Global Aviation Information Network
(GAIN)

Survey of
Analytical Processes and Requirements
for
Airline Flight Safety Management

Summary Report

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GAIN Working Group B
"Analytical Methods and Tools"

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Foreword

This report presents the findings of a survey of airline flight safety department personnel to identify and document analytical processes and requirements for methods and tools to support airline flight safety management. The results of the survey are intended to help GAIN Working Group (WG) B increase the awareness of analytical methods and tools in the aviation community and identify needs for improved analytical methods and tools.

Readers interested in more information on the analytical methods and tools referred to in this report, or analytical methods and tools in general, may find it helpful to obtain a copy of another report prepared by WG B *Guide to Analytical Methods & Tools for Airline Flight Safety Analysis*. This report is available on the GAIN website at www.gainweb.org, or can be requested from the GAIN Program Office (contact information inside the cover of this report).

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GAIN WG B acknowledges the confidential contribution of the airlines and their flight safety department staff who participated in the survey described in this report.

The following GAIN WG B members were primarily responsible for the conduct of the airline flight safety management survey and preparation of this report:

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Many other WG B members contributed their ideas and comments to the development of the survey or provided review comments on the report.

The survey methodology and findings were reviewed with members of the GAIN WG B Operational Advisory Group (OAG). The OAG members are:

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Executive Summary

This report presents the findings of a survey of airline flight safety management department staff undertaken by GAIN Working Group B to identify and document analytical processes and requirements for methods and tools to support airline flight safety management. The purpose of the survey was to better understand the need for, and potential benefits from, better analytical methods and tools, as well as to identify opportunities to improve the dissemination of information about existing analytical methods and tools.

The survey addressed (a) flight safety management processes, (b) safety-related data, and (c) the use of analytical tools in airline flight safety management. Interviews were conducted with flight safety office personnel from 15 different airlines, representing a wide range of size, type of operation, and nationality. It is recognized that the number of carriers in the survey limits the extent to which any findings for a particular subset of the sample can be considered representative of other airlines in the same category.

The following paragraphs summarize the principal conclusions of the survey.

Many Flight Safety Managers (FSMs) appear to get limited advice about the analytical procedures to follow in carrying out their job. In addition to their personal education and experience, they tend to rely on guidance from outside sources, such as their parent carrier or industry associations.

While the level of resources for flight safety management varied considerably across the airlines, many survey respondents expressed concern over inadequate resources to carry out their ***desired*** safety program. Routine tasks take too much of their time. Other functions occupy time that could beneficially be used for analysis if more effective automation was available. There is a need for more automated tools that decrease the manual routines and liberate time for more useful activities.

The survey respondents indicated the availability of a wide range of analytical tools from the most basic (spreadsheet and general purpose database software) to quite sophisticated tools designed specifically for airline flight safety applications, including flight data analysis and human factors analysis. However, many airlines have only the more basic tools. Having the basic data sources (air safety reports and flight data analysis) is a significant advantage. On the other hand, the limited capabilities of many of the tools that are used to work with these data often result in the FSMs spending more time than necessary managing and analyzing the data. In addition to more automated tools, some respondents indicated a need for better management of the information reporting process.

FSMs equipped with good state-of-the-art tools and some support staff can do their job quite well, even if they still suffer from some wasted time and limited resources, and often have to concentrate on short-term issues. Less common, FSMs with good tools and adequate resources have the potential to also undertake longer-term activities and work more proactively.

In interpreting the significance of these findings, it should be borne in mind that for many airlines it is only a few years since they established flight safety management offices. In recent years, airline flight safety officer functions have evolved from accident and incident investigation to include proactive efforts

in prevention. Therefore it is not surprising that we found diverse approaches to the challenges of an evolving field. Among the broad spectrum of carriers, with diverse patterns of organization and resources, we found that flight safety management offices are in transition.

The findings of this survey will be used to focus the activities of Working Group B during the coming year.

