic, and wind direction indicators. Inspectors also conduct nightly inspections to evaluate lighting and signage on runways, taxiways, and aprons, as well as pavement marking.

- **File reviews**—Inspectors review airport administrative files including evidence of daily airfield inspections by the airport operation personnel.

- **Testing emergency response**—Inspectors evaluate Aviation’s aircraft rescue and fire fighting programs by conducting timed-response drills, reviewing aircraft rescue and firefighting personnel training records, and checking equipment and protective clothing for operation, condition, and availability.

- **Inspecting fuel farm and mobile fuelers**—Inspectors check airport files for documentation of their quarterly inspections of the fueling facility, and review certification from each tenant fueling agent about completion of fire safety training.

**Transportation Safety Administration**—Pursuant to the Transportation Security Act of November 2001, the Transportation Safety Administration (TSA) of the Department of Homeland Security is responsible for screening every passenger and every piece of luggage that boards at DIA. In this way, TSA contributes to safety at DIA. The airport has three passenger screening checkpoints – two in Jeppesen Terminal (one north and one south on Level 5) and one prior to the pedestrian bridge to A Gates. All passengers must pass through one of these screening checkpoints before they can proceed to their airline departure gates.

**Occupational Health and Safety Administration**—As a component of local government, DIA is exempt from compliance with the Occupational Safety and Health Administration (OSHA). However, Executive Order 65 and the accompanying safety and health

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4 OSHA requirements are set forth in Title 29 C.F.R., Part 1910.
policies, as well as DIA safety policies, use OSHA guidelines as their framework. Further, contractors and vendors engaged in the business at DIA are under OSHA regulatory jurisdiction.

Aviation’s Risk and Safety Functions

Within Aviation, there are multiple entities that address risk and safety issues. These include a Risk and Safety section, the employee safety committee, and the recently-established Safety Evaluation Team (SET). Aviation’s safety programs are critical because of the risk inherent in jobs performed at DIA. According to data provided by Risk and Safety there were ninety worker’s compensation claims filed in 2008, and 110 filed in 2009. These claims were filed by workers for causes that included slips, trips, and falls; and overexertion. These 200 claims resulted in approximately $884,000 in incurred losses.

**Risk and Safety**—Aviation’s Risk and Safety section is housed in the Finance and Administration Division. Risk and Safety, which consists of six employees, has various responsibilities including managing the airport’s insurance and worker’s compensation programs, developing safety policies, designing and conducting safety trainings, performing job hazard analyses, and conducting safety inspections of various operational units within Aviation. Safety personnel from Risk and Safety also sit on the Aviation employee safety committee and on SET.

**Employee Safety Committee**—The safety committee meets on a monthly basis to discuss the safety concerns of each unit. The committee is chaired by the Safety Manager and has representatives from all the airport’s sections.

**Safety Evaluation Team**—After a fatal accident involving a DIA contractor in December 2009, the Manager of Aviation formed SET to evaluate safety practices at DIA and make recommendations for improvement. SET consists of the members of DIA executive management and representatives from the various airport sections, including Risk and Safety. SET has helped to conduct an employee safety perception survey. This survey was completed on June 25, 2010, and a third-party contractor is responsible for collecting and analyzing the results of the survey. In addition, SET has made a presentation to the Manager of Aviation regarding short-term and long-term safety efforts that would improve the safety culture at DIA, as envisioned in the airport’s strategic plan. SET also drafted an Aviation safety strategy document, which outlines the airport’s safety strategy and high level goals. We plan on reviewing the results of the survey when they become available, and as part of the audit follow-up process.

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5 The SET membership roster comprises twenty-six individuals, including the Deputy Manager of Maintenance, the Deputy Manager of Revenue Development, the Deputy Manager of Planning and Development, the Deputy Manager of Operations, the Assistant Deputy Manager of Engineering, the Assistant Chief of Operations, the Aviation Operations Manager, the Tenant Facilities Manager, the Terminal Operations Manager, the Airport Operations Manager, the Risk Manager, the Safety Manager, and a representative from the Airport Legal office.

6 By August 6, 2010, survey results had been provided to Aviation, though the results were not available for the audit team to review during the audit.
SCOPE

This audit team researched the elements of a successful safety culture, which would apply to Aviation employees and contractors. However, the audit team confined its review and recommendations to areas where Aviation management has clear jurisdiction. For example, the audit did not look at airport security. While security can impact safety, by deterring or otherwise reducing safety risks, airport security is predominantly a federal government responsibility. Therefore, the audit team scoped out functions that are primarily overseen by TSA. Further the audit did not review passenger safety issues, though the team recognizes that an effective safety culture at DIA will provide spillover benefits to passengers. Passenger safety issues are generally under the authority of the FAA.

