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Research Paper

Problems and Solutions in the Implementation of Safety Management System

Creating “Airport Safety Culture” and the Role of Airport Operator

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1 SMS: Safety Management System
2 Centrair: Central Japan International Airport
1. Introduction

The concept of Safety Management System (SMS) was defined by ICAO in “Annex 14 Aerodromes” in November 2001 and was adopted as a recommendation for strategic safety management. SMS transformed approaches to safety issues from reactive ones into proactive ones to build a preventive safety mechanism. SMS identifies roles and responsibilities of airport administrators and helped create organization-wide approaches to ensure airport safety.

The typical structure of a SMS comprises the following four elements: PDCR (P: Plan, D: Do, C: Check, R: Review). The theory alone, however, would not guarantee highly-secure environment of the airport because safety management involves thousands or tens of thousands of people ranging from the administrative sections to the frontline. Improvement of safety can only be achieved by strong commitment of all members involved in the airside operation. The key to success is to establish “safety culture” where the value of safety is shared among all airside staffs, which requires dynamic leadership of airport operator.

SMS is implemented in airports on the principle that safety takes precedence over any other consideration in the management policy. The implementation process of the SMS involves a number of challenges for the airports. The most common challenge is frequent occurrence of accidents in the apron, especially those involving vehicles and equipment. According to “ACI Survey on Apron Incidents/Accidents 2004”, vehicle accidents accounts for 70 percent of all the accident cases as shown in Fig. 1.

Central Japan International Airport (Centrair) is also faced with same problems and has performed aggressive countermeasures to reduce accidents/incidents in the apron, especially those involving vehicles. This paper discusses common problems and existing practices in the implementation of SMS and proposes Centrair’s unique solutions to the airside safety issues, especially in apron.

Chapter 2 outlines Centrair’s accident/incident cases and analyzes cause of problems. The overall airside accidents, as well as individual vehicle accidents, are analyzed to identify trend and the causes. Further, vehicle accidents/incidents are thoroughly investigated to identify characteristics of the accidents/incidents from the angle of human error.
Based on the results of the human error analysis, Chapter 3 describes common problems with the implementation of the SMS and analyzes existing practices from the following framework: “organization & safety committee”, “safety education program”, “safety information management & risk management” and “safety promotion”. These are fundamental components of the SMS, which serve as the engine of the SMS implementation.

Chapter 4 describes Centrair’s unique efforts to improve safety, which can complement existing practices and serve as alternative solutions. The proposals will include “effective communication with stakeholders”, “ramp work process analysis”, “safety information sharing and preventive measures”, and “comprehensive approach to airside accidents/incidents”, which correspond to the four key SMS functions described in the previous paragraph. The proposals will bring greater outcomes of improved safety in airports that face similar problems.

6 years have past since Centrair inaugurated in February, 2005. Prior to the introduction of SMS in Centrair, the airport’s SMS project team conducted thorough case studies of Narita, Nagasaki, Osaka and Munich airports, where SMS were already in place. The team also investigated a wide range of measures taken in another industry before officially launching the SMS in March, 2008 because the team had to establish safety culture and safety standard for the airside operation from scratch. This paper outlines Centrair’s unique safety improvement efforts on the operational side, which is in the center of Centrair’s SMS implementation.

2. Airside Accidents/Incidents Analysis
The airside operation involves several dozen of stakeholders such as airlines, ground handling companies, catering companies, refueling companies, facility maintenance companies, Civil Aviation Bureau, fire fighting institution, and the airport operator. In this section, I will introduce results from analysis of a total of 67 cases that occurred in Centrair’s airside in Fiscal 2007 (34 cases) and Fiscal 2008 (33 cases) to identify trend and cause of problems.

2.1 Type of Accidents/Incidents
In this section, all 67 airside accidents, as well as individual vehicle accident, are analyzed to specify trend of the accidents. First, as Fig. 2 “accident cases by type of operation” shows, the number of vehicle accidents amounted to 57, or 85% of all the cases, accounting for the vast majority of the accidents. Next, I analyzed these 57 cases by location. Figure 3 “accident cases by location” shows that vehicle accidents/incidents mostly occurred in two particular areas: “GSE road” and “apron”, with a total number of 47, or 82%. It is therefore critical to focus on these two areas to reduce accidents/incidents in the airside and achieve safer airport environment.
2.2 Risk Factor of Accidents/Incidents

1) ALL Accidents/Incidents Cases

This section identifies risk factors of all the 67 accidents in the airside. The risk factors are divided into 4 groups, “facility hazard”, “poor driving skills”, “lack of preventive measures”, “breach of traffic rules” as shown in Table 1. These accident risk factors are commonly seen in other airports, not being specific to Centrair.

