NLR Air Transport Safety Institute
Research & Consultancy

Executive summary

AIRCRAFT GROUND HANDLING AND HUMAN FACTORS

A comparative study of the perceptions by ramp staff and management

Problem area
Human factors have been identified by the European Commercial Aviation Safety Team as a ground safety issue for which safety enhancement action plans have to be developed.

The objective of this study is to investigate the causal factors which lead to human errors during the ground handling process and create unsafe situations, personal accidents or incidents.

This document describes the results of the study, performed by the Air Transport Safety Institute of the National Aerospace Laboratory NLR in cooperation with the Civil Aviation Authority of the Netherlands.

Description of work
The study has been performed by investigating safety culture and human factors in seven ground service providers in the Netherlands. Questionnaires were sent to the target groups Management and Operational personnel and interviews were conducted afterwards to verify the results and to place them in the right context.

Results and conclusions
The results identified opportunities for improvement in the propagation of the safety policy and principles, substantiation of the principles of a just culture, communication of safety related issues, the 'visibility' of management to operational personnel, standardisation of phraseology on the ramp and awareness of the potential risks of human factors like time pressure, stress, fatigue and communication.

Applicability
The results of this study are considered applicable to all European ground service providers.

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Author(s)
A.D. Balk
J.W. Bossenbroek

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NLR Air Transport Safety Institute
Research & Consultancy

NLR Air Transport Safety Institute

Anthony Fokkerweg 2, 1059 CM Amsterdam,
P.O. Box 90502, 1006 BM Amsterdam, The Netherlands
Telephone +31 20 511 35 00, Fax +31 20 511 32 10, Web site: http://www.nlr-atsi.nl

SUMMARY

The Ground Safety Working Group of the European Commercial Aviation Safety Team has the overall objective to encourage implementation of action plans developed by existing ground safety initiatives when addressing European ground safety issues and to develop new safety enhancement action plans otherwise. The topic of human factors has been addressed as one of the ground safety issues for which safety enhancement plans have to be developed.

This document describes research on human factors in ground handling, performed under the authority of the European Commercial Aviation Safety Team by the Air Transport Safety Institute of the National Aerospace Laboratory NLR, in cooperation with the Civil Aviation Authority of the Netherlands.

The objective of this study is to investigate the causal factors which lead to human errors during the ground handling process, creating unsafe situations, personal accidents or incidents. The results provide a basis for recommendations to the participating ground service providers and the European aviation industry.

Seven ground service providers within the Netherlands participated in the study. Questionnaires were distributed to two target groups: Management and Operational personnel, with an average response rate of 33%. The first section of the questionnaire aimed to assess the organisations' safety culture; the second section focused on human factors.

The overall level of safety culture of the participating ground service providers ranges from 3.4 to 3.8 on a five point scale.

With regard to safety culture, attention should be paid to:

- The propagation of the safety policy and principles by Management to Operational personnel;
- Substantiate and elaborate the principles of a just culture;
- Communication of safety related issues, a.o. by developing and maintaining a safety reporting system;
- The 'visibility' of Management to Operational personnel.

With regard to human factors, points of particular attention are:

- Emphasize awareness of the potential risks of human factors like time pressure, stress, fatigue and communication, and training on how to manage these factors;
- Standardisation of phraseology on the ramp.

Further research may be focused on the potential effects (damage, injury) of the current focus on on-time-departures. Simultaneously, further development of the communication chain on the ramp should be explored.

Contents

ABBREVIATIONS

ADAMS	Aircraft Dispatch and Maintenance Safety
ASC-IT	Aviation Safety Culture Inquiry Tool
CAA NL	Civil Aviation Authority of the Netherlands
CAA UK	Civil Aviation Authority of the United Kingdom
CAST	Commercial Aviation Safety Team
COSCAP	Cooperative Development of Operational Safety and Continuing Airworthiness Programme
EASA	European Aviation Safety Agency
ECAST	European Commercial Aviation Safety Team
ESSI	European Strategic Safety Initiative
FAA	Federal Aviation Administration
GHOST	Ground Handling Operations Safety Team
GSP	Ground Service Provider(s)
GSWG	Ground Safety Working Group
HFACS	Human Factors Analysis and Classification System
HSE	Health and Safety Executive
IATA	International Air Transport Association
ISAGO	IATA Safety Audit for Ground Operations
MEDA	Maintenance Error Decision Aid
NLR	National Aerospace Laboratory NLR
NLR-ATSI	NLR Air Transport Safety Institute
OTD	On Time Departure
REDA	Ramp Error Decision Aid
SAT	Safety Analysis Team
SCARF	Safety Course for Airport Ramp Functions
SMS	Safety Management System
STAMINA	Safety Training for the Aircraft Maintenance Industry

1 INTRODUCTION

1.1 BACKGROUND

The European Commercial Aviation Safety Team (ECAST) has been established in 2006 as a component of the European Strategic Safety Initiative (ESSI). ESSI is based on the principle that the industry can complement regulatory action by voluntary committing to cost effective safety enhancements.

ECAST is a partnership between the European Aviation Safety Agency (EASA), other European regulators and the aviation industry. ECAST addresses large fixed wing aircraft operations and aims to further enhance commercial aviation safety in Europe and for European citizens worldwide.

ECAST cooperates with the United States' Commercial Aviation Safety Team (CAST) and other major safety initiatives worldwide, in particular under the Cooperative Development of Operational Safety and Continuing Airworthiness Programme (COSCAP).

ECAST has developed a safety approach using a three phase process:
Phase 1 - Identification and selection of safety issues;
Phase 2 - Safety issues analysis;
Phase 3 - Development, implementation and monitoring of actions plans.

Phase 1 has been conducted from April 2006 to December 2007, in which eighteen safety subjects have been identified as topics for further analysis in Phase 2. Using a prioritising process, combining safety importance, coverage (the extent to which subjects are already covered in other safety works) and high level cost benefit considerations, ECAST decided in 2008 to launch activities on Safety Management Systems (SMS) and Ground Safety, as part of Phase 2.

In phase 2, the ECAST Ground Safety Working Group (GSWG) has been established in February 2009 and coordinates with major ground safety initiatives including the IATA Safety Audit for Ground Operations (ISAGO) established by the International Air Transport Association (IATA) and Ground Handling Operations Safety Team (GHOST) established by the Civil Aviation Authority of the United Kingdom (CAA UK). The GSWG has the overall objective to encourage implementation of action plans developed by existing ground safety

initiatives when addressing European ground safety issues and to develop new safety enhancement action plans otherwise.

The ECAST GSWG performs the following tasks:

- Identify ground safety issues in Europe;
  - Consider work already available;
  - If necessary, perform a complementary data-driven analysis, supported where appropriate by the Safety Analysis Team (SAT);
- Coordinate with existing initiatives and promote implementation in Europe of existing safety enhancement materials and plans;
- Develop 'standardised' ground handling training concepts and syllabi. Encourage adoption or mandating of minimum standards of competence. Provide training material that can be utilised as the basis of compliance to standards.
- In conjunction with the CAA of the Netherlands (CAA NL) research the effects of human factors involved in ramp safety.

This document describes the research on human factors in ground handling, performed by the Air Transport Safety Institute (NLR-ATSI) of the National Aerospace Laboratory NLR in cooperation with CAA NL.

1.2 OBJECTIVE

The objective of this study is to investigate the causal factors which lead to human errors during the ground handling process, creating unsafe situations, personal accidents or incidents. The results provide a basis for recommendations to the participating ground service providers (GSP) and the European aviation industry.

The rationale behind the research topic of human factors is the opinion of the ECAST GSWG that human factor aspects are not, or hardly, introduced in the ground handling process. This results in missed opportunities to prevent incidents and accidents, and to improve the safety of ramp personnel.

1.3 SCOPE

To define the scope of the investigation, the following IATA definition of ground handling is used [IATA]:
'Ground Handling covers the complex series of processes required to separate an aircraft from its load (passengers, baggage, cargo and mail) on arrival and combine it with its load prior to departure'.

Since previous research has shown that the risk of aircraft damage is highest at the ramp when the aircraft is parked [Balk, 2007], the scope has been further specified to include ramp handling only, so only the ground handling activities that take place around the aircraft during a turnaround are taken into account.

1.4 DOCUMENT SETUP

Chapter 2 describes the approach used to investigate human factors in ground handling. Results of the investigation are described and analysed in chapter 3. Conclusions and recommendations drawn from the analysis are provided in chapter 4.

2 APPROACH

2.1 INTRODUCTION

'Human factors refer to environmental, organisational and job factors, and human and individual characteristics which influence behaviour at work in a way which can affect health and safety' [HSE, 1999].

This definition suggests that human factors may negatively influence the behaviour of personnel at work. It is proposed that the opposite is also true: that proper attention to human factors in the working environment may positively influence the behaviour of personnel at work, which is considered a manifestation of an organisation's safety culture. In a good safety culture, the presence and effects of human factors in the ground handling process are acknowledged, training is provided to manage human factors that may surface during the task performance and the risks they may introduce are mitigated as much as possible.

Due to this perceived relation between human factors and safety culture, this study covers both components. The study focuses on the:

- Type;
- Time of appearance;
- Frequency;
- Cause; and
- Prevention of human factors in the ground handling process.

In order to investigate these topics of interest, the input of ground handling personnel is extremely valuable. Therefore, cooperation has been sought and found with the following organisations:

- Aviapartner, Amsterdam Airport;
- Aviapartner, Rotterdam The Hague Airport;
- KLM Ground Services, Amsterdam Airport;
- Maastricht Handling Services, Maastricht Aachen Airport;
- Menzies Aviation, Amsterdam Airport;
- Servisair, Amsterdam Airport;
- Viggo, Eindhoven Airport.

Previous studies of human factors in aviation maintenance and ground handling have been reviewed to find a fitting method to investigate human factors in ground handling. The following studies have been assessed on their applicability to GSP:

- Aircraft Dispatch and Maintenance Safety (ADAMS);
- Safety Training for the Aircraft Maintenance Industry (STAMINA);
- Human Factors Analysis and Classification System (HFACS) [Shappell & Wiegmann, 2000];
- Maintenance Error Decision Aid (MEDA) [Boeing];
- Ramp Error Decision Aid (REDA) [Boeing];
- Safety Course for Airport Ramp Functions (SCARF) [McDonald et al, 1997].

The following method is used for the investigation of human factors in ground handling, adapted from the method used in the ADAMS project:

Phase 1: Investigation of the current situation:

- Questionnaires with regard to safety culture and human factors;
- Interviews to better understand the identified issues.

Phase 2: Identification of possible improvements:

- Conclusions are drawn from the analysis of the results and interviews, and recommendations are made. Comparisons of the participating GSP are made in a de-identified manner.

The applied questionnaire consists of two sections. The first section aims to assess the safety culture of the participating GSP, for which the Aviation Safety Culture Inquiry Tool (ASC-IT) [Montijn & Balk, 2009] has been used. The second section aims to address specific human factors that play a role in the ground handling process, for which the REDA results form has been used to formulate statements concerning human factors.

A short description of safety culture, REDA and the way the REDA results form has been transformed into statements is provided in the next paragraphs.

2.2 SAFETY CULTURE FRAMEWORK

2.2.1 INTRODUCTION

The following definition of safety culture has been developed by [Montijn & De Jong, 2006], which is based on a scientific review of the main existing and emerging safety culture frameworks. The findings of this review have been used to develop a common culture framework founded on all common key elements of the various safety models:

'The safety culture of a group is the set of enduring values and attitudes regarding safety issues, shared among the members of the group. It refers to the extent to which the members of the group are positively committed to safety; consistently evaluate safety related behaviour; are willing to communicate safety issues; are aware of the known risks and unknown hazards induced by their activities; are willing and able to adapt themselves when facing safety issues; and are continuously behaving so as to preserve and enhance safety.'

2.2.2 CHARACTERISTICS

From the definition of safety culture, six main characteristics can be derived that together compose the safety culture of an organisation:

- *Commitment*: Reflects the extent to which every level of the organisation has a positive attitude towards safety and recognizes its importance.
- *Justness*: Reflects the extent to which safe behaviour and reporting of safety issues are encouraged or even rewarded, and unsafe behaviour is discouraged.
- *Information*: Reflects the extent to which safety related information is distributed to the right people in the organisation.
- *Awareness*: Reflects the extent to which employees and management are aware of the risks the organisation's operations imply for themselves and for others.
- *Adaptability*: Reflects the extent to which employees and management are willing to learn from past experiences and are able to take whatever action is necessary in order to enhance the level of safety within the organisation.
- *Behaviour*: Reflects the extent to which every level of the organisation behaves such as to maintain and improve the level of safety.

2.2.3 INDICATORS

The high level characteristics are broken down into more detailed and concrete indicators, which enable to assess and analyse the level of safety culture of an organisation, and thereby indicating to what extent an organisation can be said to have a good safety culture.

Table 1 lists the characteristics and their underlying indicators. A full description of the indicators is provided in Appendix A.

Table 1: Safety culture indicators

Characteristic	Indicators
Commitment	- Management concern - Personal concern - Investment in safety
Justness	- Evaluation of (un)safe behaviour - Perception of evaluation - Passing of responsibility
Information	- Safety training - Communication of safety related information - Safety reporting system - Willingness to report - Consequences of safety reports
Awareness	- Awareness of job induced risks - Attitude towards unknown hazards - Attention for safety
Adaptability	- Actions after safety occurrences - Proactiveness to prevent safety occurrences - Employee input
Behaviour	- Job satisfaction - Working situation - Employee behaviour with respect to safety - Mutual expectations and encouragement

2.2.4 PROCESSING OF RESULTS

Each participant has to provide a rating from 1 to 5 for each statement presented in the questionnaire. If the statement is not applicable to the participant, no rating is provided.

The overall rating of a group of respondents/organisational layer is calculated by taking the average of all ratings without a weighing factor. Responses for which 'not applicable' has been ticked, are not included in the overall ratings.

The rating of each indicator is calculated by taking the average of the statements which are included in that indicator. The rating of each characteristic is calculated by taking the average of all indicators included in that characteristic.

2.2.5 PRESENTATION OF RESULTS

In the presentation of results a distinction has been made between the different target groups (Management and Operational personnel) in order to identify possible differences between these organisational layers. The results are presented at three levels: at the overall level of safety culture of the entire organisation, at the characteristic level and at the indicator level. Figure 1 provides the linear classification scheme of [Hudson, 2003] that is used to rate safety culture in terms of its maturity level. In this scheme, safety culture evolves linearly in five steps:

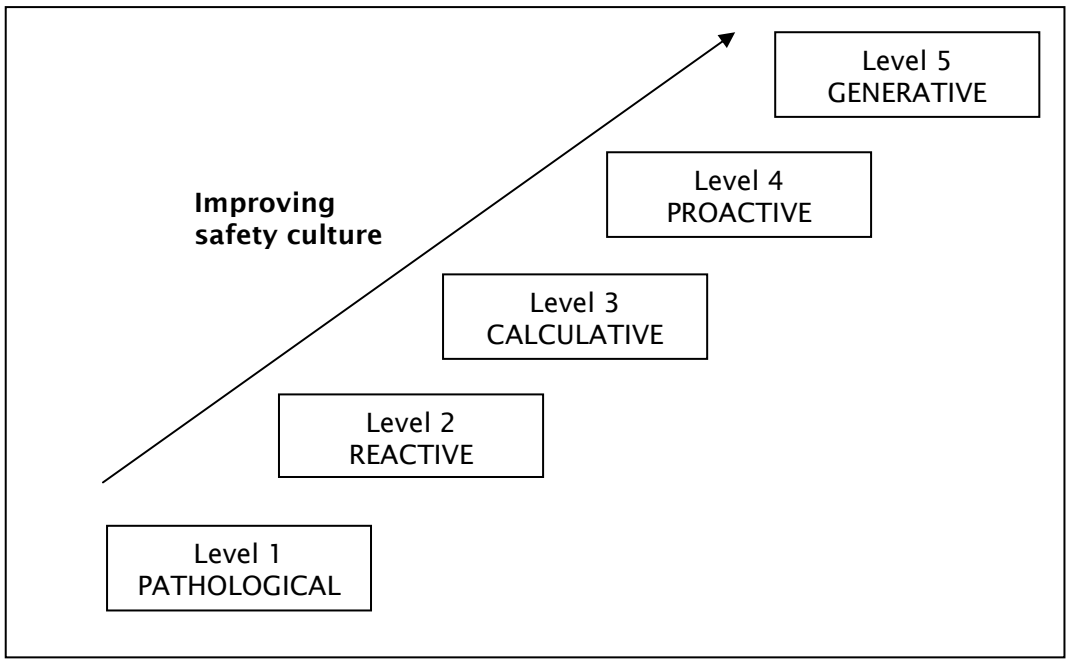

Figure 1: The safety culture maturity levels according to Hudson

De definitions of the levels of safety culture used by NLR-ATSI are provided in Appendix B.