1. Introduction

The Global Aviation Information Network (GAIN) is an industry and government partnership to promote and facilitate the voluntary collection and sharing of safety information by and among users in the international aviation community to improve safety. As part of the current GAIN Action Plan, Working Group B *Analytical Methods and Tools* has undertaken a survey of airline flight safety management staff. The aim of the survey is to guide GAIN in its future activities to address airline needs for analytical methods and tools.

The survey was undertaken to identify and document requirements for analytical methods and tools to support airline flight safety management, including:

(a) safety management analytical processes
(b) safety-related data
(c) a hierarchy of analytical tools needed for airline flight safety management.

The survey was based on the voluntary cooperation of selected airlines and involved interviews with flight safety management staff, generally conducted in the course of a visit to the airline. The aim of the interviews was to understand and document how they currently perform their flight safety duties, what data sources they have, what analytical methods and tools they currently use, and their ideas on how better analytical methods and tools could help improve safety management within their organization.

The survey was conducted with the understanding that individual responses from participating airlines would be confidential, and the findings from any specific airline would not be identified.

This report documents the general findings of the survey.

In interpreting the significance of these findings, it should be borne in mind that it is only a few years since many airlines have established flight safety management offices. In recent years, airline flight safety officer functions have evolved from accident and incident investigation to include proactive efforts in prevention. Therefore it is not surprising that we found diverse approaches to new challenges in an evolving field. Among the broad spectrum of carriers, with diverse patterns of organization and resources, we found that flight safety management offices are in transition.

We hope that sharing the range of experiences found in the survey will promote progress in this vital field.

In presenting the findings of the survey, the intent is to better understand and document flight safety management processes and procedures as they are currently practiced, not to evaluate whether these are appropriate for the circumstances of each of the airlines participating in the survey. The survey findings do address the need for better analytical methods and tools, based on the responses from the survey participants.

2. Survey Methodology

Members of GAIN Working Group B contacted appropriate safety management personnel from a sample of airlines and invited them to participate in the survey. Potential survey respondents were selected to ensure a balance of different fleet sizes, geographical distribution, and types of flight operation. Personnel agreeing to participate in the survey were interviewed in person or by telephone.

To the extent possible, interviews took place during visits to the flight safety management offices. This allowed a more detailed discussion of the flight safety management process, seeing the tools, procedures and working environment in practice.

An interview protocol was developed to ensure consistency across the different interviews, together with specific questions to be addressed (see Appendix A).

3. Analysis of Survey Results

Interviews were conducted with flight safety office personnel from 15 airlines, representing a wide range of size, type of operation, and nationality. The results of each interview were written up in a standard format. The authors of this report then reviewed each interview report and attempted to summarize the findings of the survey using five different approaches:

- The first approach was to provide an overall summary of the general findings of the survey, after reading all of the interview reports but before performing a detailed analysis of the responses.
- The second analysis examined the responses question by question.
- The third approach then addressed the implications of the survey responses for requirements for analytical methods and tools to support flight safety management – the primary motivation of performing the survey.
- The fourth analysis divided the airlines represented in the survey into three size categories and attempted to identify any differences in the responses according to the size of the airline.
- The fifth analysis focused on the analytical methods and tools discussed by the survey respondents, including the data available as inputs to the analysis and the way in which the outputs were used. This analysis attempted to determine the extent to which a hierarchy of analytical methods and tools could be identified that provide progressively increasing capabilities.

Each of these five perspectives is discussed in the following sections.

4. General Findings

After reading all the reports without looking for any particular aspects, the following points stood out as the dominant findings:

- The survey responses suggest that in many cases not much advice is given to flight safety managers (FSMs) about the analytical procedures to follow in doing their job. Several respondents stated that they received no specific guidance, while others mentioned company procedures or use of particular tools.
- Usually some definition of the safety mission exists, but there appears to be less guidance about developing a strategy to accomplish this; or in other words ***how*** to fulfill the mission. Often, from the activities that the respondents described, their strategy appears to be more on the lines of "find the safety problems whatever they are, and fix them" than a well-defined analytical process to identify safety problems, with specific objectives and priorities.