The team also did not specifically review Aviation actions in response to two fatal accidents that occurred at DIA in recent years. These incidents fall under the purview of OSHA, and OSHA has already generated a report regarding one of the fatal incidents. Further, the SET group was formed in response to a 2009 fatality, and the audit team reviewed SET’s work as part of this audit. The audit team also worked to develop an audit scope that would complement work already being done by SET, rather than trying to duplicate SET’s efforts.

OBJECTIVE

The audit’s objective was to assess the adequacy of Aviation’s safety culture.

METHODOLOGY

Numerous evidence gathering and analysis methods were used to assess key risks within Aviation’s safety activities, and to meet the audit objective.

Certain methods were used both to assess key risk areas in audit planning and to develop the audit report. These methods included, but were not limited to:

- Conducting interviews with safety subject matter experts and reviewing academic literature, trade journals, academic and corporate research papers, and a report from the International Atomic Energy Agency to identify key elements of an effective safety culture;

- Analyzing Denver City Charter and Denver Revised Municipal Code (D.R.M.C.); Executive Order 65 (Occupational Safety and Health Program) requirements; federal guidelines related to safety requirements, notably 14 C.F.R. Part 139—Certification of Airports; Aviation’s Rules and Regulations; Aviation’s performance measures; and the City’s Budget Book;
• Interviewing DIA personnel, including members of SET;
• Reviewing and analyzing information and recommendations developed by SET and provided to the Manager of Aviation;
• Reviewing Aviation’s accident data and worker’s compensation claim data for 2008 – 2010;
• Reviewing employee safety comment cards and Aviation’s follow-up on comments received for 2008-2010;
• Identifying Aviation’s workplace safety training offerings, and observing a training class;
• Taking a guided tour of the DIA grounds to view various components of Aviation’s safety programs for airside and landside operations; and
• Reviewing safety audits performed from April 2009 to April 2010 by Aviation’s Risk and Safety section;

Two specific activities yielded useful information concerning initial risk areas during our planning phase, but after further analysis, we determined that the information was not needed for subsequent fieldwork and presentation in the audit report. These methods included:

• Interviewing the City’s Risk Manager; and
• Contacting certain domestic airport internal audit departments to identify risk areas regarding safety programs.
FINDING 1

Further Challenges Face Management in Developing Aviation’s Safety Culture

Department of Aviation (Aviation) management has several elements in place to establish an effective safety culture including the formation of the Safety Evaluation Team (SET) and the issuance of an employee safety perception survey. However, Aviation management can take some additional steps to demonstrate a long-term commitment to developing an effective safety culture. For example, audit work suggests that many Aviation employees do not significantly buy into safety initiatives, and certain steps should be taken to build employee trust. Additionally, communication regarding safety appears to be largely top-down, which may inhibit effective management and employee collaboration regarding safety issues.

Aviation’s Safety Culture Has Positive Elements, However Further Management Action is Needed

Best practices indicate that a sincere, long-term management commitment is vital to developing and maintaining an effective safety culture. Aviation has some key elements of a safety program, which indicates that management places some value on safety. However, audit work has identified areas where more intensified management commitment could improve the airport’s safety culture.

Aviation has some key safety program elements in place—Some attributes of a safety culture are already in place at the Denver International Airport (DIA), indicating that Aviation management is interested in developing the organization’s safety culture. Addressing safety concerns is critical, since threats to safety can result in injuries or even death. For example, in 2008 and 2009, Aviation experienced 200 worker’s compensation claims totaling approximately $884,000 in incurred losses. Structural safety elements in place include risk management and safety management functions. Aviation has a risk manager and a safety officer who assist in providing information to Aviation management and employees.

Safety culture comprises those aspects of the organizational culture which will impact on attitudes and behavior related to increasing or decreasing risk.

Guldenmund, F.W. 2000, The Nature of Safety Culture: A Review of Theory and Research. Safety Science, 34(1-3), 251. The breadth of the definition emphasizes that safety culture permeates many aspects of the organization, and as such requires constant attention and management. In this context, the risk referred to in the definition relates the threats to the safety and wellness of workers. While safety culture can be poor, an effective safety culture is one that mitigates or overcomes risks to safety and wellness.