The ratings are presented together with the 95% confidence intervals of the results. This means that when the survey would be repeated within the same organisation, it may be expected that 95% of the ratings falls within the interval. When the 95% confidence intervals of the results of the two target groups do not overlap, this indicates that the difference between the results is statistically significant at the 95% level.

It has to be noted that the objectivity of results is highly dependent on the willingness of participants to answer truthfully to the statements presented in the questionnaire. Some of the statements are formulated in such a way that a positive answer leads to a low rating in order to avoid systematic assigning of high ratings.

2.3 RAMP ERROR DECISION AID

Boeing has developed the REDA tool [Boeing] to provide a structured process to investigate accidents, incidents and errors in aircraft ground handling. It enables organisations to learn from failures in the ground handling process.

REDA is a reactive tool, which means that it is applied only after an accident or incident has occurred. By transforming the REDA structure into statements and adding relevant topics and incident data, insight is provided into the human factors that play a role in the ground handling process, and the views of respondents on the frequency of specific incidents.

The basic philosophy of REDA is that:

- Failures do not happen on purpose;
- Failures result from a series of contributing factors;
- Most of these contributing factors are part of an organisation's process which can be improved to prevent similar failures.

The REDA tool aims to identify the contributing factors by means of a results form that is filled during accident/incident investigation. De form consists of the following sections:

- General information;
- Event;
- Apron System Failure;
- Contributing factors checklist;
- Error prevention strategies.

The division between the sections two to five is maintained in the development and design of the adapted questionnaire.

The first part of the questionnaire focuses on the perception of incident frequency for which the events and sub-events on the REDA results form is used.

The second part addresses direct causes of incidents. The main Apron System Failures from the REDA results form are translated into direct causes and some are deleted because they do not apply to ramp handling personnel, e.g. the Apron System Failures: Maintenance and Fault Isolation/Test/Inspection.

The third part assesses the perceived frequency of contributing factors leading to errors, incidents or accidents. The main contributing factors from the REDA results form are used to enable a high-level ranking. Thereafter, each contributing factor is split up into more detailed factors. Again, the factors from the REDA results form are used, complemented by factors of interest provided by CAA NL, e.g. the amount of on-the-job training.

2.4 INVESTIGATION PROCESS

In the preparation phase of the investigation, the questionnaire has been sent for assessment to various persons of the CAA NL with operational experience in ground handling, as well as to the coordinators of the 7 participating GSP. The human factors department of NLR has been consulted for comments and suggestions with regard to the contents and set-up of the questionnaire. Various comments have been received and incorporated in the final version of the questionnaire. The final version of the distributed questionnaires is provided in Appendix C.

Table 2 provides the participating GSP and coordinators.

Table 2: Participating GSP and coordinators

GSP	Coordinators
Aviapartner, Amsterdam Airport	Mr. J. Weerdmeester
Aviapartner, Rotterdam The Hague Airport	Mr. A. Van der Veen
KLM Ground Services, Amsterdam Airport	Mr. G. Van Hilten
Maastricht Handling Services, Maastricht Aachen Airport	Mr. W. Post
Menzies Aviation, Amsterdam Airport	Mr. G. Korstanje
Servisair, Amsterdam Airport	Mr. H. De Roos
Viggo, Eindhoven Airport	Mr. F. Abbink

After consultation with the coordinators is has been decided to distinguish two target groups that are applicable for both large and small GSP:

- Group 1 (Management), consisting of: Management, Department head, Supervisor and Support;
- Group 2 (Operational personnel), consisting of: Coordination, Team leaders and ramp personnel.

In order to introduce the questionnaire as best as possible to the organisations, each GSP has been visited to decide on the distribution method (e-mail/paper) and collection of completed questionnaires. The objective of the introduction was to get the highest possible response from the participating GSP. These preparation visits took place between week 40 and 42 in 2009.

Three ways have been provided to complete the questionnaire:

- Online by a link in the invitation e-mail;
- Online by a link in the introduction letter of the paper questionnaire;
- On paper.

4 of the 7 GSP have chosen for a combination of e-mail invitations to complete the questionnaire online (Management) and the distribution/collection of paper version (Operational personnel). 2 GSP have chosen for e-mail invitations for both target groups and 1 GSP has chosen for paper versions for both target groups.

Prior to distribution of the questionnaire, GSP have prepared their employees by e-mail, memos or briefings.

A reminder has been sent to employees who had not responded to the invitation e-mail after one week. Those who had partly completed the questionnaire have received a reminder the next day with the request to complete the questionnaire.

The paper versions of the questionnaire have been sent or handed over to the coordinators of the applicable GSP, together with port-free return envelopes for participants who wanted to remain anonymous. The responsibility for distribution and collection of the paper versions of the questionnaire has been assigned to the coordinators of the GSP.

After processing of the preliminary results, interviews have been conducted with the coordinators of the GSP, complemented with one or more employees with extensive knowledge of the daily operations and company processes. The interviews aimed to place the results in the right context, and to get a better understanding of identified issues.

3 RESULTS

3.1 PARTICIPATION

The paper version of the questionnaire was launched first on 22 October 2009 by one GSP. Since the paper version provided the option to complete the questionnaire online, the online version was launched on the same date. On the agreed date of 28 October, 199 persons were personally invited by e-mail to complete the online questionnaire. For these persons, the deadline for completion was set at 11 November.
Dependent on the date of distribution of the paper versions, a deadline was agreed of 11 November (5 GSP) or 18 November (1 GSP). For the remaining one GSP it was agreed to postpone the investigation to December 2009. For this GSP the investigation started on 2 December with a deadline for the online questionnaire of 20 December and for the paper versions the first week of January 2010.

In the 7 participating GSP, a total of 1174 questionnaires has been distributed, divided into:

- 172 for Management;
- 1102 for Operational personnel.

The response rate is divided into:

- Management: 57%;
- Operational personnel: 19%.

Where possible the results of the various GSP have been compared. A random code has been assigned to each GSP to enable de-identified comparison. Table 3 provides the response rates for each GSP.

Table 3: Response rates and overall levels of safety culture

GSP	Response rate	Overall level of safety culture
A	19%	3.8
B	18%	3.7
C	16%	3.7
D	35%	3.7
E	69%	3.7
F	50%	3.8
G	27%	3.4
Average	**33%**	**3.7**

The overall level of safety culture within the participating GSP is 3.7 on Hudson's scale (see Figure 1), which is between the calculative and proactive level.

Due to the low response rate of some of the participating GSP, it has been carefully considered whether conclusions and recommendations actually applied to the individual GSP. The interviews provided the necessary background information to draw conclusions and make recommendations.

3.2 SAFETY CULTURE

Table 3 provides the overall levels of safety culture of the participating GSP, ranging from 3.4 to 3.8. Since this level only provides a rough indication, a more detailed analysis is performed on the safety culture characteristics of each GSP. Figure 2 provides the level of safety culture for each characteristic and GSP.

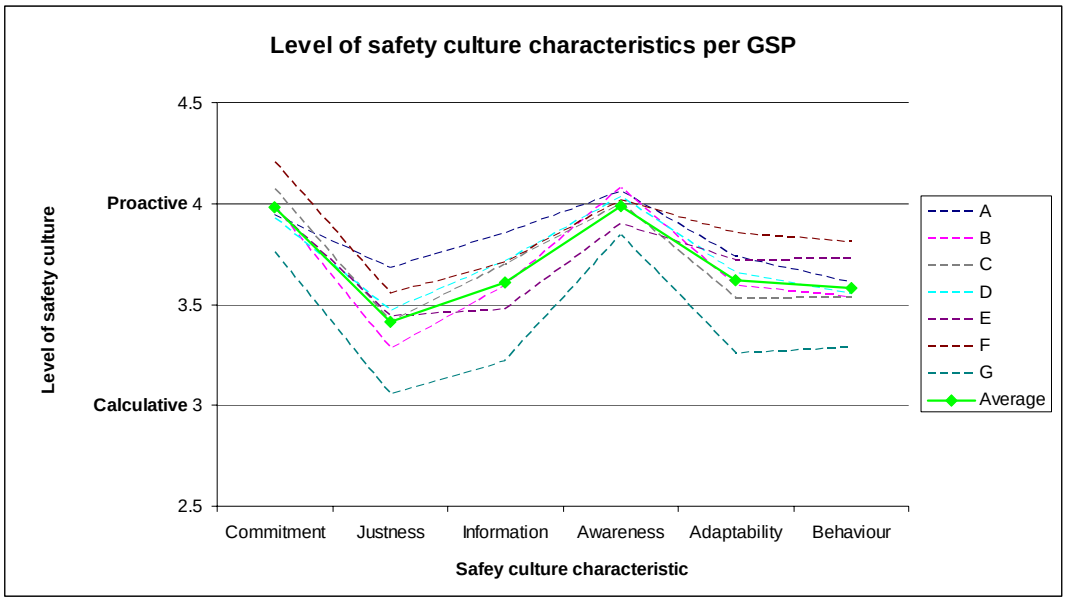

Figure 2: Level of safety culture for each characteristic and GSP

In this figure, a clear pattern can be distinguished. In all GSP, a high rating is obtained for the characteristics *Commitment* and *Awareness*. This is a positive property of the GSP and should be fostered. Commitment towards safety is of vital importance to develop and maintain a culture of safety in which safety is at the base of all activities. A good awareness of the risks that the GSP activities imply makes that personnel keep working as safe as possible. This, in turn, has also a positive effect on the commitment of personnel towards safety.

For all but one GSP, the safety culture characteristic *Justness* provides the lowest rating. As explained in paragraph 2.2.2, *Justness* reflects the extent to which safe behaviour and reporting of safety issues are encouraged or even rewarded, and unsafe behaviour is discouraged. The lower rating is mainly caused by the fact that Operational personnel of all participating GSP provide a lower rating for *Justness* than Management. The ratio between returned questionnaires from Management and Operational personnel reduces the rating for *Justness* even more. Apparently, the development and maintenance of a just culture is a point of attention for most GSP.

One of the participating GSP provides lower ratings on all characteristics when compared to the other GSP.

The safety culture characteristics and underlying indicators have been assessed for each target group, i.e. Management and Operational personnel, which enables a detailed analysis of each GSP's safety culture and resulting recommendations for improvement.

When the results of Management and Operational personnel are compared on the overall level, Management generally provides a higher rating than Operational personnel on the safety culture characteristics and indicators. Apparently Management has a stronger opinion than Operational personnel that the safety culture aspects under consideration are taken care of and that safety is given first priority. This may be caused by a too optimistic view of Management of the organisation itself or their own activities, or by difficulties in propagation of the safety policy and principles in the right way and to the right extent to Operational personnel.

Since the safety culture of each GSP differs, only the commonalities for each safety culture characteristic will be presented below.

3.2.1 COMMITMENT

The safety culture characteristic *Commitment* is composed of the following safety culture indicators:

- Management concern;
- Personal concern;
- Investment in safety.

The indicator *Personal concern* provides a high rating for both Management and Operational personnel. This implies that everybody within the organisation feels responsible for safety. With regard to the indicators for *Management concern* and *Investment in safety* provides Management a higher rating than Operational personnel. It seems that Management has to put a considerable effort in convincing Operational personnel that they are committed to safety.

In the current economic climate, investments in personnel and equipment lie under pressure, which is also shown in the ratings for the indicator *Investment in safety*. Management provides a higher score than Operational personnel due to the fact that investments have to be postponed, whereas these are desired by both Management and Operational personnel. The difference between Management and Operational personnel is that Operational personnel often are not informed about the reasons why investments are postponed and that the activities can still safely be performed with the equipment and personnel available.

3.2.2 JUSTNESS

The safety culture characteristic *Justness* is composed of the following safety culture indicators:

- Evaluation of (un)safe behaviour;
- Perception of evaluation;
- Passing of responsibility.

The relative low rating for the characteristic *Justness* is primarily caused by the low rating for the indicator *Passing of responsibility*. A low rating is provided when there is the impression that Management's primary objective is to find and punish the responsible person for an error or incident, and when Management or Operational personnel do not admit they make errors.

It seems that a blaming culture is still present in most GSP, even though Management may propagate the message that they strive to develop and maintain a just culture.

3.2.3 INFORMATION

The safety culture characteristic *Information* is composed of the following safety culture indicators:

- Safety training;
- Communication of safety related information;
- Safety reporting system;
- Willingness to report;
- Consequences of safety reports.

For all but one of the participating GSP, the indicator *Safety reporting system* provides the lowest rating within the characteristic *Information*. The primary cause lies in the opinion of the majority of Management and Operational personnel that the safety reporting system and the use of it are not included in the initial training for ramp personnel. Apparently there is no formal safety reporting system, or it is not recognised as such.

3.2.4 AWARENESS

The safety culture characteristic *Awareness* is composed of the following safety culture indicators:

- Awareness of job induced risks;
- Attitude towards unknown hazards;
- Attention for safety.

Within the safety culture characteristic *Awareness*, the indicator *Attention for safety* provides the lowest rating for all participating GSP. This relates to the availability of sufficient equipment to perform the activities safely and to whether the primary concern is to work safely or to meet the scheduled departure time.

3.2.5 ADAPTABILITY

The safety culture characteristic *Adaptability* is composed of the following safety culture indicators:

- Actions after safety occurrences;
- Proactiveness to prevent safety occurrences;
- Employee input.

Within the characteristic *Adaptability*, the indicator *Proactiveness to prevent safety occurrences* provides a higher rating than *Actions after safety occurrences* (reactive) for all but one participating GSP.

The reason behind the relative lower rating of the reactive component is that a considerable amount of Operational personnel doubt if corrective actions are actually taken after an incident or accident occurred, and both Management and Operational personnel doubt whether corrective actions are assessed on their effectiveness.

The proactive component provides a relative higher rating due to the opinion of both Management and Operational personnel that safety issues are taken seriously and that safety improvements can be made without incidents and accidents requiring these improvements.

3.2.6 BEHAVIOUR

The safety culture characteristic *Behaviour* is composed of the following safety culture indicators:

- Job satisfaction;
- Working situation;
- Employee behaviour with respect to safety;
- Mutual expectations and encouragement.

With regard to the characteristic *Behaviour*, the indicator *Mutual expectations and encouragement* provides a relative high rating for both Management and Operational personnel and for most GSP. Most participants express their view that it is expected that safety procedures are always followed. Another view is that safety related issues are discussed with colleagues, although this happens more at the management level than at the operational level.

The indicator *Working situation* provides a relative low rating, especially for Operational personnel due to the fact that in their opinion the equipment is not

sufficiently maintained and that more experienced personnel is necessary. During the interviews it became clear that this partly relates to postponed investments due to the current economic climate. Turnarounds are scheduled with a minimum amount of personnel, with the result that it becomes increasingly difficult to counterbalance disruptions in the ground handling process.