- Strong links to management exist at many airlines, but some respondents indicated that the flight safety office is not consulted as much as it could be on operational issues, such as starting operations to a new destination.
- Information from outside the airline is used quite frequently in many flight safety offices. However, some respondents suggested that such information is not particularly valuable, because people tend to think "that could not happen here". This can apply to both outside information reaching the flight safety office and the further dissemination of this information within the airline.
- Many respondents indicated that their flight safety management process relied on the effective use of internal safety data. However, some airlines have difficulties with:
    - Fleet size (too few events to see trends)
    - Reporting culture (persuading operational people to report events and/or concerns).
- A lot of time is spent in routine tasks (reports, calls, meetings, finding information, data input, administrative tasks).
- Many current safety analysis tools are seen as both an asset and a liability:
    - A lot of time is lost in working with the tools, e.g. data input
    - Respondents noted that a lot of time could be saved with better tools. When asked how the flight safety activity could be improved within current constraints, their answers often indicate the need for better tools.
- Airline flight safety offices differ widely in the level of analytical tools they are equipped with.
- Many respondents indicated that too much of their time is used in short term or reactive work, and that they would like to do more analysis and proactive work.
- Most respondents reported that implementation of safety recommendations was generally adequate, but a few noted that follow-up could be improved.
- Direct contacts with line pilots (usually during recurrent training) are found to be valuable when they can be done. (Company size may be a factor limiting this.)

5. Responses to Specific Survey Questions

The second analysis grouped the responses to each interview question together and summarized the conclusions for each question. This helped identify common aspects across the various responses, as well as apparent differences between the airlines. In addition to the points noted in the previous section, other significant findings that emerged from this analysis include:

- FSM training is quite variable and gives limited attention to analytical processes.
- Most respondents appeared fairly satisfied with their existing information sources, although these vary quite widely across airlines.
- Respondents use a wide range of ways to disseminate safety information within their airline, with safety newsletters, bulletins and similar publications being the most common.
- There is little consistency in how flight safety offices attempt to summarize the current safety situation in their airline.

- The organization of the flight safety office varies considerably from airline to airline, and typically includes both full-time staff and part-time staff with flying duties.

The detailed findings of this analysis are presented in Appendix B.

6. Implications for Analytical Requirements and Methods

The third analysis was oriented to specifically address the GAIN Working Group B work plan goal that motivated the conduct of the survey:

> *Identify and document analytical requirements and methods to support airline safety management processes and procedures, including:*
>
> *(a) Safety management **analytical processes***
>
> *(b) Safety-related **data***
>
> *(c) Hierarchy of analytical **tools** needed for an airline flight safety office.*

A set of 14 questions were developed to cover the main issues in these three areas. The survey responses were then used to attempt to answer these questions.

Some questions could not be answered clearly from the survey responses. Data collection and management emerged as a significant issue, with respondents identifying a need to automate data entry and improve the consistency and quality of reported information. The generation of routine reports was also an area that could benefit from automation. The capability to measure and improve the level of safety through a combination of tools that support the analysis of a broad range of data sources within the airline does not appear to be widely implemented.

In addition, a set of 11 hypotheses were defined that try to characterize the effective use of analytical methods and tools in a flight safety management program. The survey responses were used to identify whether these statements appear to be representative of current airline flight safety offices.

Most of the hypotheses were not found to be characteristic of the airline flight safety management activities in the airlines participating in the survey. The two that appear to be supported by the survey responses indicate that typical flight safety management strategies can be adequately implemented with existing analytical tools, and that the resources typically available allow the FSMs to perform case-by-case analysis and respond to short-term issues. However, having the resources to do proactive higher level analysis does not appear to be characteristic of most of the FSMs participating in the survey. Thus the typical FSM can be characterized as trying to manage flight safety without a clear strategy to guide and prioritize analysis activities, concentrating on short-term actions, and lacking resources for longer term projects, higher level analysis or to follow up previous actions.