7 There is no single, universally-accepted definition of safety culture. Several academic articles have proposed definitions of safety culture, and there is a lively debate in professional circles regarding the distinction between safety culture and safety climate. For the purposes of this performance audit, we selected the following definition of safety culture: Those aspects of the organizational culture which will impact on attitudes and behavior related to increasing or decreasing risk. Guldenmund, F.W. 2000, The Nature of Safety Culture: A Review of Theory and Research. Safety Science, 34(1-3), 251. The breadth of the definition emphasizes that safety culture permeates many aspects of the organization, and as such requires constant attention and management. In this context, the risk referred to in the definition relates the threats to the safety and wellness of workers. While safety culture can be poor, an effective safety culture is one that mitigates or overcomes risks to safety and wellness.
Further, the safety staff has worked to develop safety policies, which are based on Occupational Safety and Health Administration (OSHA) guidelines. In addition, Aviation has established an employee safety committee to provide a forum for employees to identify and discuss safety concerns.

Aviation management has also organized SET, comprised of senior management and key employees, which has reviewed and assessed safety needs at DIA. This group has made recommendations to the Manager of Aviation for short-term, mid-term, and long-term goals, including focusing on developing the safety culture at DIA. SET also helped to initiate an employee safety perception survey, which was initiated in June 2010.

Aviation management has signaled that it places value on having a safe work environment through its efforts to maintain safety in areas regulated by the Federal Aviation Administration (FAA), such as airfield operations. Auditors reviewed FAA inspection reports, and found that the results of the FAA reports were generally positive. Auditors also observed in a tour of the DIA facility that Aviation management has placed safety comment boxes in DIA work spaces.

Finally, Aviation management commissioned an outside consultant to perform an operational safety assessment. The draft report, issued in 2007, made several recommendations to Aviation in areas including the role of senior management, safety investigations, safety supervision, and interdepartmental communications. Other management steps are needed—Proper Tone at the Top is critical for an organizational safety program to succeed long term. Audit work identified areas where Aviation management can strengthen its safety activities and deepen its commitment to developing an effective safety culture.

- Eliminating recurring safety audit findings—Auditors reviewed safety audits conducted by Risk and Safety from April 2009 through April 2010. The audits reviewed the elements contained in working environments for Building Maintenance, the Central Plant, Fleet Maintenance, the Graphics Shop, Materials Management, the Paint Shop, the Plumbing Shop, and the Vehicle Storage Building. Each site was audited three times in the time period reviewed, and all but the Central Plant had recurring issues. Some issues recurred across multiple worksites, including securing equipment such as a band saw or belt sander to the floor and ensuring that the eyewash equipment is inspected monthly. Other issues that recurred in at least one worksite included having storage in front of fire control sprinkler valves, and maintaining spill clean-up materials for a battery storage room in an area difficult to reach. The Manager of Aviation should reiterate the organization’s commitment to safety by ensuring that safety audit findings are immediately rectified and do not recur.

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• **Balancing safety and efficient production**—Interview information and a review of Aviation’s performance measures suggests that Aviation’s primary role is to ensure that airline partners are successful in moving planes in and out of the airport on time, and that passengers get to their gates in a timely manner. This primary operational goal affects various areas of Aviation’s operations. For example, auditors learned that Aviation management has focused on reducing the time needed to clear snow from runways to ensure that flight disruptions are minimized. In addition, contract monitoring of retail establishments includes ensuring that retail signage does not impede passengers moving to and from their gates. Finally, Aviation’s Operations unit remotely monitors various areas of the DIA terminal, in part to ensure that passenger movement is able to continue freely.

While these efforts are important parts of Aviation’s role, stressing this role increases the risk that Aviation will value safety to a lesser degree. For example, large equipment used for runway snow clearance must be operated safely, but pressure to resume flight operations may lead to a lower than optimal approach to safe equipment usage. Ideally, business processes should be conducted efficiently and safely. Appropriate performance standards can assist management in achieving this balance. Aviation performance evaluations have general standards related to safety. However to balance efficiency and safety, the Manager of Aviation should ensure that specific activities, such as runway clearance, that are central to its key business processes have related performance standards that hold management and employees accountable for operating safely.

**Considering the placement of Risk and Safety in the organization**—Some Aviation officials discussed with the audit team the possibility of elevating the placement of the Risk and Safety section in the organizational structure. This was also a recommendation made in the 2007 consultant’s report. However, auditors’ review of best practices regarding the location of the safety office in an organization did not lead to a consensus. Most literature reviewed did not address the concept of organizational placement, and subject matter experts consulted by the team differed regarding the importance of the safety office’s placement. However, one subject matter expert interviewed by the audit team believed that elevating the safety office in the organization was important to allow for direct communication with senior management. Another subject matter expert advocated that a safety office serve as an independent resource for the organization. Consequently, the Manager of Aviation should focus on ensuring ongoing direct communication between the Risk and Safety and senior management. This would likely be a more substantive contribution to safety culture than simply elevating the placement of Risk and Safety, which could be merely cosmetic.
Creating an effective safety culture requires a team effort by the organization’s management and employees

Aviation Management Should Further Develop Employee Collaboration

Leading research and experts agree that in order to have an effective safety culture it is imperative that organizations establish a high level of management and employee collaboration to increase employee buy-in. Aviation management has taken some steps to involve employees in safety culture development, and some additional steps would likely be useful.