With regard to the equipment it has been commented in the interviews that the equipment is maintained according to the manufacturer's requirements, but that different complaints (that are instantly repaired) on the same equipment, or e.g. the rusty look of equipment, may lead to the impression that the maintenance is inadequate, although the equipment is perfectly safe to use.

3.3 HUMAN FACTORS ANALYSIS

The human factors analysis is performed with the results of all participants. It is assumed that all GSP are confronted with similar human factors during the ground handling process. The analysis is based on the results of the following number of participants:

- 93 Management;
- 197 Operational personnel.

All figures in this paragraph only provide the *views* of Management and Operational personnel.

It has been chosen to take a top-down approach in describing the human factors results, starting with the end result (incidents) and ending with a detailed analysis of the contributing causes.

3.3.1 INCIDENTS

In order to investigate what kind of human errors are made in the ground handling process, participants have first been asked what kind of incidents occurs most frequently within their own GSP. Figure 3 provides the views of Management and Operational personnel on the frequency of certain categories of incidents. The incidents are ordered from high to low frequency, in which the average frequency of Management and Operational personnel has been taken as reference.

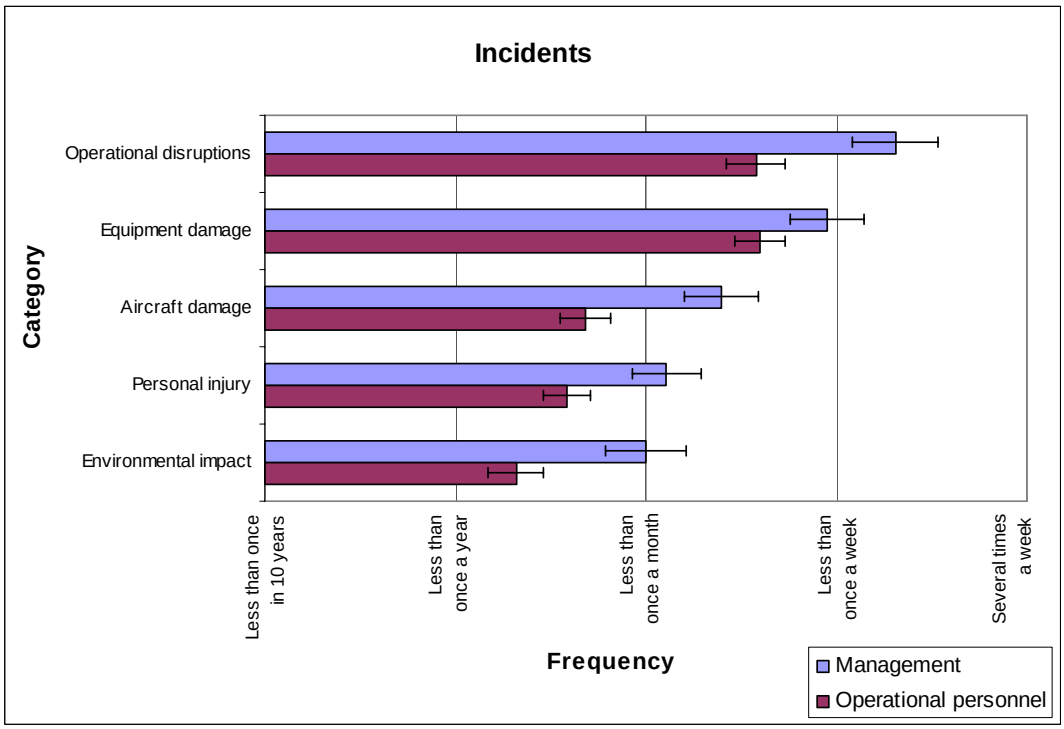

Figure 3: Frequency of incidents

Of notice is that significant differences exist between the views of Management and Operational personnel concerning all incident categories. This is probably due to the fact that Management has a wider view on the operations and is better able to estimate the incident frequencies. The smallest difference between the views of Management and Operational personnel exists in the incident category of equipment damage. Whereas Management may have a wider view on the operations, Operational personnel have daily, hands-on experience with the equipment and their activities are directly affected should equipment be damaged.

All incident categories are further analysed in the following sub-paragraphs.

Operational disruptions

Figure 4 provides the perceived frequency of O*perational disruptions* in the ground handling process.

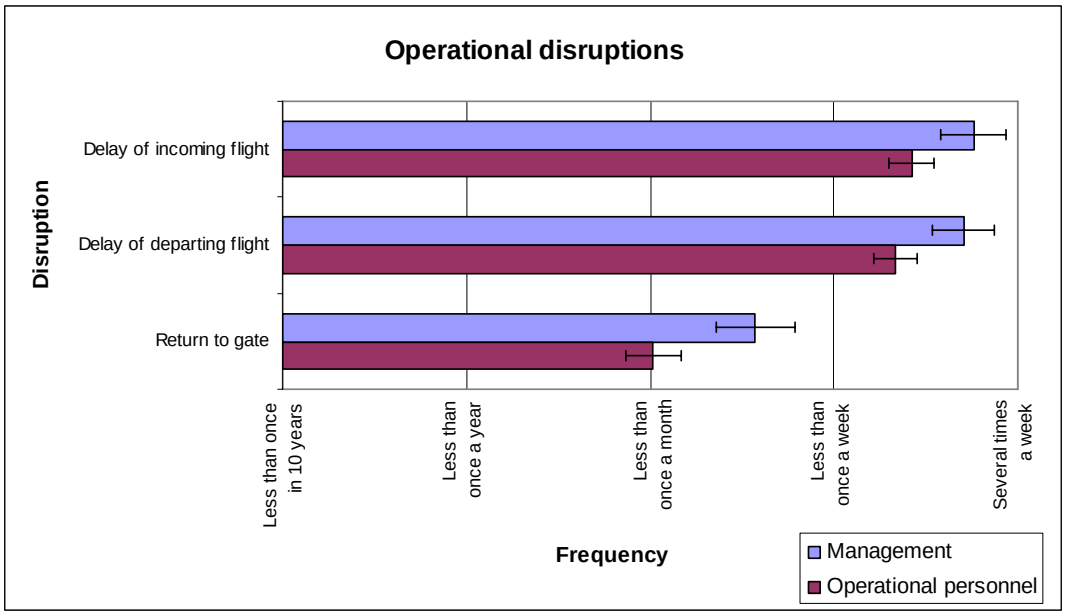

Figure 4: Frequency of operational disruptions

Operational disruptions may be the result of human errors in the ground handling process, but may also increase the risk on human error. The latter situation is important when investigating ways to decrease this risk.

Both Management and Operational personnel agree that delays are disruptions which may contribute to human error. Management even provides a higher frequency than Operational personnel, suggesting that Management is well aware of the risks that are associated with delays. Delay of incoming flights provides a slightly higher frequency than delay of departing flights. It may prove difficult to separate these two kinds of disruptions, since a delayed departure may be the result of a delayed incoming flight of the same aircraft.

Operational disruptions in which the aircraft has to return to the gate for any reason are perceived to occur less frequent. This is probably due to the fact that most ground handling activities have already been performed and do not have to be repeated, e.g. catering, cleaning, toilet service, water service, etc.

Equipment damage

Figure 5 provides the perceived frequency of *Equipment damage*.

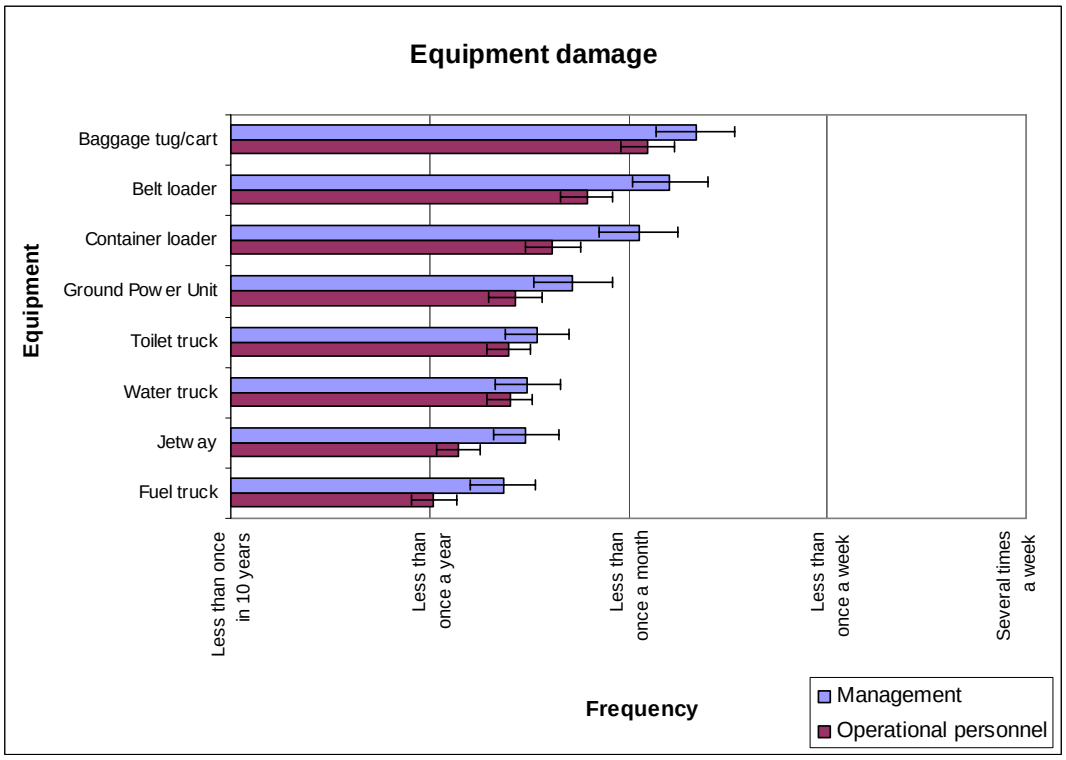

Figure 5: Frequency of equipment damage

Management and Operational personnel more or less agree that the baggage tug or carts are damaged most often. The three kinds of equipment on top of this list all relate to the transport and (un)loading of cargo or baggage. The relative high frequency of damage of this equipment is possibly caused by the fact that more pieces of this equipment are used during the turnaround, making the exposure and risk of damage higher. Additionally, the remaining kinds of equipment are not necessarily used during every turnaround or are not operated by ramp personnel.

Aircraft damage

Figure 6 provides the perceived frequencies of A*ircraft damage*.

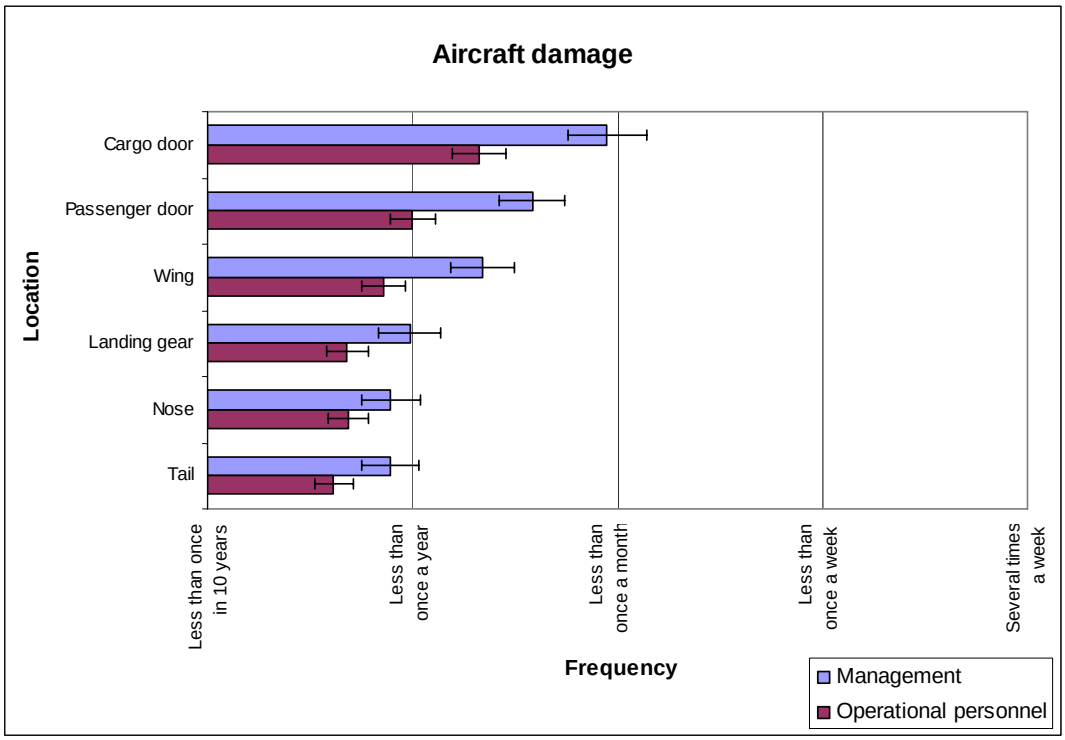

Figure 6: Frequency of aircraft damage

Both Management and Operational personnel agree that the cargo doors and passenger doors are damaged most frequently. This is probably caused by the fact that equipment has to be attached to several doors during each turnaround. Movement of either the equipment or the aircraft may result in damage to the aircraft fuselage in the vicinity of the door or to the door itself (seals, locking mechanism, etc.).

Personal injury

Figure 7 provides the perceived frequencies of *Personal injuries* that occur during the ground handling process.

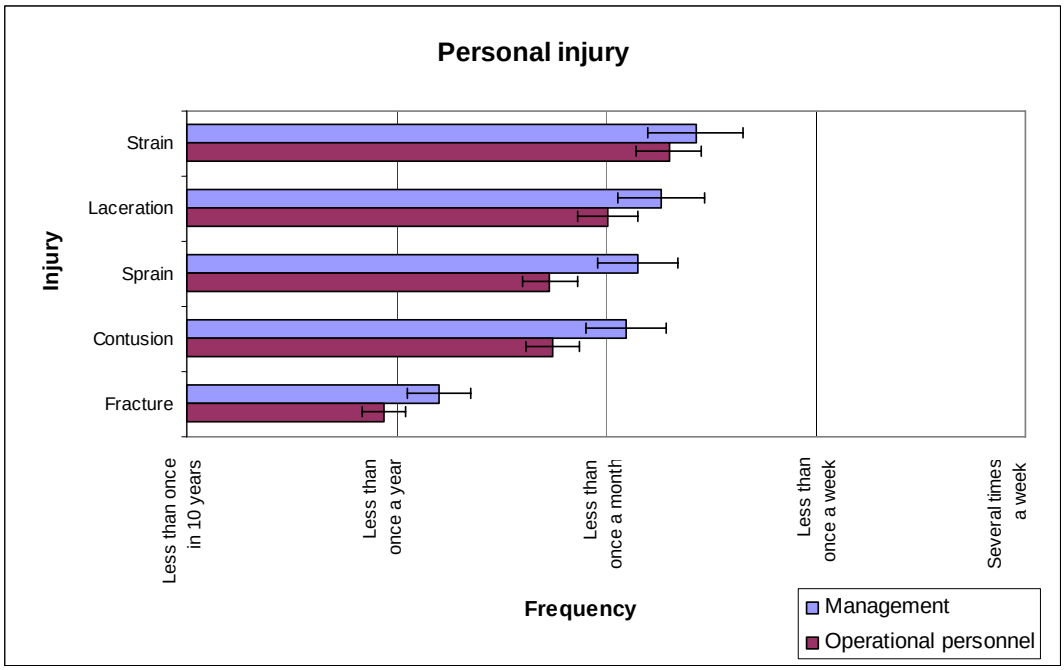

Figure 7: Frequency of personal injury

Due to the high physical exertions that are required in the ground handling process, especially while (un)loading baggage and/or cargo, strain is considered by both Management and Operational personnel as the most frequent personal injury.

Environmental impact

Figure 8 provides the perceived frequency of incidents with an *Environmental impact*.