Table 1. Accident risk factor classifications

<table>
<thead>
<tr>
<th>Risk Factors</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Facility hazard</td>
<td>- Lack of opportunities to exchange opinions to improve facilities or operational procedures&lt;br&gt;- Lack of available materials showing hazard spots in the airside area</td>
</tr>
<tr>
<td>2 Poor driving skills</td>
<td>- Insufficient information exchanges about ramp side operation, including the work processes and potential risk factors</td>
</tr>
<tr>
<td>3 Lack of preventive measures</td>
<td>- Insufficient information sharing about past accident cases or near-miss cases</td>
</tr>
<tr>
<td>4 Breach of traffic rules</td>
<td>- Breach of traffic rules such as speed limit and road signs because of the lack of drivers’ attention and concentration&lt;br&gt;- Lack of opportunities to evaluate the cases after accidents/incidents or dangerous driving occurred</td>
</tr>
</tbody>
</table>

2) Vehicle Accidents/Incidents Cases

Now, following the analysis of the preceding section (Fig. 3), I will analyze the risk factors of vehicle accidents in GSE road and apron, which accounts for a large share of the total airside accidents. The number of the accidents in GSE road and apron are 27 and 20, respectively, and the cases were analyzed in terms of so-called “human errors” by carefully reviewing various reports to identify characteristics of the accidents.

According to “ICAO Safety Management Manual (SMM)”4.5.12, the term “human error” is defined as follows:

“The term ‘human error’ allows concealment of the underlying factors that must be brought to the fore if accidents are to be prevented. In modern safety thinking, human error is the starting point rather than the stopping point”.

This means “human error” is not a conclusion of discussion but serves as the starting point of the risk factor analysis.
Figure 4 shows human errors which caused accidents in GSE road. The number of “insufficient clearance”, a careless human error, was 10, or 37% of total errors. In contrast, Fig. 5 shows results of the apron cases, where the number of “insufficient clearance” amounted to as many as 14 cases, or 70%.

Table 2 shows definitions of human errors used for the analysis above.

<table>
<thead>
<tr>
<th>Error types</th>
<th>Insufficient clearance</th>
<th>Too-narrow focus</th>
<th>Prediction error</th>
<th>Distracted driving</th>
<th>Unsafe driving (including breach of traffic rules)</th>
<th>Procedure error</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insufficient clearance</td>
<td>- Miscalculation of clearance to other vehicles or facilities</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Misunderstanding about the size of an vehicle that one tows</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Safety confirmation error when making a U-turn or driving backwards</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Too-narrow focus</td>
<td>- Too much focus on one particular point, failing to pay attention to other risk factors</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prediction error</td>
<td>- Failure to predict other vehicles’ movements which caused unavoidable collision accident</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Distracted driving</td>
<td>- Use of radio-communication service while driving</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Gazing at objects outside the vehicle</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Doing other things while driving</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unsafe driving (including breach of traffic rules)</td>
<td>- Dangerous driving</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Intentional unsafe act</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Procedure error</td>
<td>- Failure to follow Standard Operation Procedures</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

This factor analysis identifies characteristics of accidents/incidents by location and allows us to plan and execute effective measures, which could not have been achieved if “human error” was a final conclusion of the analysis. For example, findings from analysis suggest that comprehensive measures must be taken in GSE road to better understand facility hazard, improve driving skill, enhance preventive measures and ensure compliance of rules. As for apron, where specific work process is required, findings suggest that “driving skill” must be significantly improved to enhance safety. These measures identify high-risk areas and situations and bring them to drivers’ attention, so that further accidents/incidents can be prevented.
3. Problems and Existing Practices of the SMS Implementation

Further to analysis in the previous chapter, Chapter 3 analyzes risk factors, or “problems”, by incorporating them into the SMS framework, followed by analysis of existing practices.

3.1 Four Key Functions to Implement SMS Effectively

The following four functions of the SMS are particularly important because they serve as the engine of its implementation:

1) Organization & safety committee
2) Safety education program
3) Safety information management & risk management
4) Safety promotion

In addition to the above, “safety policy”, “safety objective”, “safety management plan”, “internal safety audit” and “document & record management” are also included to shape the whole SMS structure.