Aviation issued a safety survey—One way of gauging the success of a safety culture is an employee safety survey. Aviation management recently sent a safety survey to its approximately 1,140 employees in an effort to obtain employee feedback regarding the safety culture at the airport. Three hundred eight-three (approximately 34 percent) employees responded to the survey, which was lower that Aviation’s internal goal of a 50 percent response rate. Aviation requested employee participation through an e-mail to all employees. There are multiple reasons why employees may not respond to a survey. For example, they may not feel they have time to do so. However, some Aviation personnel expressed concern that while Aviation’s safety survey was anonymous, it may have asked questions that inhibited the response rate. Specifically, the survey asked questions regarding employee tenure and work unit which could provide unique identifying information related to the respondents.

Literature reviews and subject matter expert interviews suggest that one reason for employees not responding is a lack of confidence in management’s safety culture development efforts. Employees may lack confidence because they believe they will be blamed for safety problems, or because they question management’s commitment to developing an effective safety culture. Aviation management should be mindful that lack of employee confidence in management’s efforts to develop the safety culture presents a threat to effective employee collaboration.

Safety training not widely attended—Auditors’ literature review and discussion with subject matter experts confirm that safety training can benefit an organization in several ways. Specifically, training can lead to lower injury rates, provide on-going support in a safety culture, contribute to an employee’s perception of management commitment, and ensure that all employees have access to the same critical information. Risk and Safety has identified specific training required for various job positions and for individuals who work in hazardous conditions, such as in confined spaces or working with forklifts. However, Risk and Safety consistently observes low participation in safety training classes, including safety training for supervisors. Figure 1 depicts the 2009 level of participation for Aviation’s Maintenance Division in required training courses. The graph clearly indicates that employees and supervisors are not adhering to Aviation’s policies and procedures regarding safety training requirements.
**Additional measures needed to enhance training program**—While audit research indicates that training is important, it is not a panacea. The ultimate goal for improving safety is to have employees create good safety habits which may be impacted very little by formalized training. However, safety training takes on greater importance when human beings must face hazards that cannot be removed from a process. There are three main areas where Aviation could benefit from changes in its safety training structure.

- **Mandatory training**—Aviation policies and procedures require specific safety training for certain positions. However, according to experts, enforcing mandatory training early in the safety culture development process could erode employee buy-in by making it seem as if management blames the employees for safety problems. Experts recommend requiring safety training for new hires as a less risky approach because they have not developed a lack of trust in management. This would also begin developing a group of individuals with appropriate knowledge and skills. Because of these concerns, Aviation management should proceed cautiously if it plans to enforce mandatory training for employees. However, Aviation management should require supervisors as well as upper management to participate in all safety leadership training, since this develops safety leadership skills and demonstrates management’s sincere commitment to developing an effective safety culture.
- **Create incentives for training**—An alternative to enforcing mandatory training for all employees is creating incentives for employees to participate in useful training opportunities. Literature review and subject matter expert interviews suggest that in an organization where training seems punitive in nature, individuals may not participate to the best of their ability. These experts recommend creating an incentive program to encourage individuals to attend safety training. For example, management could require a certain level of training for career advancement, develop an internal safety certification system, or require a minimum number of hours of safety training per year, thereby allowing the employee to choose which area of safety they want to learn more about. In addition to elevating employee buy-in, incentives allow employees who attend training to better internalize safety messages due to their interest in the subject matter.

- **Effective training**—Once employees attend a training class, it is critical to ensure that they retain the information presented. Experts revealed that passive teaching techniques, such as lectures, PowerPoint presentations, or videos are not as effective as active teaching techniques. Active techniques include such activities as hands-on training, cognitive applications, such as case studies, or role-playing. Ideally, training should be site-specific and examples or demonstrations should be tailored to employees’ actual job duties. Aviation offers classroom training one day per week at various times during the day. Risk and Safety also has one employee who goes to various work units and meets with employees on an individual basis, but one person cannot provide as much coverage as necessary. Risk and Safety should find ways to incorporate active learning into its training activities to increase internalization of safety messages. For example, trainers could provide safety training at the work site for a group of employees and solicit direct feedback from unit workers by asking how they could improve safety in a particular task or with a particular piece of equipment. Another method would be to take employees from one area into another area and have them identify ways of improving work methods to increase safety.