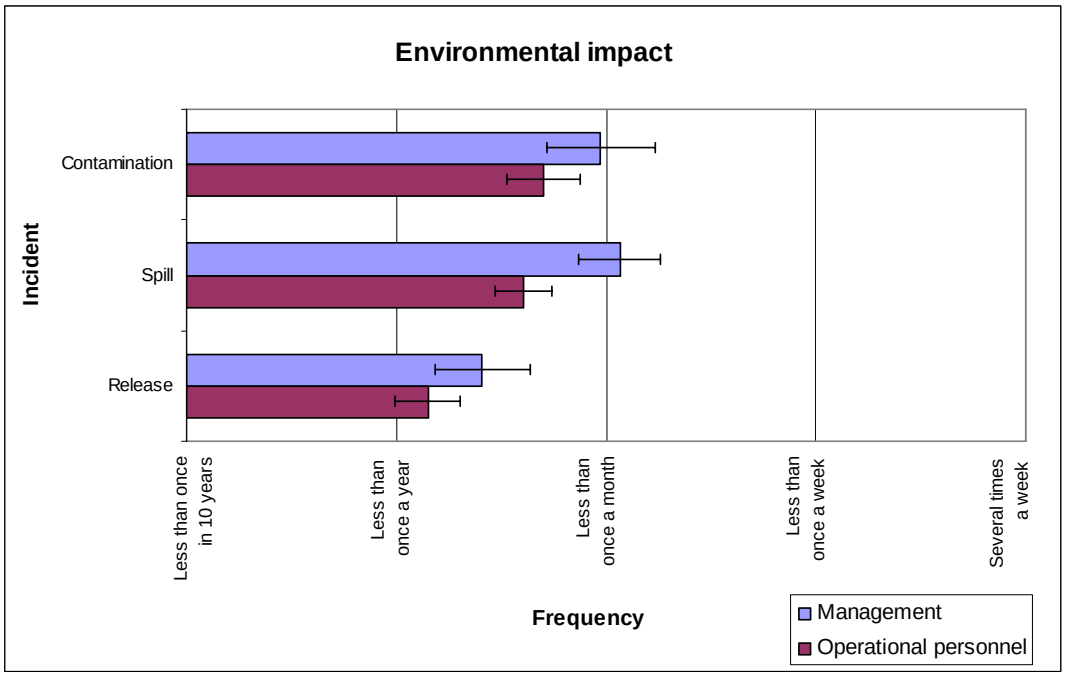

Figure 8: Frequency of incidents with environmental impact

Contamination of the ramp and spills of fluids on the ramp are seen by both Management and Operational personnel as the incidents with an environmental impact that occur most frequently.

3.3.2 DIRECT CAUSES

By investigating the direct causes of the incidents that have been discussed in the previous paragraph, it is tried to actually identify the type, time of appearance, frequency and cause of human factors in the ground handling process.

Figure 9 provides the views of Management and Operational personnel with regard to the direct causes of accidents, incidents or human errors. The direct causes are ordered from high to low frequency, in which the average frequency indicated by Management and Operational personnel has been taken as reference.

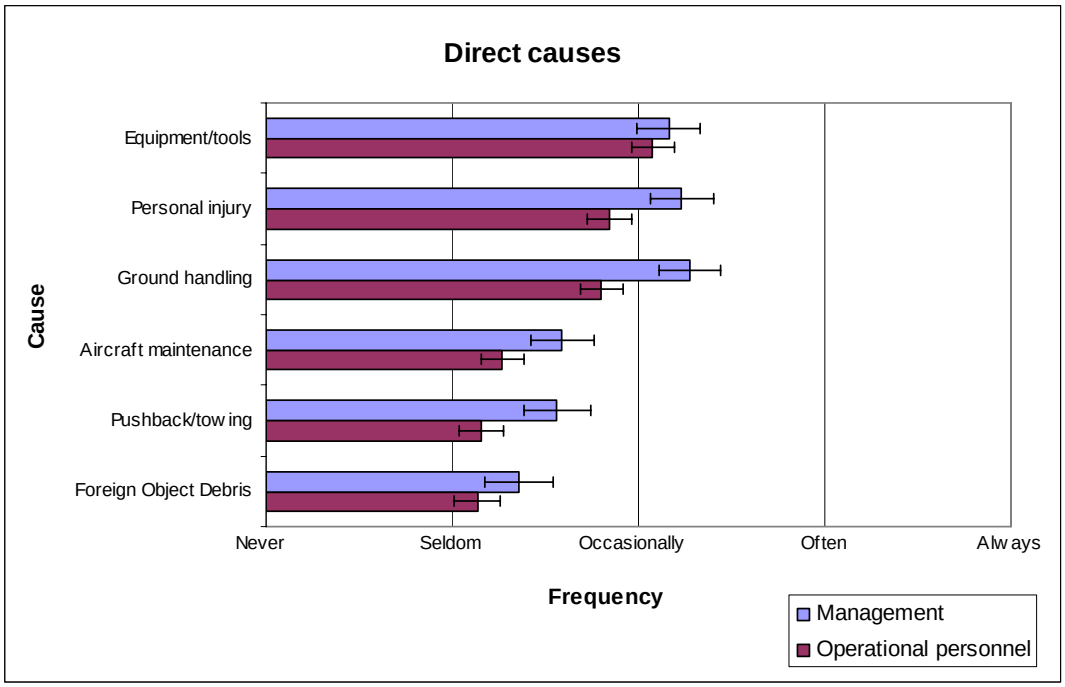

Figure 9: Direct causes of accidents, incidents or human error

Interesting in this figure is that Operational personnel mostly attribute accidents, incidents or human errors to the equipment or tools, which is in line with the findings of the safety culture assessments, in which Operational personnel had regularly the impression that ground handling equipment was insufficiently maintained. Instead of Operational personnel, Management mostly attribute accidents, incidents or human errors to the ground handling itself.

It is noticed that 'Personal injury' is also included as incident category in figures 3 and 7. When looking at the direct causes in figure 9, 'Personal injury' relates to

the *causes* of personal injuries, like slipping, caught between something, etc. Figure 3 and 7 provide the incident or 'end result': personal injury.

3.3.3 CONTRIBUTING FACTORS

Figure 10 provides the perceived frequency of factors that, according to the views of Management and Operational personnel, contribute to accidents, incidents and human errors on the ramp.

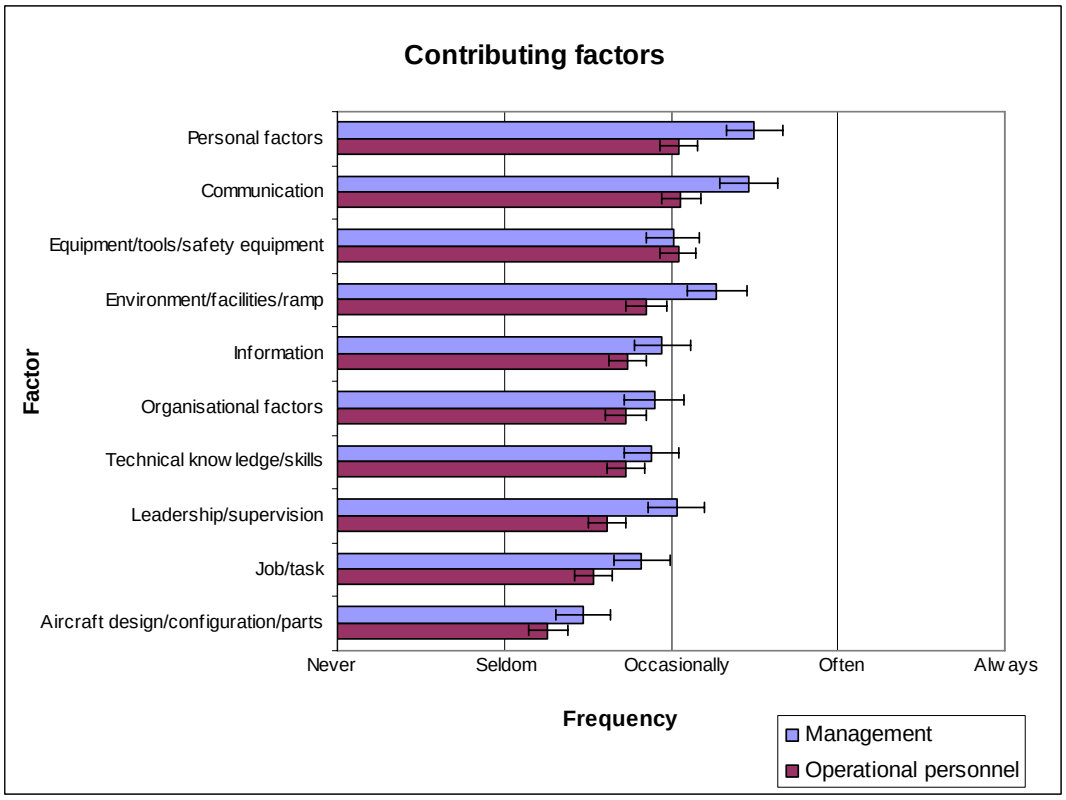

Figure 10: Contributing factors

Personal factors and *Communication* receive a relative high frequency from both Management and Operational personnel, although Management seems to be more aware that these contribute to errors.

Next to *Personal factors* and *Communication*, Management attributes a relative high frequency to the contributing factors of *Environment/facilities/ramp* and *Leadership/supervision*. With regard to the *Environment/facilities/ramp*, it may prove to be difficult to mitigate risks resulting from human factors, since aspects related to the environment, facilities and the ramp are mostly managed by the Airport Authorities. With regard to *Leadership and supervision* is Management

apparently aware that poor leadership or supervision may easily lead to human errors or incident.

Operational personnel provide a higher frequency than Management to the contributing factor of *Equipment/tools/safety equipment*. This is probably caused by their daily, hands-on experience with the equipment and tools. When compared to the direct causes presented in figure 9, *Equipment/tools/safety equipment* has dropped to the third place, although Operational personnel provide an almost similar frequency to the first three factors in figure 10. For Management, *Equipment/tools/safety equipment* drops to the fifth place. This is due to the fact that there are numerous ways in which equipment or tools may contribute to incidents or human errors.

All contributing factors are further analysed in the following sections.

Personal factors

Figure 11 provides a further analysis of *Personal factors*.

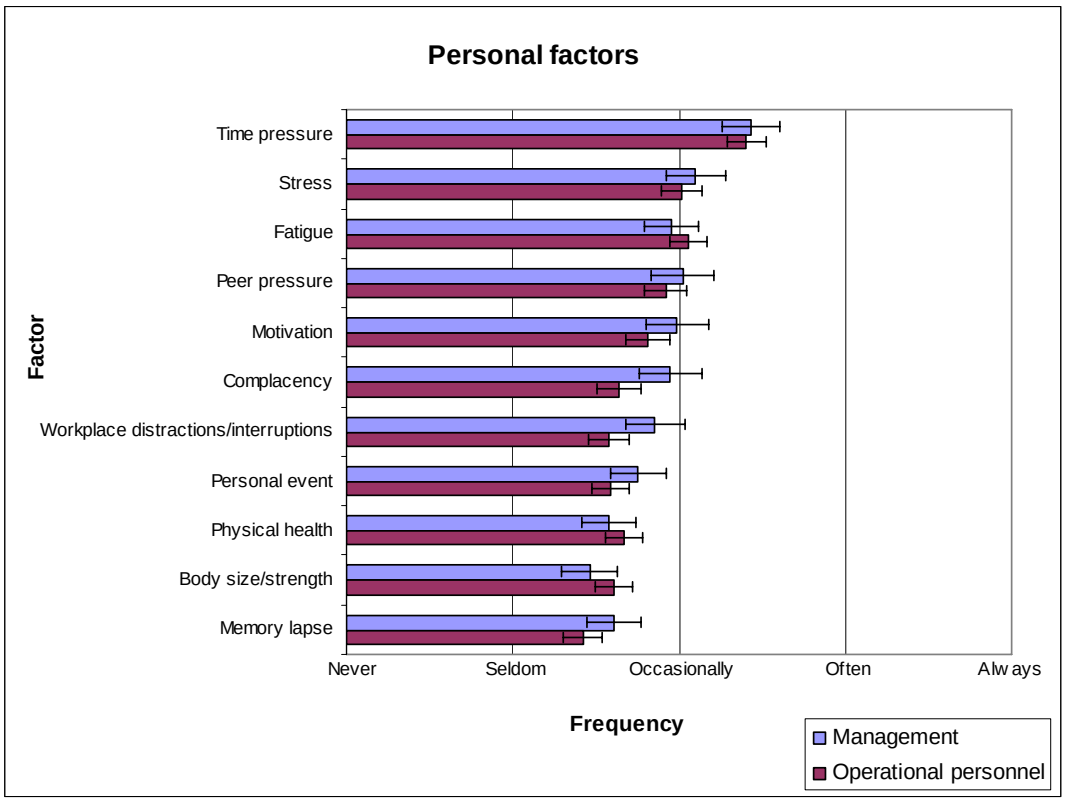

Figure 11: Personal factors

Time pressure is considered by both Management and Operational personnel as the most frequent contributing cause of human error. Next to time pressure, *Stress* and *Fatigue* are also mentioned as important factors, which may be related to time pressure. In the interviews it was stated that another contributing factor to *Fatigue* is the notion that ground handling staff may have to work double shifts (for different employers) to generate sufficient income. *Peer pressure* and *Motivation* are also important contributing factors to consider.

The existence of time pressure relates to the fact that airlines and GSP focus on on-time-departures (OTD), which makes the scheduled departure time of the aircraft a commercially important deadline for the airline, but also for the GSP due to contractual arrangements. In the interviews it was expressed that professional pride may play a role in meeting the departure time, even if shortcuts have to be taken.

The safety culture of GSP plays an important role in the correct management of time pressure. From the safety culture assessments it was determined that within the safety culture characteristic *Awareness*, the indicator *Attention for safety* provided the lowest rating for all participating GSP. This related partially to whether the primary concern is to work safely or to meet the scheduled departure time. In one of the interviews it was told that Operational personnel often see safety and a fast turnaround to meet the OTD as incompatible, whereas in reality there is always a balance between safety and speed. This balance may differ for each turnaround due to the dynamic environment or different conditions, but when the right balance is found, safety is not compromised.

Communication

Figure 12 provides a further analysis of the contributing factor *Communication*.

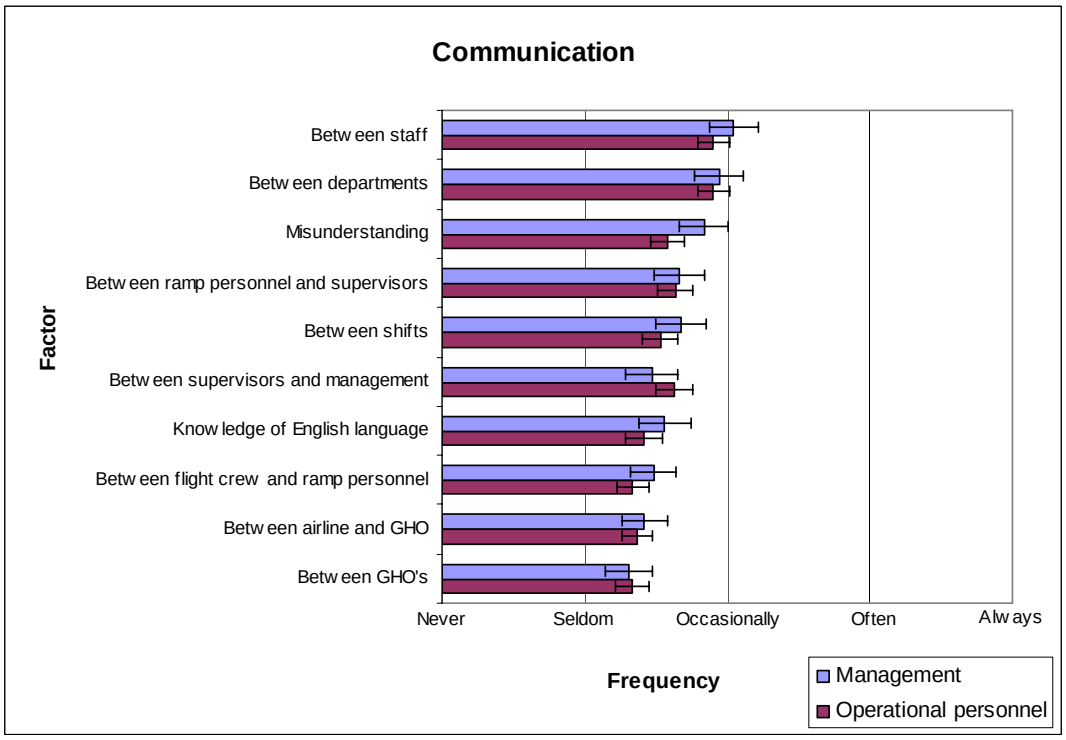

Figure 12: Communication

Communication between staff and between departments is considered by both Management and Operational personnel as human factors that may contribute to errors. Operational personnel also provide a high frequency for communication between ramp personnel and supervisors, and between supervisors and management.