The detailed findings of this analysis are presented in Appendix C.

7. Influence of Carrier Size on Survey Findings

In order to understand whether the survey findings appear to vary by carrier size, the airlines were divided into three groups: small, medium and large, as follows:

Small - Less than 30 aircraft
Medium - From 30 to 70 aircraft

Large - Greater than 70 aircraft or greater than 60 aircraft where all are twin aisle and wide bodies and the airline's operations are all scheduled international flights.

These carrier size criteria were selected based on what appeared to be natural groupings from the review of the interview results, and resulted in the sample of 15 airlines being divided into 4 large, 7 medium and 4 small carriers. The responses to each survey question were then grouped according to these three categories and examined for any apparent differences across the carrier size categories. It was recognized that the limited number of carriers in each category, particularly the large and small categories, combined with the wide variation of other characteristics across the airlines in the survey, could have accounted for any apparent differences between the carrier size categories.

Responses to many of the questions in the survey were so variable that it was difficult to identify any consistent pattern within the carrier size categories. This was found to be the case with the training that FSM personnel have received, as well as the factors that make their work easier and those that make their work harder. There did appear to be differences in the ease of implementation of safety recommendations, with the medium carriers having greater difficulty than either the small or large carriers.

8. Hierarchy of Analytical Methods and Tools

As airlines increase in size or implement more sophisticated approaches to flight safety management, the demands on the analytical resources of the flight safety management staff will also grow. While a small airline may find a spreadsheet program, such as Microsoft Excel, adequate to store and analyze a limited number of air safety reports, larger carriers with a much greater number of such reports are likely to find that special-purpose safety data management systems will become necessary. These systems may also provide more sophisticated analytical tools, or better integration with other tools. The implementation of a human factors reporting system implies the need to be able to analyze the information provided by these reports. Likewise, the increasing use of flight data analysis (FDA) or flight operational quality assurance (FOQA) programs[1] requires the use of special-purpose tools to analyze the data obtained in these programs.

In response to the question of which tools their organization used, most respondents mentioned specific reports (e.g. air safety reports or human factors reports) or report data management systems, such as the Aviation Quality Database (AQD), Aviation Safety Information System (AVSiS), or British Airways Safety Information System (BASIS). A number of respondents reported that they were using various flight data analysis tools. Some respondents reported using Microsoft Excel or Access. These respondents noted that while these tools were easy to use, they also involved a lot of work entering data and transferring analysis results to reports. Only two respondents reported using advanced tools for analyzing human factors issues, such as the Aircrew Incident Reporting System (AIRS) or the Procedural Event Analysis Tool (PEAT).

The effective use of analytical tools is likely to depend, at least in part, on the training that FSMs have received. The survey results show that training of FSMs is very diverse, varying in duration from a

[1] The term *flight data monitoring* is becoming more widely used in place of flight data analysis. We have used the term flight data analysis throughout this report since that was the term used by most of the survey respondents.

one week course to a Masters program. Content of courses varies from accident investigation, human factors, crew resource management, and some analytical techniques. There appears to be a large amount of "learning while doing". However, most FSMs do not appear to have received much, if any, formal training directed at the effective use of analytical tools.

The effective use of analytical tools also depends on the availability of data and information to support and guide the analysis. This includes both internal data reported within the organization and external data sources that allow FSMs to place their internal data within a broader context, alert them to issues that they may need to watch out for, and provide guidance on particular analyses that they might undertake. Most respondents indicated that their airline had some form of air safety reporting system, while about half the respondents reported that their airline had the capability to perform flight data analysis. The extent and type of other internal data, such as human factors reports or a safety hot line, varied more widely across the different airlines. External data sources available to the FSM are as varied as the training, and there appear to be no generally used data sources. There is no formal system to support communications between different flight safety offices and no professional organization. In consequence, communication and sharing of information is often informal, although the responses from some regional airlines suggested more formal arrangements with their parent airline.