![Interdependence of the four core functions](image)

**Fig. 6 Interdependence of the four core functions**

3.2 Identifying Problems

As previously described, airside operation involves several dozen of stakeholders from airlines to ground handling companies. Therefore, airport operators must engage all stakeholders to promote SMS. This section examines accident risk factors shown in Table 1 by applying them to the four core functions. These functions particularly require strong leadership of airport operator to function effectively.

1) Organization & Safety Committee

In terms of “organization & safety committee”, failure to sound operation of the committee and disagreements among stakeholders are most likely to cause problems. Thousands or tens of thousands of people from different companies share airside as a common field of their business activity. Many airports make maximum effort to coordinate them by way of committee or subordinate working groups. Still, a favorable environment for one stakeholder may become unsafe to another, as seen in such a case that a large vehicle in a size of a ramp bus being parked at a corner area may become an obstacle to other vehicles.
2) Safety Education Program
Insufficient safety education program may cause a gap in knowledge and skills among companies or individuals who have different work experience and expertise. In apron, for instance, a large number of staffs and vehicles are working in a limited space. Lack of basic understanding about other people’s job may lead to a severe damaging or even life-threatening condition.

3) Safety Information Management & Risk Management
Airport operators often face challenges in collecting safety information because stakeholders are often reluctant to share such information if they are not mandatory. The concept of the SMS has been designed to achieve a preventive safety mechanism. From this perspective, collecting voluntary safety information is the first step to implement the SMS. Safety information collected from stakeholders is also essential to develop effective preventive measures against recurrence of similar accidents/incidents. However, despite non-punitive and strict confidentiality policy of the SMS, many stakeholders are still reluctant to submit safety information voluntarily, leading to poorer collection rate of the information than airport operators expected.

4) Safety Promotion
The biggest challenge of “safety promotion” is how to achieve a tangible result, which is the first priority for both airport operators and stakeholders. All airports have taken aggressive measures to promote safety, including major Japanese international airports as shown in Table 3 below. The result of each single project may be measurable in a short term. However, it may take several years to evaluate their impact on overall airport safety.

<table>
<thead>
<tr>
<th>Safety Measure</th>
<th>Centrair</th>
<th>Narita</th>
<th>Kansai</th>
</tr>
</thead>
<tbody>
<tr>
<td>Height limit sign of a fixed bridge to Passenger Terminal Building</td>
<td>Done</td>
<td>Done</td>
<td>Done</td>
</tr>
<tr>
<td>Speed limit sign of GSE road</td>
<td>-</td>
<td>Done</td>
<td>Done</td>
</tr>
<tr>
<td>Ground marking of PBB (Passenger Boarding Bridge) zones</td>
<td>Done</td>
<td>Done</td>
<td>Done</td>
</tr>
<tr>
<td>PBB safety guard equipment</td>
<td>Done</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>PBB operator qualification system</td>
<td>Done</td>
<td>Done</td>
<td>Done</td>
</tr>
<tr>
<td>Create airside hazard map</td>
<td>Done</td>
<td>Done</td>
<td>Done</td>
</tr>
<tr>
<td>Monitor speed of airside vehicles</td>
<td>Done</td>
<td>Done</td>
<td>Done</td>
</tr>
<tr>
<td>Provide a special training for vehicle drivers after accident or reckless driving</td>
<td>Done</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Airside safety patrol (with partner agents)</td>
<td>Done</td>
<td>Done</td>
<td>Done</td>
</tr>
<tr>
<td>Airside ramp cleaning (with partner agents)</td>
<td>Done</td>
<td>Done</td>
<td>-</td>
</tr>
<tr>
<td>Create safety poster (with partner agents)</td>
<td>Done</td>
<td>-</td>
<td>Done</td>
</tr>
<tr>
<td>Safety lectures</td>
<td>Done</td>
<td>-</td>
<td>Done</td>
</tr>
<tr>
<td>Create a booklet to introduce actual accident/incident cases</td>
<td>Done</td>
<td>Done</td>
<td>Done</td>
</tr>
<tr>
<td>Create a booklet to introduce near-miss cases</td>
<td>Done</td>
<td>-</td>
<td>Done</td>
</tr>
<tr>
<td>Create a website to share safety information</td>
<td>-</td>
<td>Done</td>
<td>Done</td>
</tr>
</tbody>
</table>
3.3 Analyzing Existing Practices of the SMS Implementation
This section examines existing practices for the SMS implementation in line with the four key functions and specifies areas for future investigation.