**Aviation receives few safety comments**—Aviation provides a method of employee communication to Risk and Safety by placing safety comment boxes at the airport. Employees may fill out comment cards to provide feedback on safety issues and may choose to do so anonymously. Audit review of these comment cards revealed that from 2008–2010 only twelve safety comments were submitted. Risk and Safety provided data from an academic study that suggests there are 400 non-injury safety incidents for every major injury accident. Risk and Safety reports that in 2008 and 2009 Aviation had 200 worker’s compensation claims, which means that there are potentially several thousands of safety incidents that might be reported. There may be many reasons for a low number of comments. These include employees’ unwillingness to come forward or lack of trust in management to address safety threats effectively.

Auditors observed that Risk and Safety provided some type of follow-up for each comment, and in some cases the problem was reported to be fixed. However, in some cases, the follow-up appeared inadequate. For example, one employee complained
about dangerously high noise levels in his work area. The documented follow-up did not indicate any evidence of testing performed to measure noise levels, or to educate management and employees about the hazard and methods of reducing this risk. In another case, a worker in a “man-lift” complained about not having an individual on the ground in help prevent vehicle accidents or be available to help in case of equipment failure. The follow-up solely focused on determining whether this was an OSHA violation, and once it was determined that this was not a violation, the matter was referred to the supervisor for possible further education of employees. There was no indication of follow-up by Risk and Safety to determine if the supervisor provided the further education to the employees.

The safety comment card system is a good method of obtaining feedback and is an opportunity for airport management to connect with employees. However, in order to build trust within the organization and improve employee buy-in to a successful and effective safety culture, the Manager of Aviation must show employees that their comments are meaningful and taken seriously by ensuring effective follow-up on all safety comment cards submitted. Because the public can also be impacted by Aviation’s safety culture, the Manager of Aviation should also determine whether the organization will provide the public an opportunity to make comments about DIA safety issues.

**Management should be represented on the safety committee**—Aviation’s employee safety committee can be a useful tool for elevating safety issues identified by employees. Research shows that safety committees are associated with improvements in organizational safety. However, while Aviation’s employee safety committee is chaired by the Safety Manager, there are no senior management representatives on this committee. One subject matter expert interviewed stressed that senior management decision-makers should sit on safety committees. This representation would further demonstrate management’s interest in employee’s safety concerns and would help ensure that safety concerns are acted upon. Such actions would in turn help to develop employee buy-in to management’s efforts to develop a safety culture. Consequently, the Manager of Aviation should ensure that senior management with decision-making authority is represented on the employee safety committee.

**Additional Steps Should Be Taken to Enhance Safety Communication**

Effective communication is a key management skill, and is essential to developing a sound safety culture. However, safety-related communication within Aviation is largely from management to employees. In addition, management should encourage employees who narrowly avoid accidents to report these near-misses. Finally, Aviation management should work to break down silos between divisions that can inhibit sharing of information regarding safety.

**Safety communication should include more information from employees**—The audit team has observed that communication regarding safety within Aviation appears to be mainly provided to employees by management. For example, Aviation’s safety-related
information, such as various safety and health policies, trainings, and safety audits, emanate from management. While these are important modes of information-sharing, relying on top-down information suggests that only management has important things to say about safety. In addition, communication from management may not always be understood in the way that management intended. Consequently, in addition to placing management representation on the employee safety committee, the Manager of Aviation should ensure there are other forms of direct communication about safety issues between management, including senior management, and employees who encounter safety threats as part of their normal routine. This information will help to increase employee buy-in in developing safety culture, and will likely result in additional information regarding safety threats that can be addressed prior to an accident occurring.

Aviation’s Risk and Safety section has already adopted a practice of seeking employee feedback that can serve as a model for further management-employee communication. Specifically, one of Risk and Safety’s staff members has informal talks with employees working on snow removal shifts and personnel from DIA Maintenance regarding their safety concerns. Following up on the information obtained during these conversations has resulted in some additional safety measures. To further strengthen communication about safety issues, Risk and Safety should continue to ensure that safety enhancements identified in its discussion with employees are communicated to the Aviation management for timely action. In addition, the Manager of Aviation should determine whether any additions should be made to the current safety incentive program to further reinforce the idea that the organization values safe operations.

**A no-fault near-miss reporting system is needed**—While Risk and Safety collects safety comment cards, this is the only formal venue for reporting accidents that are narrowly avoided. These near-misses can be great leading indicators of safety problems before they become safety accidents. Research into developing safety culture revealed that organizations should rely on leading indicators of safety rather than lagging indicators, such as accident data or worker’s compensation claims.