Communication of safety issues through the various levels of a GSP is considered important, since is raises the awareness of the role safety plays in the organisation. Communication of safety information makes it possible to learn from safety occurrences and to take proactive action. It is therefore important to promote the development and use of a safety reporting system. This was also one of the findings in the safety culture assessments, in which the safety reporting system was not known or not recognized as such by both Management and Operational personnel.

Equipment/tools/safety equipment

Figure 13 provides a further analysis of the contributing factor *Equipment/tools/safety equipment*.

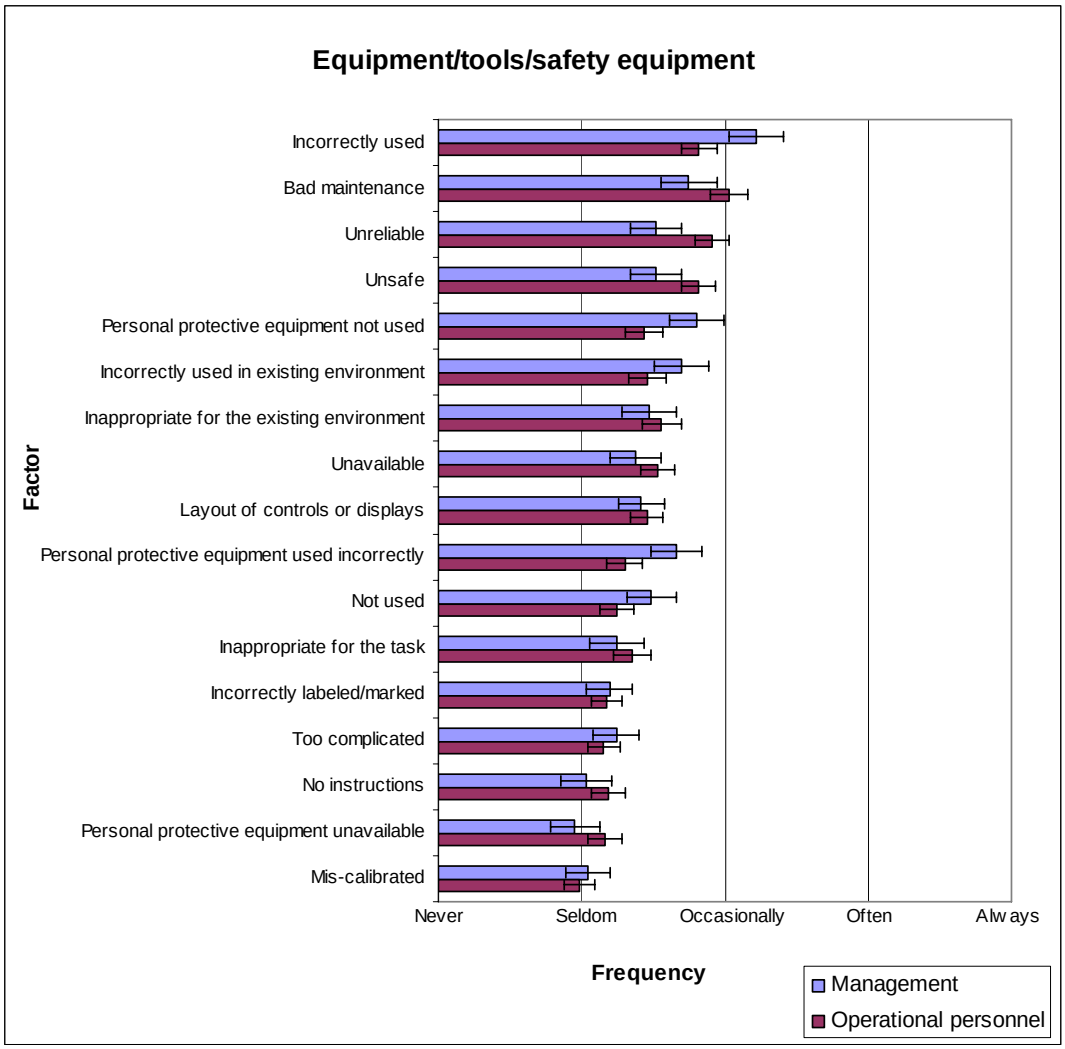

Figure 13: Equipment/tools/safety equipment

Important to notice in this figure are the differences between the views of Management and Operational personnel. Management seeks the contributing factors of human errors and incidents primarily in incorrect use, or lack of use, of the ground handling equipment or personal protective equipment. Operational personnel, on the contrary, expresses the view that bad maintenance, poor reliability and poor safety of the equipment contributes to errors and incidents. This is in line with the findings in the safety culture assessments, in which Operational personnel often expressed their view that maintenance of ground handling equipment is insufficient.

One issue to consider is that the actual use of ground handling equipment may contribute to the impression that the equipment is poorly maintained. Equipment that is roughly or incorrectly handled will likely need maintenance earlier than scheduled.

Environment/facilities/ramp

Figure 14 provides a further analysis of the contributing factor *Environment/facilities/ramp*.

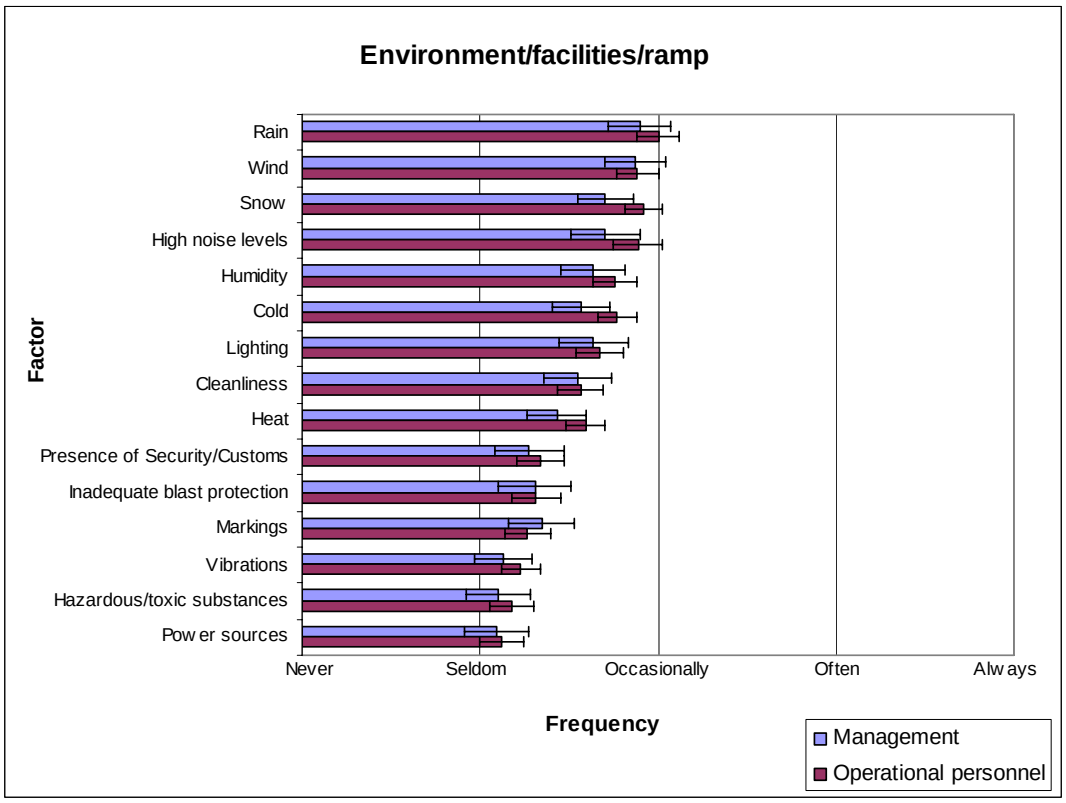

Figure 14: Environment/facilities/ramp

Both Management and Operational personnel agree that exposure to the weather is an important contributing factor to consider. Especially rain, wind and snow provide a relative high frequency. Non-weather related issues like high noise levels, lighting on the ramp and the cleanliness of the ramp itself are also issues that may increase the risk on human error and for which a relative high frequency is provided.

Information

Figure 15 provides a further analysis of the contributing factor *Information*.

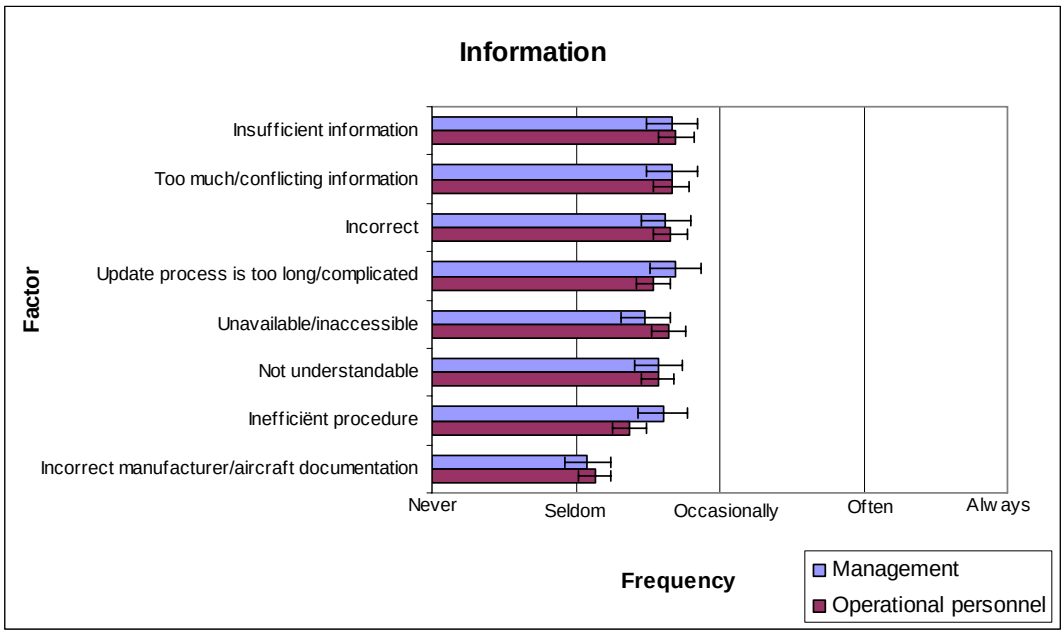

Figure 15: Information

Within the contributing factor *Information*, most underlying factors are rated at similar frequencies, except incorrect manufacturer/aircraft documentation. Errors in this kind of documentation may be rare, or otherwise GSP are not closely associated with this documentation, for example when procedures have been incorporated in GSP company documents, like Ground Handling Manuals.

It should also be noted that information relates to communication. Next to the way of communication, it is important what information is communicated to make the communication effective.

Organisational factors

Figure 16 provides a further analysis of *Organisational factors*.

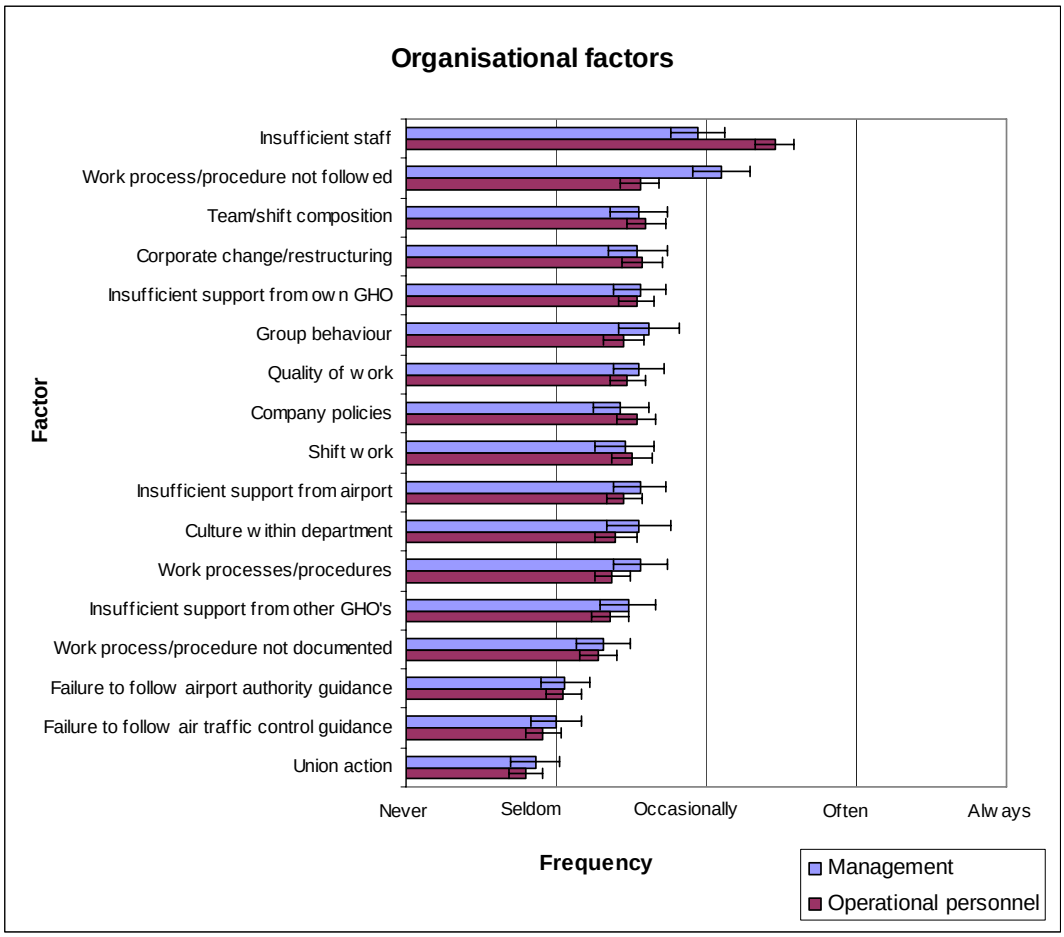

Figure 16: Organisational factors

With regard to organisational factors, significant differences between the views of Management and Operational personnel exist in the contributing factors of staffing and adherence to processes and procedures. The opinion that there are insufficient personnel to perform the ground handling activities is shared by both Management and Operational personnel, but expressed a lot stronger by Operational personnel. In the interviews that concluded the surveys it was expressed that in the current economic tense climate, turnarounds are scheduled with a minimum amount of personnel, with the result that disruptions are increasingly difficult to compensate. This also corresponds with the safety culture assessments, in which the shared impression exists that more experienced personnel are necessary.

In the opinion of Management, human errors are occasionally caused by the fact that working processes or procedures are not followed. Operational personnel, on the other hand, provide a much lower frequency to this factor.