1) Organization & Safety Committee
Airport operators are expected to take a leading role in facilitating communication among airside stakeholders through organization of committees. Under the Japanese regulation, Japanese airports are required to establish an aerodrome safety committee and form a subordinate working group when necessary to share information at staff level. It is important that airport operators ensure to harmonize various values and interests and resolve disagreements among stakeholders to enhance productivity and bring the best possible solutions to the organization. Airport operators are held responsible for making committees and working groups truly interactive, so that participants can freely exchange their opinions.

2) Safety Education Program
All airside staffs must go through certain training provided by their own companies, as well as the ones provided by an airport operator. Typical education programs provided by an airport operator include training for the airside pass holders and vehicle operators. All airside staffs are required to obtain certain level of knowledge and skills about safety through these programs. However, these programs are not a perfect solution to prevent accidents/incidents because there still remains a gap in knowledge or skills to understand hazards between different agents or individuals. To fill in such a gap, airport operators must take a leading role to consolidate information about safety education programs available in the airside and give feedback to stakeholders. It is useful for airport operators to conduct a survey of stakeholders, share its results, or visit them to learn about their safety measures. Airport operators should also give an opportunity to all stakeholders to present their safety efforts in a committee or working group. These activities will make a significant contribution to fostering “safety culture”. The remaining challenge to this effort is how we can obtain sufficient information from stakeholders who are reluctant to provide such information.

3) Safety Information Management & Risk Management
- Encouraging Voluntary Safety Information Sharing -
Airport operators must take aggressive approach to encourage stakeholders to voluntarily share safety information with others, in addition to existing communication tools such as email, telephone and facsimile. To make it successful, airport operator should:

- Welcome any small safety information
- Actively share safety information with stakeholders even when airport operator making an error
- Quickly respond to an informant to notify possible countermeasures
- Share safety information with relevant parties in a timely manner
This allows potential information givers to better understand types of information being required. The information givers will also benefit from providing information, which is expected to promote further exchanges of information. There is no doubt that sharing information on the past accident/incident or near-miss cases with stakeholders are highly effective to prevent recurrence of similar accidents/incidents.

- Correction of Imbalanced Safety Condition -
Information sharing on safety not only serves as a fundamental part of preventive safety but also helps to correct imbalance of safety conditions. Such imbalanced condition can be represented by difference in value of safety, where what is considered to be acceptable for some staffs can be dangerous act to others, which may be reported in the safety information. People often do not realize risks associated with their acts until they are told. To correct this imbalance, airport operators, who are responsible for managing safety information, must utilize information collected from all stakeholders effectively.

4) Safety Promotion
The purpose of safety promotion is to solve individual problems in each airport. This requires a variety of options to fit individual needs and brings different outcomes to each airport. “ACI Airside Safety Handbook” contains a large collection of examples including airside safety rules or facility safety requirement. To promote safety effectively, we must ensure that airport operators take comprehensive approaches by finding a problem, identifying the cause, and implementing effective measures. It is also extremely useful for airport operators to refer to other airport’s cases or examples in “ACI Airside Safety Handbook” to achieve tangible results because these examples will show appropriate steps that airport operators should follow.

In summary, Chapter 3 described common problems and existing practices in the implementation of SMS based on the four key functions of the SMS. We must remember, however, different airport has different problems, and they vary depending on the size, history, facility condition, airside operation style, safety conditions of each airport. Therefore, airport operators should make every effort at all times to collect information of problems facing the airport. The existing practices should also be reviewed and improved as necessary because a long-term, repeated method often reduces effectiveness of the measures even if they are known to be reliable ones.

4. Centrair Practices
In Chapter 4, I will propose new solutions to the airside problems using Centrair’s examples based on the following four key areas: “effective communication with stakeholders”, “ramp work process analysis”, “safety information sharing and preventive measures”, and “comprehensive approach to airside accidents/incidents”. These areas correspond to the four key functions of the SMS implementation: “organization & safety committee”, “safety education program”, “safety information management & risk management” and “safety promotion”, respectively, and serve to complement existing practices.
4.1 Effective Communication with Stakeholders (Organization & Safety Committee)

Centrair aims to deepen communications with stakeholders by building teamwork through effective organization of a committee or a working group and by sharing best practices with the members.