As discussed earlier, auditors observed some indications that Aviation employees lack significant trust in management that safety information they share will not be used in a punitive way against them. To overcome that concern, the Manager of Aviation should ensure that a no-fault near-miss reporting system is developed and implemented. This no-fault system would mean that employees who report near-misses would not be subject to formal or informal management sanctions. By providing a forum for discussion of safety concerns without fear of sanctions, management will be taking another step to develop a culture where safety is everyone’s responsibility. This will likely have ancillary effects in other areas of communication and management-employee collaboration. Another important benefit of a near-miss reporting system is that management will be
able to have a database of safety information that can be used to identify safety hazards and risks before they create safety accidents.

**Aviation’s departments should readily share safety information**—In addition to ensuring the management and employees are communicating effectively, management should make sure its various representatives are communicating effectively. Interviews with the members of DIA management indicate the airport divisions and units work in silos, inhibiting safety-related information sharing. This assessment was confirmed by an Aviation safety review performed by an outside consultant in 2007. Examples of information that could be shared widely within Aviation management include information on employee accidents and data on accidents that occur on Pena Boulevard. The Manager of Aviation should identify key safety information to be shared with all senior management, and institute a distribution list including senior management in each department to help ensure that useful safety information is widely shared.

**RECOMMENDATIONS**

1.1. The Manager of Aviation should reiterate the organization’s commitment to safety by ensuring that safety audit findings are immediately rectified and do not recur.

1.2. The Manager of Aviation should ensure that the organization provides relevant safety leadership training, and that supervisors and management avail themselves of this training.

1.3. The Manager of Aviation should ensure that specific activities, such as runway clearance, that are central to its key business processes have related performance standards that hold management and employees accountable for operating safely.

1.4. The Manager of Aviation should focus on ensuring ongoing direct communication between Risk and Safety and senior management.

1.5. Risk and Safety should find ways to incorporate active learning into its training activities to increase internalization of safety messages.

1.6. The Manager of Aviation should ensure effective follow-up on all safety comment cards submitted.

1.7. The Manager of Aviation should also determine whether the organization will provide the public an opportunity to make comments about DIA safety issues.

1.8. The Manager of Aviation should ensure that senior management with decision-making authority has representation on the employee safety committee.

1.9. In addition to placing representation on the employee safety committee, the Manager of Aviation should ensure there are other forms of direct communication about safety issues between management, including senior
management, and employees who encounter safety threats as part of their normal routine.

1.10. Risk and Safety should continue to ensure that safety enhancements identified in its discussion with employees are communicated to the Aviation management for timely action.

1.11. The Manager of Aviation should determine whether any additions should be made to the current safety incentive program to further reinforce the idea that the organization values safe operations.

1.12. The Manager of Aviation should ensure that a no-fault near-miss reporting system is developed and implemented.

1.13. The Manager of Aviation should identify key safety information to be shared with all senior management, and institute a distribution list including senior management in each department to help ensure that useful safety information is widely shared.
APPENDIX

Appendix A – Bibliography


AGENCY RESPONSE

Audit Response Letter

August 4, 2010

Mr. Kip R. Memmott, MA, CGAP, CICA
Director of Audit Services
Office of the Auditor
City and County of Denver
201 West Colfax Avenue, Dept. 705
Denver, Colorado 80202

Dear Mr. Memmott:

The Office of the Auditor has conducted a performance audit of the Department of Aviation’s Safety Culture.

This memorandum provides a written response for each reportable condition noted in the Auditor’s Report final draft that was sent to us on July 14, 2010. This response complies with Section 20-276 (b) of the Denver Revised Municipal Code (DRMC).

FINDING 1: Further Challenges Face Management in Developing Aviation’s Safety Culture

RECOMMENDATION 1.1: The Manager of Aviation should reiterate the organization’s commitment to safety by ensuring that safety audit findings are immediately rectified and do not recur.

RESPONSE/ACTION PLAN: In addition to departmental managers, safety audit reports will be sent to all appropriate Deputy Managers. Deputy Managers will assign one central person to take the lead in coordinating correction and compliance within a reasonable period of time.
<table>
<thead>
<tr>
<th>State your agreement or reason for disagreement with Recommendation</th>
<th>Target date to complete implementation activities (Generally expected within 60 to 90 days)</th>
<th>Name and phone number of primary individual responsible for implementation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agreed – Deputy Managers will review all audit reports and coordinate corrective action.</td>
<td>September 30, 2010</td>
<td>Ken Greene (303) 342-2269</td>
</tr>
</tbody>
</table>

**RECOMMENDATION 1.2:** The Manager of Aviation should ensure that the organization provides relevant safety leadership training, and that supervisors and management avail themselves of this training.

**RESPONSE/ACTION PLAN:** DIA has a Safety Leadership training course in place. Risk and Safety will work with HR and management to ensure that all managers and supervisors in high risk areas, that have not taken the Safety Leadership training, receive safety leadership training within one year beginning October 4, 2010.