Technical knowledge/skills

Figure 17 provides a further analysis of contributing factor *Technical knowledge/skills*.

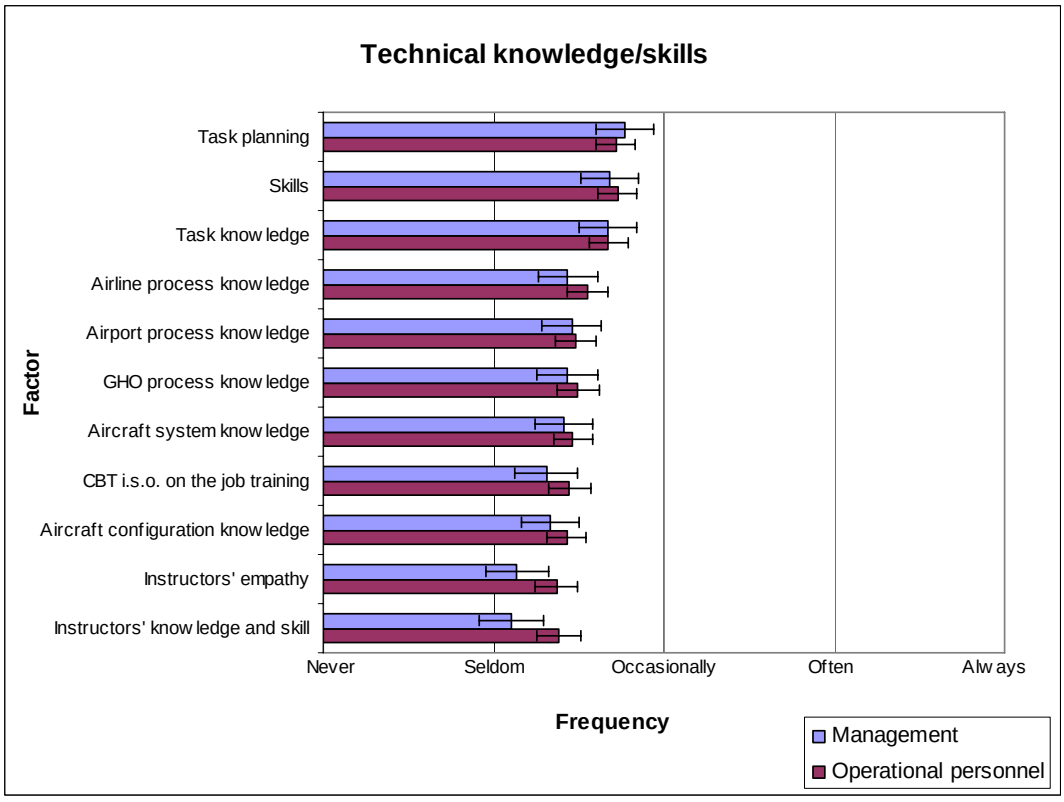

Figure 17: Technical knowledge/skills

Next to planning of the tasks, skills and task knowledge are important factors to consider in preventing human errors.

Leadership/supervision

Figure 18 provides a further analysis of the contributing factor *Leadership/supervision*.

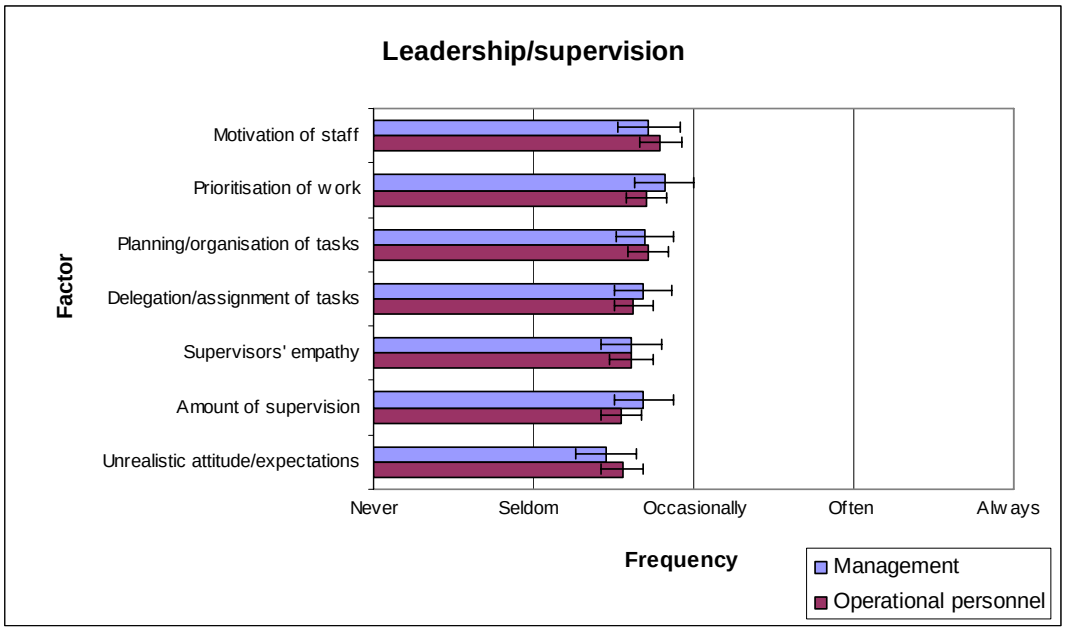

Figure 18: Leadership/supervision

Whereas figure 10 suggests that leadership and supervision are particularly seen by Management as important contributing factors to human error, this does not clearly show in figure 18, in which all underlying factors are more or less rated at the same frequency by either Management and Operational personnel.

Job/task

Figure 19 provides a further analysis of the contributing factor *Job/tasks*.

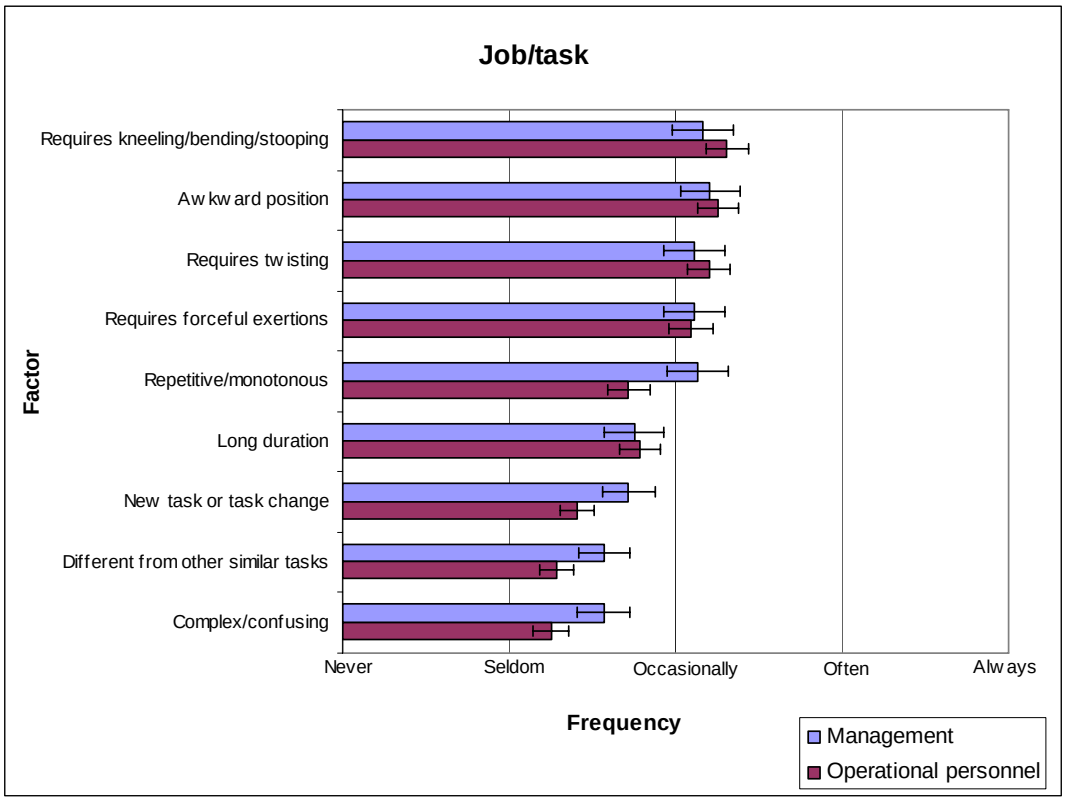

Figure 19: Job/task

The first four factors relate to physical movements required to perform most ground handling activities. Management as well as Operational personnel are well aware of the required physical effort and their potential contribution to human errors or incidents.

Management provides a higher frequency than Operational personnel for the factors that relate to the nature of the work, i.e.: R*epetitive/monotonous, New task or task change, Different from other similar tasks and Complex/confusing*. In the development of schedules and procedures it is important that Management remains aware of these factors.

Aircraft design/configuration/parts

Figure 20 provides a further analysis of the contributing factor *Aircraft design/configuration/parts*.

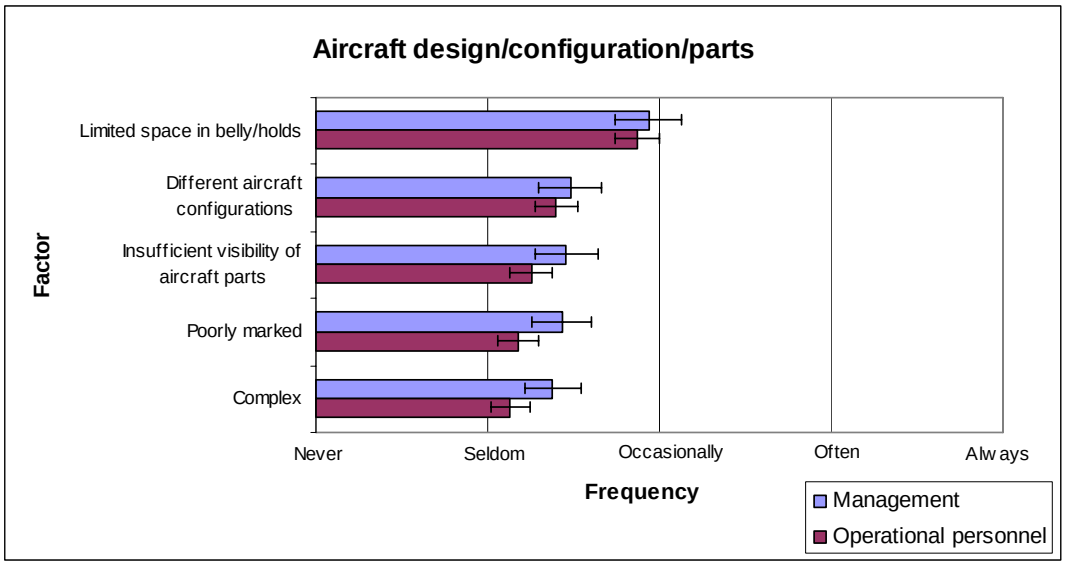

Figure 20: Aircraft design/configuration/parts

The limited space in the aircraft belly and holds are considered by both Management and Operational personnel as an important factor that contributes to human errors and incidents. This may play an important role in management of health and safety issues in the ground handling of aircraft.

3.4 INTERVIEWS

After the questionnaire results had been processed and analysed, interviews were scheduled with the participating GSP to discuss the preliminary results. The interviews were conducted with the coordinator and one or two personnel involved in ramp operations, e.g. instructor, ramp supervisor or HSE representative.

In all interviews, the current economic situation and its effects on ground handling were discussed. The current economic situation is considered to be one of the reasons why prices have to be lowered to stay competitive in the GSP market. This, in turn, leads to postponement of investments in equipment and personnel. Although safety requirements are met, disruptions in the operational process are difficult to counterbalance when a minimum amount of personnel and/or equipment is scheduled for a turnaround. This is probably why

Operational personnel, and to a lesser extent Management, indicate that more experienced personnel would be necessary.

With regard to personnel it was also expressed in some interviews that most personnel employed by GSP take professional pride in their job and do anything within their capabilities to meet the scheduled departure time. When time pressure, stress and fatigue were discussed, it was stated that that ground handling staff may have to work double shifts (for different employers) to generate sufficient income.

Operational personnel of all participating GSP had the impression that the ground handling equipment was insufficiently maintained. During the interviews it became clear that this is not recognised in the GSP, since all equipment is maintained according manufacturers' standards. However, equipment may give the impression that it is always defective when different complaints are reported within a short period of time. Additionally, the appearance of the equipment may also create an impression of age or wear.

4 CONCLUSIONS AND RECOMMENDATIONS

Seven GSP have been invited to participate in the ECAST investigation into human factors in ground handling. Questionnaires have been distributed to two target groups:

- Management (Management, Department head, Supervisor and Support);
- Operational personnel (Coordination, Team leaders and ramp personnel).

The response rate of participants varies from 16% to 69%, with an average of 33%. The first section of the questionnaire aims to assess the safety culture of each GSP; the second section focuses on human factors.

The overall level of safety culture ranges from 3.4 to 3.8 on a five point scale, with an average level of safety culture of 3.7 for all participating GSP.

When the results of Management and Operational personnel are compared on the overall level, Management generally provides a higher rating than Operational personnel for the safety culture characteristics and indicators. Apparently Management has a stronger opinion than operational personnel that the safety culture aspects under consideration are taken care of and that safety is given first priority. This is possibly caused by a too optimistic view of Management or by difficulties in propagation of the safety policy and principles in the right way and to the right extent to Operational personnel.

The safety culture characteristics *Commitment* and *Awareness* provide a high rating for all GSP. This is a positive property and should be fostered. One point of attention is that Management has to communicate to Operational personnel that safety and a rapid turnaround are not incompatible, and that always a correct balance between safety and speed has to be found. Another issue is that Operational personnel have to be informed why certain investments are postponed. This creates an understanding why Management has to take certain decisions, without casting doubt on their commitment towards safety.

For all but one of the participating GSP, the safety culture characteristic *Justness* provides the lowest rating. For the better part this can be attributed to how the issue is perceived differently by Management and Operational personnel. Apparently, the development and maintenance of a just culture, and most importantly, the dissemination to Operational personnel, is a point of attention for most GSP. In case of incidents or accidents in the ground handling process, it

is recommended to let a team leader participate in the investigation to provide the operational background and context, and to avoid that the personnel involved are treated unfair.

Within the safety culture characteristic *Information*, developing and promoting a safety reporting system is highly desirable to provide an open means of communication about safety issues between the various levels of the GSP. Management has to be genuinely concerned with the reported safety issues, admit that errors may originate from management decisions and empathise with the operational environment of Operational personnel. This may be acquired by e.g. Management's physical presence on the ramp every now and then. This makes Management 'more visible' to Operational personnel, which in turn may improve the impression of Operational personnel that Management is genuinely committed to safety.

With regard to the safety culture characteristic *Adaptability*, a good communication system to exchange safety information will enable GSP to learn from past experiences and enhance the level of safety.

Safety related behaviour of both Management and Operational personnel is considered to be a manifestation of the existing safety culture within the GSP. In all participating GSP, personnel expect from each other that safety procedures are followed. Safety issues are discussed with colleagues, although this happens more at the Management level than at the operational level. Insufficient maintenance of equipment and insufficient personnel are issues that affect the Operational personnel's working situation. It is the task of Management to communicate that equipment is adequately maintained and that the current economic situation requires being careful in making investments in equipment and personnel, but that the work can still safely be performed with the number of personnel and equipment available.

Management provides a higher frequency to all incident categories than Operational personnel. This is possibly caused by the wider view of Management on the operations or on their ability to estimate incident frequencies. Management is of the opinion that operational disruptions occur most frequent; in the view of Operational personnel equipment damage occurs most frequent.