9. Conclusions

Many Flight Safety Managers (FSMs) appear to get limited advice about the analytical procedures to follow in carrying out their job. In addition to their personal education and experience, they tend to rely on guidance from outside sources, such as their parent carrier or industry associations.

Generally, flight safety offices do not appear to publish "safety summaries" which reflect an analytical assessment of safety threats ***and*** recognize the limitations of the tools and methods used. The limited coverage of the safety tools in use is commonly not well defined. Safety summaries tend to concentrate on aspects that are visible with the tools and methods used, and do not address other safety threats that are not readily apparent with the tools and methods in use. Many safety reports are simply event lists and trend statistics. This tends to result in a focus on the events themselves rather than the underlying risk factors, often limited to a rather short time period or to only certain types of event.

Many survey respondents expressed concern over inadequate resources to carry out their ***desired*** safety program. Adequate workforce and some of the basic tools are often lacking. Routine tasks take too much of their time. Other functions occupy time that could beneficially be used for analysis if more automated tools were available. Most FSMs indicated that the implementation of safety recommendations is adequate, but some noted that the follow-up could be improved.

The available tools are both an asset and a liability. Having the basic data sources (air safety reports and flight data analysis) is a significant advantage. On the other hand, the poor capabilities of the tools that are used to work with these data often result in the FSMs spending too much time on data entry and manual routines. Better tools would liberate time for more useful activities, as well as support more effective management of the information reporting process.

There are a lot of common problems affecting most FSMs, such as lack of compatibility of tools and data standards, and resource problems. Similarly, many reported positive factors are simply investments in good facilities and personnel. There are also "virtually free" positive factors, which could

be included in a list of "best practices". When survey respondents were asked how to improve flight safety management, their answers cover better tools, improved internal processes and changes in the organizational culture.

The stereotypic image of an FSM drawn by these results is a person who is trying to manage safety without a clear set of detailed objectives and priorities and with limited guidance about how to do the work. He has inadequate resources and is losing a lot of valuable time in less-productive routine activities. He has to concentrate on short-term actions, and does not have enough time for longer-term activities and higher-level analysis. FSMs who are equipped with a set of good state-of-the-art tools and some manpower can do their job quite well, even if they still suffer from lost time and limited resources, and often have to concentrate on short-term issues. Less common, FSMs with good tools and ample resources have the possibility to also undertake longer-term activities and work more proactively.

There is a need for effective automated tools that could help get the routine jobs done and allow more resources for analysis.

The primary differences between flight safety offices across different carriers were found to be:

- The office staff is very variable (number, full or part time, qualifications, analytical skills)
- Reporting culture in the airline
- Existing safety analysis and management tools
- Larger airlines suffer more from the extra tasks due to non-optimal tools, whereas the smaller ones are faced more with resource and funding problems.

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Appendix A

Survey Questions

Airline Flight Safety Management Survey

1) What kind of training has the flight safety office staff received?

2) What kind of advice did you get concerning HOW safety could be managed?
- Parameters to follow
- What is normal, what is not
- Tools to use, how to use them best

3) What is your safety management strategy in practice?
- Are you able to write it down
- Is it a personal one or has the company clearly defined one
- Are the management actions in practice in line with the safety management strategy

4) What are your data/information sources?
- What are their positive aspects
- What are their negative aspects

5) Which tools do you use?
- For what purpose do you use each tool
- How exactly do you use each tool

6) What are the positive and negative aspects of the tools?

7) What are your outputs and how are they disseminated in the organization?

8) Is the implementation of your safety recommendations adequate, in your opinion?

9) How is the current safety situation summarized?
- Regular written summaries? Who receives them?
- In someone's head?

10) What are your regular tasks (daily/weekly/monthly/yearly/etc.) in your safety manager role?

11) How is your flight safety office organized: organization, responsibilities, are staff full time or do they have flying duties too?