<table>
<thead>
<tr>
<th>State your agreement or reason for disagreement with Recommendation</th>
<th>Target date to complete implementation activities (Generally expected within 60 to 90 days)</th>
<th>Name and phone number of primary individual responsible for implementation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agreed – safety leadership training will be provided to supervisors and managers in high risk areas.</td>
<td>October 4, 2010</td>
<td>Keith Williams (303) 342-2132</td>
</tr>
</tbody>
</table>

**RECOMMENDATION 1.3:** The Manager of Aviation should ensure that specific activities, such as runway clearance, that are central to its key business processes have related performance standards that hold management and employees accountable for operating safely.

**RESPONSE/ACTION PLAN:** DIA will spend the next 90 days evaluating the best means of holding employees accountable for performance, while at the same time being held to the same level of accountability for accomplishing the work in a safe manner. We will report back to the Office of the Auditor with our plan to address this situation.
<table>
<thead>
<tr>
<th>State your agreement or reason for disagreement with Recommendation</th>
<th>Target date to complete implementation activities (Generally expected within 60 to 90 days)</th>
<th>Name and phone number of primary individual responsible for implementation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agreed – DIA needs to evaluate this issue and determine a course of corrective action.</td>
<td>November 4, 2010</td>
<td>John Kinney (303) 342-4601 Ken Greene (303) 342-2259</td>
</tr>
</tbody>
</table>

**RECOMMENDATION 1.4:** The Manager of Aviation should focus on ensuring ongoing direct communication between Risk and Safety and senior management.

**RESPONSE/ACTION PLAN:** Risk and Safety will provide a quarterly report to Senior Management with data on key safety indicators. The report will also include a narrative section regarding current critical safety concerns and requirements.

<table>
<thead>
<tr>
<th>State your agreement or reason for disagreement with Recommendation</th>
<th>Target date to complete implementation activities (Generally expected within 60 to 90 days)</th>
<th>Name and phone number of primary individual responsible for implementation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agreed – Risk and Safety will provide safety pertinent information to Senior Management on a routine basis.</td>
<td>October 4, 2010</td>
<td>Kate Trembley (303) 342-2152</td>
</tr>
</tbody>
</table>

**RECOMMENDATION 1.5:** Risk and Safety should find ways to incorporate active learning into its training activities to increase internalization of safety messages.

**RESPONSE/ACTION PLAN:** DIA needs 90 days to evaluate each and every internal safety training course to determine what active learning concepts can be incorporated (for example, having employees put on a safety harness and set up rescue equipment for confined space entry). During this period, we will also research adult learning principles and perform benchmarking with other organizations. An update on this recommendation will be provided to the Office of the Auditor after 90 days, detailing the actions taken.
<table>
<thead>
<tr>
<th>State your agreement or reason for disagreement with Recommendation</th>
<th>Target date to complete implementation activities (Generally expected within 60 to 90 days)</th>
<th>Name and phone number of primary individual responsible for implementation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agreed – all safety training courses will be evaluated to determine the active learning concepts that can be incorporated.</td>
<td>November 4, 2010</td>
<td>Keith Williams (303) 342-2132</td>
</tr>
</tbody>
</table>

**RECOMMENDATION 1.6:** The Manager of Aviation should ensure effective follow-up on all safety comment cards submitted.

**RESPONSE/ACTION PLAN:** Risk and Safety, working with the associated responsible division or section, will determine a corrective action and a time line will be set for completion. Risk and Safety will follow-up to ensure that the action items have been completed or some other acceptable action is taken. A standardized form will be used to document the entire process.

<table>
<thead>
<tr>
<th>State your agreement or reason for disagreement with Recommendation</th>
<th>Target date to complete implementation activities (Generally expected within 60 to 90 days)</th>
<th>Name and phone number of primary individual responsible for implementation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agreed – a formal procedure will be used to ensure documentation.</td>
<td>October 4, 2010</td>
<td>Keith Williams (303) 342-2132</td>
</tr>
</tbody>
</table>

**RECOMMENDATION 1.7:** The Manager of Aviation should also determine whether it will provide the public an opportunity to make comments about DIA safety issues.

**RESPONSE/ACTION PLAN:** Passengers already have avenues for stating concerns about airport safety. Two such options are Guest Services comment cards and the CRM system via the DIA internet site. White courtesy telephones may also be used to report safety concerns.