For a few years after the airport inauguration, Centrair’s airside partners had little opportunities to discuss safety issues with us. Given such background, there was a high expectation among them for the launch of SMS because it may facilitate communication between us. Following the official launch of the SMS, we first worked with them to create an airside hazard map which indicates locations of the past accidents and high-risk areas for vehicle accidents. We as an airport operator took initiative to compile a 6-page document by incorporating input from the stakeholders. The document created jointly with our partners is extremely useful in our effort to improve airside safety. Accomplishment through joint effort helped us to facilitate effective communication with stakeholders and make them realize the importance of the committee and working group. More importantly, it encouraged their firm commitment to the implementation of SMS.

4.2 Ramp Work Process Analysis (Safety Education Program)

For the purpose of improving safety in the ramp area, Centrair’s airside partners learn with each other to close the gap between different levels of business processes and to better understand potential risks attached.

Centrair experienced a big accident in the ramp area after the launch of SMS. To prevent recurrence of the similar accidents, we conducted thorough investigation of the case to identify hazards that exist in the ramp work processes, focusing on the facilities and the process that caused the error chain. The hazards identified by the investigation include a wide gap of understanding about safety among airside workers. To close this gap, we worked with the working group members to conduct analysis of the ramp work processes. After having repeated discussions and interviews with all partners, the working group produced a booklet entitled “Ramp Work Process Analysis for Aircraft Arrival and Departure”, which contains 53 pages, with 20 arrival and 21 departure cases. This booklet is a completely
original production and covers entire ramp work processes in Centrair, including staffs and vehicle allocations and their expected actions. The booklet shows full of unique cases of Centrair, which cannot be found in commercially available booklets. The booklet is now fully utilized by our stakeholders for an educational purpose including trainings for new hires and for accident prevention program.

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4.3 Safety Information Sharing and Preventive Measures

(Safety Information Management & Risk Management)

As described in previous sections, Centrair has conducted a number of measures to collect safety information from partner agents. In addition to the ones described in section 3.3-3) “Safety Information Management & Risk Management -Encouraging Voluntary Safety Information Sharing-”, a "safety information mail box" was installed to collect a wide range of opinions from all airside staffs. This allows staffs to send in anonymous comments directly to the airport operator. It also helped us collect information on the near-miss cases, as well as suggestions for facility improvement and better operational rules. In fact, some ideas collected from the mail box were realized. To date, a total of 150 cases of safety information have been voluntarily submitted to Centrair since the SMS launch in March, 2008 through the mail box and other means of communication. It is noteworthy that these numbers do not include any mandatory reporting of the accidents.

Furthermore, we also analyzed both mandatory and voluntary reports on accident/incident cases and near-miss cases in Centrair and compiled a 29-page booklet specifically focused on vehicle accidents. The booklet is named “Airside Accident/Incident Cases and Near-miss Cases in Centrair” and is often used as a training material. The booklet contains 10 accidents and 10 near-miss cases that occurred in Centrair and consists of the following contents: summary of accidents, accident causes, lessons learned and introduction of similar cases. Our stakeholders use this booklet in training to prevent occurrence of similar accidents/incidents.

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Fig. 9 Sample picture of airside accident/incident cases and near-miss cases
### 4.4 Comprehensive Approach to Airside Accidents/Incidents (Safety Promotion)

As described in Chapter 2 “Airside Accidents/Incidents Analysis”, Centrair experiences frequent accidents in the airside and has performed comprehensive approaches to significantly reduce the number of accidents.

Table 4 shows the number of accidents that occurred in Centrair from Fiscal 2007 to 2009. While the numbers kept the same level in FY2007 and 2008, it dropped by 20% to 26 in FY2009. This is due to the fact that FY2008 was a transitional period when the Centrair SMS was launched and that the program became practically effective in FY 2009. Although the result of FY 2009 did not meet the annual target of a 50%-reduction from the previous year, we can see favorable progress over a 3-year period.

Table 5 shows specific measures being implemented in Centrair. We developed a feasible plan after carefully considering the accident risk factors given in Table 1. The measures described in Sections 4.1 to 4.3 are also included in the plan below.