12) Which factors make your work easier or more difficult?

13) What takes too much time; what would you like to do more?

14) How could the safety management activities in your company be improved (tools, data, methods, etc.)?

15) Have you used the GAIN Operator's Flight Safety Handbook; is it useful?

Appendix B

Analysis of Survey Results by Question

The answers to each question were collected together from all interview sheets, and the conclusions written for each question separately. The results are as follows:

1) What kind of training has the flight safety office staff received?

In most cases, little training is received or consists of training courses specific to some special activities like accident investigation, biohazards, etc. It seems that analytical processes are very little addressed.

2) What kind of advice did you get concerning HOW safety could be managed?

- **Parameters to follow**
- **What is normal, what is not**
- **Tools to use, how to use them best**

In many cases, there is limited advice given about HOW to carry out the job of the FSM. Guidance is sought from the outside world (regional airline associations, ATA, etc.). Some interviewees mentioned the GAIN Operator Flight Safety Handbook.

Some respondents mentioned internal company guidelines. It is not known how detailed those guidelines are. One respondent answered: "keep passengers safe, no injuries; same for own staff and property". That is easy to say because it is so general. But the real question here is "do you get advice about ***HOW to achieve that in practice***". In this respect, it seems that many FSMs are almost starting from zero when starting the job.

We can conclude that knowledge about how to do the job comes mostly from the education and experience of the FSMs and the outside world. This suggests that there is a market for enhancing the FSM skills and knowledge about how to do the job well.

3) What is your safety management strategy in practice?

- **Are you able to write it down**
- **Is it a personal one or has the company clearly defined one**
- **Are the management actions in practice in line with the safety management strategy**

We can summarize the 15 answers as follows:

- Clear safety strategy, derived down to practices for tools and processes: **1** airline
  - "It is risk management. We are concentrating on the top 4 most likely and catastrophic accident types. We monitor their precursors and eliminate contributing factors"
- Implicit partial strategy, with some clear sub-elements: **3** airlines
  - "How can I prevent the bad accident from happening. The idea is to work on the lower part of the pyramid (incidents, errors, etc.). "
  - "Maximize incident reporting; find deficiencies. Use only internal data, do not talk about money, monthly committee recommends actions."
  - "We have to ask what are the big risks out there. Don't get confused by the details, follow ASR trends, listen to unofficial information from pilots, and put all that together. We are open to all risks."
- Several elements of an implicit strategy, i.e. some good practices, but no clearly stated strategy: **3** airlines
  - "Review ASRs, HFRs, audit outstations, talk a lot with pilots; i.e. find problems, and interact a lot with pilots."
  - "Identify risks, and eliminate system deficiencies."
  - "Proactively look for precursors to events that may lead to accidents."
- Something official written, but the details are unknown: **4** airlines
- No evidence of a safety management strategy: **4** airlines

In this respect, the flight safety community is still developing.[2] FSMs need to define a clear strategy of how to perform their mission, which today seems to be missing in many airlines.

[2] Flight safety managers and officers are not necessarily staying in the position longer than 2-3 years. They may also be doing the job as an additional job besides flying. This kind of setting does not facilitate the creation of a safety management strategy very well. And these people are absolutely necessary for writing the strategy, because it's about the practical aspects of the activity, not only high level mission statements.

4) What are your data/information sources?

- **What are their positive aspects**
- **What are their negative aspects**

The typical data sources (with some pros and cons mentioned by the survey respondents) are:

- Air safety reports, incident reports, sometimes also cabin safety reports
  - \+ Very good. We trust the system.
  - \+ Excellent
  - \+ Show us the risk areas. Also a follow-up tool.
  - \- Data entry and getting more information takes a lot of time
  - \- More used as a filing cabinet, not so much analysis
  - \- Manpower needed to enter and manipulate data, and to identify trends
- Human factors reports or confidential reports (in some cases)
- Reports from local civil aviation authority or ATC (in some cases)
  - +/- Valuable information from different perspectives. Time needed to write reports and distribute them.
- Other operational reports, like pilot reports (in some cases)
- Flight data (in some cases)
  - +/- Very good but sometimes it is not clear "why" something happened
  - \+ Everybody very happy
- Discussions during training sessions
- Other (more informal) discussions
- Surveys, questionnaires, audits
- Safety hotline (in some cases)
- Attending conferences, reading publications
  - \- FSF conference is too big, we don't go there
  - \- Generally, articles found in publications are sometimes doubtful, except maybe the ones from manufacturers
  - \- Some of the information is not applicable to us; hence it takes time to identify the related, useful information.
- Interaction with other operators, directly or through organizations
- Information from aircraft manufacturers
  - \+ Boeing gives some valuable data and their web site is an invaluable source of cross-reference data

It could be concluded that the information sources work more or less well. If the interviewees all had a clear strategy, they would be in a better position to judge if they get exactly the information they need. Today everybody is looking a bit everywhere.

The common point is that ***getting and processing*** the data takes time and effort. This is a potential area for improvement. It is also time consuming and resource intensive to distill the useful information from ***outside sources***: screening doubtful or non-applicable material, days spent in meetings and on

travel. Getting information from third parties (company internal or external, like ATC) can take a lot of time.

5) Which tools do you use?

- **For what purpose do you use each tool**
- **How exactly do you use each tool**

6) What are the positive and negative aspects of the tools?

The tools used as reported by the survey respondents are:

- Access and Excel, manual trending
- NTSB accident/incident database, very manual, no automated tailored searches
- ASR, HFR, FDA
- ASR
- ASR, FDA, AIRS
- Incident reporting system soon replaced by AVSiS, FDA
- Excel, PEAT
- AQD, FDA
- ASR, confidential reporting, FDA, surveys,
- ASR, FDA soon
- ASR, FDA, confidential human factors scheme
- AVSiS soon maybe AERO
- AQD, Reason's model, root cause analysis, others
- FDA, AvScan Flight for DFDR data, internal database for trending

Air safety reporting is definitely the first process put in place by the flight safety offices. Especially recently, the next is probably flight data analysis. Human factors reporting (usually confidential) is third.

In addition to the positive and negative aspects mentioned in Question 4, the following points were mentioned:

- Not user friendly for the type of analysis desired. Too much manual extraction. Switching from Access to Excel and then again to another format for the report writing.
- One has to be very clever to go from a database to publishing in a smart way.
- Very labor intensive to find the valuable information in a timely manner.
- Excel spreadsheet is easy to use, but requires regular updating, which is difficult with flight safety officers who are also flying.
- System too complicated. Should be linked to the ASR system.

The necessary tools are probably available. However, it takes too much time to use them (separately and together[3]). This may depend on the features of the tools, as well as on the skills and methods of the user.

[3] The better linking of different tools (including the taxonomies in them) is certainly one major area where improvement is needed.

7) What are your outputs and how are they disseminated in the organization?

Typical ways to record and distribute safety information mentioned by the survey respondents include:

- ASR and FDA digests (text and statistics)
- Confidential reports digest
- Cabin safety publication
- Bulletins informing about individual events (to pilots, to management)
- Safety newsletter
- Safety reports to management
- Safety recommendations
- Actions follow-up
- Audit reports
- Inputs to training programs
- Briefings to new pilots and pilots in recurrent training (same for cabin crew)
- Company safety seminars
- Web site
- Flight safety notice board

The information needs for these purposes can be quite different in terms of both content and format. The tools should support producing such information.

8) Is the implementation of your safety recommendations adequate, in your opinion?

Almost without exception, the answer is "yes". However, some respondents noted that follow-up of safety actions was not always well tracked. This could be addressed in several ways: tools, methods, industry best practices.

9) How is the current safety situation summarized?