Management and Operational personnel agree in the view that delays of incoming and departing flights are the most frequent occurring operational disruptions. With regard to equipment damage, baggage tugs/carts, belt loaders and container loaders are most frequently damaged. The relative high frequency

is possibly caused by the fact that more pieces of this equipment are used during the turnaround, making the exposure and risk of damage higher.

Equipment/tools is indicated by Operational personnel as the most frequent direct cause involved in accidents, incidents or human errors. Management, on the other hand, provides the highest frequency to the ground handling itself.

With regard to the contributing causes, *Personal factors* and *Communication* receive a relative high frequency from both Management and Operational personnel.

Personal factors that occur most frequent in the views of Management and Operational personnel are time pressure, stress and fatigue. These may be related to the most frequent occurring operational disruptions, i.e. delays of arriving and departing flights. Time pressure and its effect on safety may be decreased when the focus in the ground handling process is changed from on-time-departures to on-time-arrivals. It is also recommended to provide awareness training to adequately cope with time pressure, stress and fatigue. Further research may be focused on the possible implications of the focus on on-time-departures on the number and time of occurrence of ground handling incidents.

When communication as contributing factor is further specified, communication between staff and communication between departments receive a relative high frequency from both Management and Operational personnel. Standardisation of phraseology and awareness training may decrease the chance of communication errors on the ramp and between departments. Further research may be focused on the further development of the communication chain on the ramp.

There are differences between the views of Management and Operational personnel with regard to the contributing factor *Equipment/tools/safety equipment*. Management seeks the contributing factors of human errors and incidents primarily in incorrect use, or lack of use, of the ground handling equipment or personal protective equipment. Operational personnel, on the contrary, expresses the view that bad maintenance, poor reliability and poor safety of the equipment contributes to errors and incidents. This is in line with the findings in the safety culture assessments, in which Operational personnel often expressed their view that maintenance of ground handling equipment is insufficient. It is important for Management to be aware of the importance of ground handling equipment to the Operational personnel.

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Appendix A SAFETY CULTURE INDICATORS

This appendix describes in detail the indicators belonging to each of the six safety culture characteristics.

A.1 INDICATORS RELATING TO COMMITMENT

The characteristic *Commitment* reflects the extent to which every level of the organisation has a positive attitude towards safety and recognizes its importance. Top management should be genuinely committed to keeping a high level of safety and give employees motivation and means to do so as well. The following indicators for commitment have been identified:

I1_1. *Management concern*

A good safety culture starts with management being genuinely concerned with safety. Therefore, one of the most important goals of (top-) management should, apart from making profit, be to keep a high level of safety, for the operations, for the customers, and for their employees. The concern for safety expresses itself in management being willing to release job pressure if safety is at stake, and also in management accepting setbacks and human errors as inevitable, putting everything into place to minimize the chance of such errors occurring. Management concern for safety should furthermore be projected onto the employees, who, in a good safety culture, have confidence in the management doing everything possible to keep high safety records.

I1_2. *Personal concern*

Management concern for safety will reflect on the personal concern for safety of the other members of the organisation. Like management, (operational) staff should consider safety as a core value, and be aware that a high level of safety is essential for the continuity of the operations. This means that safety should always been given priority above efficiency and profit, and safety issues, however small, should be considered seriously.

I1_3. *Investment in safety*

The prioritisation of safety discussed above is reflected, among others, by the amount of money and effort that is invested over the entire organisation in order to maintain and improve the level of safety. The existence of a safety department ensures that safety issues are taken seriously, safety requirements and

procedures are installed, and that an intermediary regarding safety issues between management and employees exists. Obviously, such a safety department should function in reality and emanate the authority necessary to be taken seriously. Finally, in case an incident or accident has occurred, the organisation should put all possible means at the disposal of a solution.

A.2 INDICATORS RELATING TO JUSTNESS

The characteristic *justness* reflects the extent to which safe behaviour and reporting of safety issues are encouraged or even rewarded, and unsafe behaviour is discouraged.

I2_1. *Evaluation of safety related behaviours*
Safety related behaviour should be evaluated in a consistent and just manner. Safe behaviour should be rewarded and occasional mistakes should not lead to grave punishments. In contrast, reckless behaviour should imply negative consequences for the person concerned, and actions should be taken against violations of safety procedures or rules. Also, no negative consequence should be attached to the usage of the reporting system.

I2_2. *Perception of evaluation*
The evaluation system should be perceived as just by those evaluated. Employees should not be concerned with the evaluation when reporting occasional mistakes. The evaluation should be clear in when employees can be expected to be rewarded, punished, or not undergo any consequence from their actions.

I2_3. *Passing of responsibility*
Management should acknowledge that the causes of accidents or incidents often originate from management decisions, rather than actions undertaken on the shop floor. Of course, the final responsibility could be put at the front line employees, but management needs to realize that the cause of failure of safe behaviour on the shop floor has to be sought for in management decisions.

A.3 INDICATORS RELATING TO INFORMATION

The characteristic *information* reflects the extent to which information is distributed to the right people in the organisation. Employees should be encouraged to report safety concerns, therefore demanding the existence of a reporting system. Work related information has to be communicated in the right

way to the right people in order to avoid miscommunications that could lead to hazardous situations.

I3_1. *Safety training*

Employees should be given training in order to carry out their job in safe manner. Training in adequate behaviour and communication in case of emergency situations should also be given to everyone in the organisation. Training in safe behaviour and emergency situations should be given at regular intervals

I3_2. *Communication of safety related information*

Safety reports should be communicated to the right people, and safety issues should be communicated to all employees in order to keep them informed with known hazards. When changes are implemented that anyhow affect safety, management should inform the employees concerned by those changes. Talking about safety issues amongst employees, amongst management and between employees and management should be viewed as normal and desirable. Events involving safety issues should be reviewed by management and employees.

I3_3. *Safety reporting system*

An important ingredient to assure safety of operations is to install a system to report safety issues. Such a system should enable reporting safety concerns regarding technical systems, procedures, and safety related behaviour. It should be ensured that all employees know about the existence of the reporting system and are familiar with its usage.

I3_4. *Willingness to report*

The reporting system can only reach its aim, namely to make management knowledgeable of safety issues, if employees are willing to use it. Not only should they be willing to report accidents, but also minor incidents as well as near misses[1]. Indeed such near misses could, if recurring, lead to graver incidents or accidents. Usage of the reporting system should be encouraged. The willingness of using the reporting system is enhanced by making it possible to report safety issues anonymously.

I3_5. *Consequences of safety reports*

The reporting system should be used to genuinely and rapidly take action to reduce the safety concerns. Moreover, the usage of the reporting system should

[1] A near miss in this context is a happening that could have led to an incident or an accident but did not thanks to some lucky circumstances.

by no means imply negative consequences for those using it. It should be possible to report anonymously, but employees should feel be confident to identify themselves when reporting.

A.4 INDICATORS RELATING TO AWARENESS

The characteristic *Awareness* reflects the extent to which employees and management are aware of the risks the organisation's operations imply for themselves and for others. Employees and management should be constantly maintaining a high degree of vigilance with respect to safety issues.

I4_1. *Awareness of job induced risk*
Management and employees should be aware of the risk the organisation's operations induces not only to themselves, but also to other people, e.g. people living in the surroundings of the organisation and people using the organisation's products (typically aircraft passengers in the case of air transport). Management and employees should never think that they have achieved the highest possible level of safety, and always be looking for ways to improve their safety records. Management and employees should always be aware that safety can be improved and look for ways to do so.

I4_2. *Attitude towards unknown hazards*
A good safety culture is a means to obtain a high level of safety. However, a high level of safety can also lead to the belief that all safety issues are taken care of, and hence it could release the pressure upon performing safely. A high level of safety thus represents a danger to maintaining a high level of safety. Therefore, employees should always be aware of known hazards, and also constantly be on the look-out for new ones.

I4_3. *Concern for safety*
High safety awareness is reflected in a continuous attention for safety issues. This means that even in the absence of safety occurrences the organisation's members are concerned with safety. They are aware of the importance of safety for the continuity of the operations and act accordingly.

A.5 INDICATORS RELATING TO ADAPTABILITY

The characteristic *adaptability* reflects the extent to which employees and management are willing to learn from past experiences and be able to take whatever action is necessary in order to enhance the level of safety within the organisation.

I5_1. *Actions with respect to safety occurrences*

When faced with safety concerns, incidents or accidents, management and employees should take immediate action to prevent such negative happenings to recur. Near misses should also be taken into account by management and employees, and their causes should be looked for in order for them not to recur with possibly graver consequences. Installed improvements should be followed up in order to check whether they are indeed effective, and do not imply other unforeseen safety concerns.

I5_2. *Proactiveness to prevent safety occurrences*

Reaction upon safety issues, incidents or accidents is not sufficient for a high level of safety to be reached. Indeed, rather than being reactive, the organisation's management and employees should be proactive in solving safety problems. Improvements should be looked for and implemented before negative happenings occur, and employees should be encouraged to look autonomously for ways to improve safety on the shop floor.

I5_3. *Employee input*

In an organisation with a good safety culture, it is highly appreciated that employees communicate their knowledge and experience. Employees should be enabled to suggest improvements with respect to their or others' job. When facing problems, management should not hesitate to assign the right persons, even if they are front-line employees, to solve those problems. When facing problems or safety issues, employees should be enabled, if necessary, to interfere even if these problems or issues are beyond their work area. In this case, they should not be treated as meddlers, but their proactiveness should on the contrary be appreciated.

A.6 INDICATORS RELATING TO BEHAVIOUR

The characteristic *Behaviour* reflects the extent to which every level of the organisation behaves such as to maintain and improve the level of safety. From the management side, the importance of safety is recognized and everything to maintain and enhance safety records is put in place. Employees should be empowered to keep high safety levels, not only through reporting but also through decision making.

I6_1. *Job satisfaction*

Job satisfaction is an important requirement to carry out safe operations. Indeed, it promotes concentrated behaviour at work, and thereby safe behaviour. It includes a good physical and mental state during normal working periods, a good contact with colleagues, and an adequate job pressure, which is, amongst others, assured by a sufficient size of the staff. Work should be appreciated in an adequate manner by the employees' foreman/supervisor as well as by the colleagues. This will promote the job satisfaction, hence safe operations.

I6_2. *Working situation*

The employees should be able to have access to the equipment necessary to perform their job in a safe manner. The equipment should be in a good condition, and adequate training to use the equipment should be given. Also, safety equipment (e.g. fire extinguishers) should be available at all times.

I6_3. *Employee behaviour with respect to safety*

A necessary ingredient to safe operations is the willingness of employees to behave and execute their job in safe manner. They should be aware that risk taking, whether unnecessary or driven by profit or performance concerns, could potentially be very harmful and that it should therefore be reduced to a zero rate. Employees should furthermore be enabled to prevent the occurrence of accidents or incidents, by taking responsibility and undertaking action when needed.

I6_4. *Mutual expectations and encouragement*

Safe behaviour should be expected and encouraged mutually amongst employees, and should result in the acquirement of colleagues' respect. When faced with unsafe operations, employees should be encouraged to stop and report those. Violations of procedures and regulations should be effectively discouraged.

Appendix B LEVELS OF SAFETY CULTURE

This appendix describes the levels of safety culture used by NLR-ATSI.

Level 1 (pathological)
In a pathological safety culture, safety is considered as unimportant and even senseless. Safety plays no role in any layer of the organisation, from top management to frontline personnel. Action is taken only after severe safety occurrences, and only consists of identifying and punishing the directly responsible person(s) without further noticing, let alone investigating, the organisational factors that are likely to have played a role. If safety already is a subject of communication, it is only after severe safety occurrences and for only a short period of time. If there is already any awareness of existing safety risks, there is in general no willingness to do something about them. Employees raising safety concerns are not appreciated, in particular when (other) interests (e.g. profit, efficiency, quality or environment) are at stake. Safety considerations do not play an important role in the behaviour of frontline personnel. Unsafe behaviour in the benefit of (other) interests is rewarded.

Level 2 (reactive)
In a reactive safety culture, safety is generally regarded as a burden that is imposed from the Authorities. Safety is taken into account to meet the requirements imposed by the regulations. Action is taken only to satisfy the law, or after a safety occurrence, in which case it mainly consists of identifying and punishing the directly responsible person(s). Only if the safety occurrence is severe it becomes object of communication and measures are taken to prevent recurrence. There is only willingness to take action against an existing safety risk when it is too late. Behaviour is barely influenced by safety considerations. Unsafe behaviour in the benefit of (other) interests is allowed.

Level 3 (calculative)
In a calculative safety culture, safety is considered as a factor that has to be accounted for. Safety is taken into account in management's decision making, but in itself safety is not a core value. Action is only taken after a safety occurrence, and next to identifying directly responsible person(s), it also aims at investigating the organisational processes that might have played a role. A safety issues reporting system is installed to meet legal requirements, and is only used for gathering information in the aftermath of safety problems. There is a general

awareness of the safety risks induced by the operation, and one is willing to take measures if these become too large. The behaviour of frontline employees is influenced, amongst others, by safety considerations. There are situations in which unsafe behaviour in the benefit of other interests is allowed, but in general there is a mutual expectation of safe behaviour.

Level 4 (proactive)
In a proactive safety culture, safety is considered as a prerequisite. Safety is a core value of the organisation and plays an important role in decision making at management level as well as in day-to-day operations. The safety reporting system is not only used for detecting severe safety issues, but also for issues with less or no impact. Safety reports only have consequences for the directly responsible person(s) if there appear to be intentional actions or negligence. The operations are regularly assessed on their safety, and safety measures are thoroughly evaluated after implementation. After a safety occurrence, the first concern of management is to prevent recurrence. After that the directly responsible person(s) often are still pointed out and punished, but responsibility is also assigned to organisational factors. There is a general awareness of the safety risks induced by the operation, and action is taken to reduce them as much as possible.

Level 5 (generative)
In a generative safety culture, safety is the core value of the organisation and is recognized as essential for the continuity of the operations. There is a clear line between acceptable and unacceptable behaviour. As long as safety occurrences are not the result of negligence or intention there are no consequences for the directly responsible person(s). In this atmosphere of trust the safety issues reporting system is widely used and the measures resulting from safety reports are fed back to the involved parties. One is aware of the existence of unidentified safety risks, aware of the fact that the next accident is just around the corner, and keeps a constant level of vigilance with respect to these unidentified risks. Safety is decisive for the behaviour of front line personnel, and unsafe behaviour is never tolerated.

Appendix C QUESTIONNAIRE

This appendix presents the questionnaires that have been used in the survey.

The section about safety culture has been split into the questions presented to Management (Appendix B.1) and the questions presented to Operational personnel (Appendix B.2). Participants had to agree to statements on a five point Likert scale:

- 1 = completely disagree
- 2 = disagree
- 3 = do not agree nor disagree
- 4 = agree
- 5 = completely agree

In general, a score of 1 corresponds to a low level of safety culture, and a score of 5 to a high one. However, some statements are posed negatively, i.e. a score of 1 corresponds to a high level of safety culture. In that case, the results are computed by transposing the scores.

In the section about human factors, participants had to provide the perceived frequency of events on the following 5-point scale:

- 1 = Never
- 2 = Seldom
- 3 = Occasionally
- 4 = Often
- 5 = Always

In the section about incidents, participants had to provide the perceived frequency of events on the following 5-point scale:

- 1 = Less than once in 10 years
- 2 = Less than once a year
- 3 = Less than once a month
- 4 = Less than once a week
- 5 = Several times a week

An option is provided to indicate if the statement is not applicable for the respondent (N/A). These answers are not taken into account in the statistics.

C.1 SAFETY CULTURE – MANAGEMENT

1. Please specify your organisation.
    a. Aviapartner, Amsterdam Airport
    b. Aviapartner, Rotterdam The Hague Airport
    c. KLM Ground Services, Amsterdam Airport
    d. Maastricht Handling Services, Maastricht Aachen Airport
    e. Menzies Aviation, Amsterdam Airport
    f. Servisair, Amsterdam Airport
    g. Viggo, Eindhoven Airport

2. What part of the organisation are you working in?
    a. Sales
    b. Quality
    c. Contracts
    d. Training
    e. Other, please specify

Please provide your opinion concerning the following statements from the perspective of your own working environment and way of working, in the current situation.