#### Table 4. Number of accidents/incidents FY2007-2009

<table>
<thead>
<tr>
<th></th>
<th>FY2007</th>
<th>FY2008</th>
<th>FY2009</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of cases</td>
<td>34</td>
<td>33</td>
<td>26</td>
</tr>
<tr>
<td>Annual target</td>
<td>-</td>
<td>-</td>
<td>17</td>
</tr>
</tbody>
</table>

#### Table 5. Measures to mitigate airside hazards and risks in Centrair

<table>
<thead>
<tr>
<th>Measure</th>
<th>Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Facility hazard</td>
</tr>
<tr>
<td></td>
<td>- Establish a working group to identify and mitigate facility hazards</td>
</tr>
<tr>
<td></td>
<td>- Create airside hazard map</td>
</tr>
<tr>
<td>2</td>
<td>Poor driving skills</td>
</tr>
<tr>
<td></td>
<td>- Create a booklet on ramp work process analysis</td>
</tr>
<tr>
<td>3</td>
<td>Lack of preventive measures</td>
</tr>
<tr>
<td></td>
<td>- Collect safety information (e.g. installation of “safety information mail box”)</td>
</tr>
<tr>
<td></td>
<td>- Create a booklet on airside accident/incident cases and near-miss cases in Centrair</td>
</tr>
<tr>
<td>4</td>
<td>Breach of traffic rules</td>
</tr>
<tr>
<td></td>
<td>- Regularly monitor vehicle speed and share its result with partner agents</td>
</tr>
<tr>
<td></td>
<td>- Provide a special training for vehicle drivers after accident or reckless driving</td>
</tr>
<tr>
<td></td>
<td>- Conduct on-site inspection, airside safety patrol and safety lectures</td>
</tr>
</tbody>
</table>

The result of these measures is expressed in a figure in Table 4. Also, as you can see from Fig. 10, our focused approach to prevent vehicle accidents has been effective in reducing entire accident volume.

One positive example of individual measures can be seen in the result of weekly monitoring of vehicle speed. Today, we see almost no reckless driving in the airside while it used to be a major problem. Our partner agents also participate by rotation in the speed monitoring as part of the regular safety patrol.
In addition, nearly 7,000 airside staffs, who had an accident or drove dangerously, have participated in a special training. This special training for the drivers is intended to provide them with an opportunity to look into their own errors and analyze them. The training has been well received by our stakeholders because it brings a sense of order that is not usually seen in the in-house training.

To sum up, Chapter 4 described Centrair’s unique safety improvement measures based on the four key functions explained in Chapter 3. Although different airport needs different safety improvement measures, I strongly believe that the Centrair’s methods described in this chapter should bring greater outcome to other airports that are facing similar problems.

5. Conclusion
To achieve safer airside environment, it is essential to establish “safety culture” which allows all relevant parties to share the value of safety. Centrair has demonstrated strong leadership in engaging all airside staffs to build a strong foundation for the safety promotion through cooperation with stakeholders. More specifically, Centrair has set the target to reduce airside accidents, analyzed the situation, and then developed own solutions to complement existing practices. This has brought a successful working relationship with partner agents and spread of the SMS practice throughout the airside. This is indeed what we define as “creation of safety culture”. The positive outcome is clearly reflected in the decreased accident/incident volume as shown in 4.4.

Finally, I would like to briefly introduce two more examples of Centrair’s new SMS efforts.

The first example is about applying the concept of ISO9001, or the quality management system, to Centrair SMS. The successful combination of these two concepts made it possible to incorporate SMS internal audit, which is designed to assess soundness of the SMS, into the entire company’s internal audit process. This has brought enormous benefits to the airport; it enables us to conduct annual safety audit, and more importantly, it brings more objective view to the internal audit by selecting auditors from all the departments and established a consolidated reporting system to the top management.

The second example is our new effort to create a checklist for emergency response procures, which we believe is the first attempt of all Japanese airports. We all know that an emergency can happen any time even if SMS is implemented effectively. Airport operators therefore held responsible for preventing an aggravation of the situation. Centrair has initiated a project to create a handy checklist which specifies actions to be taken by Centrair Operation Center (COC) in an emergency, from its occurrence to initial response of COC and to the resumption of business. The checklist defines such procedures as a reporting system to airlines, air traffic control, police station and fire station, protection of passengers and staffs, assessment of the runway condition to determine its closure or reopening, and confirmation of condition of the air navigation facilities. The items are consistent with the concept of effective checklists in
preparation for an emergency as described in Section 11.5 of “ICAO Safety Management Manual (SMM)”. To date, Centair has completed 16 items under the following 4 categories:

- Irregular aircraft operation (4 items)
- Events/accidents (5 items)
- Airport facility trouble (4 items)
- Natural disaster (3 items)

Centair is determined to further develop its safety culture by taking a leading role in implementing these new initiatives, as well as maintaining practices described in this paper. We firmly believe that our best practices will provide useful examples to other airports from around the world.

References
1. ICAO Annex14 Aerodromes (Volume 1 Aerodrome Design and Operations)
3. ACI Survey on Apron Incidents/Accidents 2004 (December 2005)