<table>
<thead>
<tr>
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<th>Target date to complete implementation activities (Generally expected within 60 to 90 days)</th>
<th>Name and phone number of primary individual responsible for implementation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agreed – passengers already have options for reporting airport safety concerns.</td>
<td>In Place</td>
<td>In Place</td>
</tr>
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</table>
RECOMMENDATION 1.8: The Manager of Aviation should ensure that senior management with decision-making authority has representation on the employee safety committee.

RESPONSE/ACTION PLAN:

<table>
<thead>
<tr>
<th>State your agreement or reason for disagreement with Recommendation</th>
<th>Target date to complete implementation activities (Generally expected within 60 to 90 days)</th>
<th>Name and phone number of primary individual responsible for implementation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agree - Senior Leadership needs to be actively involved in promoting a culture of safety at the Airport. DIA wants to ensure that employees have proper venues to voice concerns, so we will assess this recommendation to make sure it does not conflict with that goal. NOTE: Minutes of the Safety Committee meetings are already provided to members of senior staff.</td>
<td>60 Days.</td>
<td>Keith Williams (303) 342-2132</td>
</tr>
</tbody>
</table>

RECOMMENDATION 1.9: In addition to placing representation on the employee safety committee, the Manager of Aviation should ensure there are other forms of direct communication about safety issues between management, including senior management, and employees who encounter safety threats as part of their normal routine.

RESPONSE/ACTION PLAN: We would like 90 days to evaluate this recommendation to determine what, if any, additional means of communication can be put in place. The Safety Evaluation Team will be instrumental in making this determination. DIA will report back to the Office of the Auditor after the 90 day evaluation period.
<table>
<thead>
<tr>
<th>State your agreement or reason for disagreement with Recommendation</th>
<th>Target date to complete implementation activities (Generally expected within 60 to 90 days)</th>
<th>Name and phone number of primary individual responsible for implementation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agreed – D/A will evaluate methods to directly communicate with management and Executive staff.</td>
<td>November 4, 2010</td>
<td>John Smithwick (303) 342-4255</td>
</tr>
</tbody>
</table>

**RECOMMENDATION 1.10**: Risk and Safety should continue to ensure that safety enhancements identified in its discussion with employees are communicated to the Aviation management for timely action.

**RESPONSE/ACTION PLAN**: Risk and Safety will continue to provide relevant safety information to the responsible manager in a timely manner.

<table>
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<tr>
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</thead>
<tbody>
<tr>
<td>Agreed – safety information will be provided to responsible managers.</td>
<td>In place</td>
<td>In place</td>
</tr>
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</table>

**RECOMMENDATION 1.11**: The Manager of Aviation should determine whether any additions should be made to the current safety incentive program to further reinforce the idea that the organization values safe operations.

**RESPONSE/ACTION PLAN**: This is an important initiative of the Safety Evaluation Team (SET) to develop a Safety Campaign including branding, rewards/incentives and communications to all levels of CCD employees and other stakeholders at the airport. SET is scheduled to present to senior management within the next 60 days more specifics about the cost of the campaign. Once the finances are approved, the program would be developed over the following 90 day period.
RECOMMENDATION 1.12: The Manager of Aviation should ensure that a no-fault near-miss reporting system is developed and implemented.

RESPONSE/ACTION PLAN: This is perhaps the most ambitious of all the audit recommendations and therefore will need the most time to evaluate and develop. Our suggested timeline for simply evaluating the feasibility of a near miss system for the airport is 120 days.

<table>
<thead>
<tr>
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<th>Target date to complete implementation activities (Generally expected within 60 to 90 days)</th>
<th>Name and phone number of primary individual responsible for implementation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agreed – DIA will evaluate the challenges of implementing an effective near miss reporting system.</td>
<td>December 4, 2010</td>
<td>John Kinney (303) 342-4091 Ken Greene (303) 342-2269</td>
</tr>
</tbody>
</table>

RECOMMENDATION 1.13: The Manager of Aviation should identify key safety information to be shared with all senior management, and institute a distribution list including senior management in each department to help ensure that useful safety information is widely shared.

RESPONSE/ACTION PLAN: Similar to Recommendation 1.4, Key safety information will be included in the quarterly report to senior staff. Copies of the quarterly report will be distributed to Section Managers.

<table>
<thead>
<tr>
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<th>Name and phone number of primary individual responsible for implementation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agreed – important safety information will be communicated to Section Managers.</td>
<td>October 4, 2010</td>
<td>Kate Tremblay (303) 342-2152</td>
</tr>
</tbody>
</table>
Please contact Patrick Heck, Deputy Manager of Aviation, Denver International Airport at 303-342-2207 with any questions.

Sincerely,

[Signature]

Patrick Heck, Deputy Manager
Department of Aviation
City and County of Denver

cc: Kim Day
    Steve Campbell
    John Kinney
    Ken Greene