3. Commitment
    a. Safety plays an important role in management's decision making.
    b. Management thinks safety is more important than realising shortest turnaround times.
    c. Safety plays an important role in my daily work.
    d. For me, safety comes before profit.
    e. I invest sufficient resources to ensure flight safety.
    f. I invest sufficient resources to ensure a safe working environment for personnel.

4. Justness
    a. There is a clear distinction between safe and unsafe behaviour.
    b. Action is consistently taken against employees who violate safety procedures or rules.
    c. When something goes wrong on the job, there are procedures in place to fairly judge the responsible persons.
    d. There are clear evaluation standards for safe and unsafe behaviour.

e. Incidents or accidents can often be related to human error, in which case the person responsible should be punished.
f. Management acknowledges they make errors.

5. Information
   a. Any change (e.g. other aircraft type, new airline) is accompanied by an appropriate training for the employees involved.
   b. I think training in emergency procedures is important.
   c. It is important to talk with Operational personnel about flight safety.
   d. Recent incidents or accidents are reviewed even at top level meetings.
   e. Procedures are sufficiently assessed on their effect on safety.
   f. The use of the safety reporting system is part of the initial training.
   g. It happens that safety issues are not reported.
   h. Management encourages everyone to address safety issues.
   i. Reporting of safety issues has no negative consequences for the reporter.
   j. This organization handles safety reports correctly.

6. Awareness
   a. Flight safety can always be improved.
   b. Safety of ramp personnel can always be improved.
   c. We have reached such a high level of safety that there is no need for further improvement.
   d. There are safety risks that have not been thought of.
   e. I am aware that an accident is around the corner.
   f. All employees have the necessary means/equipment to do their work safely.
   g. My main concern is that the aircraft departs on time.

7. Adaptability
   a. In this company, genuine action is taken to prevent safety occurrences from recurring.
   b. After installation, safety improvements are evaluated to ensure they are effective.
   c. I always consider potential safety problems seriously.
   d. Safety improvements can only be made with the input of past safety occurrences.
   e. I am appreciated for my knowledge and experience.
   f. I often have to solve a problem that is not in my field of work.

8. Behaviour
    a. The working atmosphere in this company is good.
    b. My work has a high social status.
    c. This company needs more experienced employees.
    d. It is essential to keep the equipment in good condition.
    e. It happens that various nationalities in the team create a potential risk to flight safety.
    f. Safety procedures and routines are regularly assessed.
    g. I expect safety procedures to be followed.
    h. I often talk with colleagues about safety and safe behaviour.

C.2 SAFETY CULTURE – OPERATIONAL PERSONNEL

1. Please specify your organisation.
    a. Aviapartner, Amsterdam Airport
    b. Aviapartner, Rotterdam The Hague Airport
    c. KLM Ground Services, Amsterdam Airport
    d. Maastricht Handling Services, Maastricht Aachen Airport
    e. Menzies Aviation, Amsterdam Airport
    f. Servisair, Amsterdam Airport
    g. Viggo, Eindhoven Airport

2. What is your current function?
    a. Foreman/Team leader turnaround
    b. Ramp employee
    c. Passage employee
    d. Other, please specify

Please provide your opinion concerning the following statements from the perspective of your own working environment and way of working, in the current situation.

3. Commitment
    a. Safety plays an important role in management's decision making.
    b. Management thinks safety is more important than realising shortest turnaround times.
    c. Safety plays an important role in my daily work.
    d. For me, safety comes before profit.

e. Management puts enough effort in improving the safety of flight operations.
f. Management puts enough effort in improving my personal safety.

4. Justness
   a. There is a clear distinction between safe and unsafe behaviour.
   b. Action is consistently taken against employees who violate safety procedures or rules.
   c. It happens that, when something goes wrong on the job, my colleagues and I are not fairly judged.
   d. There are clear evaluation standards for safe and unsafe behaviour.
   e. When something goes wrong on the job, management's primary concern is to find a scapegoat.
   f. Colleagues acknowledge they make errors.
   g. Management acknowledges they make errors.

5. Information
   a. I receive regular training to keep up with changes (e.g. other aircraft type, new airline).
   b. I think training in emergency procedures is important.
   c. It is important to talk with management about flight safety.
   d. Recent accidents and incidents are discussed on the work floor.
   e. Procedures are sufficiently assessed on their effect on safety.
   f. The use of the safety reporting system is part of the initial training.
   g. When I am confronted with minor safety issues, it happens that I do not report them.
   h. Management encourages everyone to address safety issues.
   i. Reporting of safety issues has no negative consequences for the reporter.
   j. This organization handles safety reports correctly.

6. Awareness
   a. Flight safety can always be improved.
   b. Safety of ramp personnel can always be improved.
   c. We have reached such a high level of safety that there is no need for further improvement.
   d. There are safety risks that have not been thought of.

e. I am aware that an accident is around the corner.
f. All employees have the necessary means/equipment to do their work safely.
g. My main concern is that the aircraft departs on time.

7. Adaptability
    a. In this company, genuine action is taken to prevent safety occurrences from recurring.
    b. After installation, safety improvements are evaluated to ensure they are effective.
    c. I always consider potential safety problems seriously.
    d. Safety improvements can only be made with the input of past safety occurrences.
    e. I am appreciated for my knowledge and experience.
    f. I often have to solve a problem that is not in my field of work.

8. Behaviour
    a. The working atmosphere in this company is good.
    b. My work has a high social status.
    c. This company needs more experienced employees.
    d. The equipment I use is in a good condition.
    e. It happens that various nationalities in the team create a potential risk to flight safety.
    f. Safety procedures and routines are regularly assessed.
    g. I am expected to always follow the safety procedures.
    h. I often talk with colleagues about safety and safe behaviour.

C.3 HUMAN FACTORS

C.3.1 DIRECT CAUSES OF INCIDENTS/HUMAN ERROR

Please answer the questions from the perspective of your own working environment and experience with incidents and/or human errors in which you were directly involved.

1. Please indicate for the following factors how often in your opinion they are the direct cause of incidents/human errors.
    a. Ground handling equipment;
    b. Foreign Object Debris;
    c. Pushback/towing;
    d. Ground handling;
    e. Aircraft maintenance;
    f. Personal injury;
    g. Other factor, please specify.

C.3.2 CONTRIBUTING FACTORS OF INCIDENTS/HUMAN ERROR

2. Please indicate for the following factors how often in your opinion they are the contributing cause of incidents/human errors.
    a. Information;
    b. Equipment/tools/safety equipment;
    c. Aircraft design/configuration/parts;
    d. Job/task;
    e. Technical knowledge/skills;
    f. Personal factors;
    g. Environment/facilities/ramp;
    h. Organisational factors;
    i. Leadership/supervision;
    j. Communication;
    k. Other factor, please specify.

3. Please indicate for the following factors with regard to *Information* how often in your opinion they are the contributing cause of incidents/human errors.
    a. Information not understandable;
    b. Information unavailable/inaccessible;
    c. Incorrect information;

d. Too much/conflicting information;
e. Insufficient information;
f. Update process is too long/complicated;
g. Incorrect maintenance/aircraft manuals;
h. Inefficient procedure
i. Other factor, please specify.

4. Please indicate for the following factors with regard to *Equipment/tools/safety equipment* how often in your opinion they are the contributing cause of incidents/human errors.
    a. Unsafe;
    b. Unreliable;
    c. Layout of controls or displays;
    d. Bad maintenance;
    e. Not used;
    f. Unavailable;
    g. Inappropriate for the task;
    h. Incorrectly used;
    i. Inappropriate for (weather) conditions;
    j. Incorrect use in existing (weather) conditions;
    k. Too complicated;
    l. Incorrectly labelled/marked;
    m. Personal protective equipment not used;
    n. Personal protective equipment used incorrectly;
    o. Personal protective equipment unavailable;
    p. Mis-calibrated;
    q. No instructions;
    r. Other factor, please specify.

5. Please indicate for the following factors with regard to *Aircraft design/configuration/parts* how often in your opinion they are the contributing cause of incidents/human errors.
    a. Complex;
    b. Inaccessible;
    c. Different aircraft configurations;
    d. Insufficient visibility off aircraft parts;
    e. Poor marking;
    f. Other factor, please specify.
6. Please indicate for the following factors with regard to the *Job/task* how often in your opinion they are the contributing cause of incidents/human errors.

a. Repetitive/monotonous;
b. Complex/confusing;
c. New task or task change;
d. Different from other similar tasks;
e. Requires forceful exertions;
f. Requires kneeling/bending/stooping;
g. Requires twisting;
h. Long duration;
i. Awkward position;
j. Other factor, please specify.

7. Please indicate for the following factors with regard to *Technical knowledge/skills* how often in your opinion they are the contributing cause of incidents/human errors.
    a. Skills;
    b. Task knowledge;
    c. Task planning;
    d. Computer based training instead of on-the-job training;
    e. Instructors' knowledge and experience;
    f. Instructors' empathy;
    g. Airline process knowledge;
    h. Ground service provider process knowledge;
    i. Airport process knowledge;
    j. Aircraft system knowledge;
    k. Aircraft configuration knowledge;
    l. Other factor, please specify.

8. Please indicate for the following factors with regard to *Personal factors* how often in your opinion they are the contributing cause of incidents/human errors.
    a. Physical health (including hearing and sight);
    b. Fatigue;
    c. Time pressure;
    d. Peer pressure;
    e. Complacency;
    f. Body size/strength;
    g. Personal event (e.g. family problem, car accident, etc.);
    h. Distractions/interruptions during task performance;
    i. Memory lapse;
    j. Motivation;

k. Stress;
l. Other factor, please specify.

9. Please indicate for the following factors with regard to the *Environment/facilities/ramp* how often in your opinion they are the contributing cause of incidents/human errors.
    a. High noise levels;
    b. Heat;
    c. Cold;
    d. Humidity;
    e. Rain;
    f. Snow;
    g. Wind;
    h. Lighting;
    i. Vibrations;
    j. Cleanliness of the ramp;
    k. Hazardous/toxic substances;
    l. Power sources;
    m. Inadequate blast protection;
    n. Markings;
    o. Presence of Security/Customs;
    p. Other factor, please specify.

10. Please indicate for the following factors with regard to *Organisational factors* how often in your opinion they are the contributing cause of incidents/human errors.
    a. Insufficient support from own organisation;
    b. Insufficient support from other ground service providers;
    c. Insufficient support from the airport;
    d. Company policies;
    e. Insufficient personnel;
    f. Corporate change/restructuring;
    g. Union action;
    h. Work process/procedure;
    i. Work process/procedure not followed;
    j. Work process/procedure not documented;
    k. Quality of daily work;
    l. Failure to follow Air Traffic Control guidance;
    m. Failure to follow Airport Authority guidance;
    n. Shift work;

o. Composition of shifts;
p. Group behaviour;
q. Culture in the department;
r. Other factor, please specify.

11. Please indicate for the following factors with regard to *Leadership/supervision* how often in your opinion they are the contributing cause of incidents/human errors.
    a. Planning/organisation of tasks;
    b. Prioritisation of work;
    c. Delegation/assignment of tasks;
    d. Unrealistic attitude/expectations;
    e. Amount of supervision;
    f. Supervisors' empathy;
    g. Motivation of employees;
    h. Other factor, please specify.

12. Please indicate for the following factors with regard to *Communication* how often in your opinion they are the contributing cause of incidents/human errors.
    a. Communication between departments;
    b. Communication between employees;
    c. Misunderstanding;
    d. Proficiency in English language;
    e. Communication between shifts;
    f. Communication between ramp personnel and supervisors;
    g. Communication between supervisors and management;
    h. Communication between flight crew and ramp personnel;
    i. Communication between airline and ground service provider;
    j. Communication between ground service providers;
    k. Other factor, please specify.

13. For which of the following areas do you have suggestions to improve flight safety or your personal safety?
    a. Information, namely:
    b. Equipment/tools/safety equipment, namely:
    c. Aircraft design/configuration/parts, namely:
    d. Job/task, namely:
    e. Technical knowledge/skills, namely:
    f. Individual factors, namely:

g. Environment/facilities/ramp, namely:
h. Organisational factors, namely:
i. Leadership/supervision, namely:
j. Communication, namely:
k. Other area, please specify.

14. Additional space is provided for other comments and/or suggestions to improve your personal safety on the ramp or to improve flight safety.

C.3.3 INCIDENTS

15. Please indicate for the following *incidents* how often in your opinion they occur in your own organisation.
    a. Aircraft damage;
    b. Ground handling equipment damage;
    c. Operational disruptions;
    d. Personal injury;
    e. Environmental impact events;
    f. Other incident, please specify.

16. Please indicate for the following *aircraft damage events* how often in your opinion they occur in your own organisation.
    a. Cargo door;
    b. Passenger door;
    c. Tail;
    d. Nose;
    e. Wing
    f. Landing gear;
    g. Other aircraft damage event, please specify.

17. Please indicate for the following *ground handling equipment damage events* how often in your opinion they occur in your own organisation.
    a. Baggage tug/cart;
    b. Loading bridge/jetway;
    c. Belt loader;
    d. Container loader;
    e. Lavatory truck;
    f. Water truck;
    g. Fuelling truck;
    h. Ground power unit;
    i. Other ground handling equipment damage event, please specify.

18. Please indicate for the following *operational disruptions* how often in your opinion they occur in your own organisation.
    a. Delay of incoming flight;
    b. Delay of departing flight;
    c. Return to gate;
    d. Other operational disruption, please specify.

19. Please indicate for the following *personal injuries* how often in your opinion they occur in your own organisation.
    a. Strain;
    b. Sprain;
    c. Laceration;
    d. Contusion;
    e. Fracture;
    f. Other personal injury, please specify.

20. Please indicate for the following *environmental impact events* how often in your opinion they occur in your own organisation.
    a. Spill (kerosene, etc.);
    b. Release of harmful fumes;
    c. Contamination;
    d. Other environmental impact event, please specify.

C.3.4 PERSONAL DETAILS

(This information will remain confidential and only be used for analysis purposes).

21. What is your gender?
    a. Male;
    b. Female.
22. What is your age?
    a. 18 years or younger;
    b. Between 19 and 29 years;
    c. Between 30 and 39 years;
    d. Between 40 and 49 years;
    e. Between 50 and 59 years;
    f. 60 years or older.

23. What is your country of origin?

24. What is your current function?

25. How long have you already been employed by this organisation?
    a. Less than 1 year;
    b. Between 1 and 5 years;
    c. Between 5 and 10 years;
    d. Between 10 and 20 years;
    e. More than 20 years.

26. How long have your been working in your current function?
    a. Less than 1 year;
    b. Between 1 and 5 years;
    c. Between 5 and 10 years;
    d. Between 10 and 20 years;
    e. More than 20 years.

27. When did you receive your latest safety training?
    a. Less than 1 month ago;
    b. Between 1 and 6 months ago;
    c. Between 6 and 12 months ago;
    d. Between 1 and 2 years ago;
    e. Between 2 and 5 years ago;
    f. More than 5 years ago;
    g. Never.

C.3.5 FEEDBACK

28. What do you think of the length of the questionnaire?
    a. Much too long;
    b. Too long;
    c. Good;
    d. Too short.
29. What do you think of the clarity of the questions?
    a. Impossible to answer;
    b. Difficult to understand;
    c. Too abstract;
    d. Good;
    e. Other, please specify.

30. Did the questions relate to your activities?
    a. Most questions did not relate to my activities;
    b. Some questions did not relate to my activities;
    c. Most questions related to my activities;
    d. Other, please specify.

31. Other comments.