- **Regular written summaries? Who receives them?**
- **In someone's head?**

None of the survey respondents appeared to talk about a safety summary as defined in this document (footnote on page C-1). Other kinds of summaries that are done include:

- Safety office keeps a running list of the five top safety items of concern
- A flight safety officer writes an article where main points are summarized
- Several companies produce event-based summary lists, possibly with statistics and pivot tables

Several respondents indicated that any summary is unwritten:

- In the head of the safety manager, but a line pilot might know more about safety concerns than the safety officers. Written format might even introduce legal problems.
- In someone's head
- People have their own summaries in their heads
- The closest we get are discussions between colleagues in the flight safety office

10) What are your regular tasks (daily/weekly/monthly/yearly/etc.) in your safety manager role?

Time is taken by:

- Monitoring incidents and reports, as well as flight data
- Writing regular reports and bulletins to pilots and to management
- Writing longer-term safety overview reports
- Reviewing reports and recommendations
- Closing out safety issues; immediate concerns and "ones from the pile"
- Updating safety records
- Editing and contributing to the flight safety magazine
- Overseeing flight ops monitoring activities
- Establishing and implementing policies (like non-punitive...)
- Planning
- Taking part in investigations and audits
- Lecturing in training sessions (recurrent or basic)
- Meetings: company-level, department-level, management and ad hoc
- Outside safety seminars, conferences
- Miscellaneous: updating manuals, developing a go-kit, etc.
- A lot of "fire-fighting"
- Losing time searching information (instead of working on the fixes)

It is clear that without the necessary resources, the FSM's job is very difficult.

11) How is your flight safety office organized: organization, responsibilities, are staff full time or do they have flying duties too?

The flight safety office staff varies a lot from one company to another. Usually it is a mixture of full-time and part-time people, where the latter are flying line pilots. In some cases the total staff is 2-4 persons, and in other cases it is 10-15, with many part-time members.

12) Which factors make your work easier or more difficult?

Any time-related matters are discussed in Question 13. The positive factors mentioned by the survey respondents include:

- Being a full time safety manager
- Adequate funding
- Good facilities
- Management support to get all necessary data
- Flight safety office very accessible to pilots, coffee and FS magazines available
- Being near operations and pilots
- Being part of operations makes incident investigation easier
- Good communication
- Dedicated people in the flight safety office
- Good team
- Having an assistant
- Delegation of investigation work to other departments
- An incident reporting tool
- FDA being done at the safety office
- AASES in the future
- AVSiS in the future
- Good tools
- Pivot table function in Excel is extremely useful
- Good IT support
- Work is independent

The negative factors mentioned by the survey respondents include:

- Lack of a tool for automated data exchange between operators
- Lack of compatibility between data elements from different systems
- Lack of standardization of reporting forms
- Inaccurate reports and data
- Lack of timely information
- Cases where one cannot get enough information
- Work volume
- Lack of personnel
- Not having an assistant
- Small team, sensitive to absences
- Never away from work because of mobile phone
- Lack of more safety analysis education
- Working with some chief pilots
- IT department is not easy to work with
- People who want to minimize everything; trying to make them face the reality
- Heavy flight schedule makes arranging pilot interviews difficult

Many of the important positive factors are simply investments in good facilities and personnel. But there are "virtually free" factors that can be included in the "best practices" list, e.g. the right location for the flight safety office.

Looking at the negative factors, one can see that many FSMs are suffering from industry wide problems like standardization and compatibility issues, where GAIN can be active. Many other factors are again reflecting the resources allocated to the flight safety office.

13) What takes too much time; what would you like to do more?

What takes too much time (quotes):

- Telephone conversations to get information
- Manual data entry from handwritten reports
- Manual rewriting of the data reports to correct the entries
- Correcting reports in the database
- Re-doing work done by others to get the English right
- A manual review of the monthly safety reports
- Database entry and correspondence duties
- Investigation and generation of the routine incident reports
- Flight department air safety report administration
- Interaction with the air safety management system
- Preparation for inspections
- Review of audit reports to determine trending
- Getting information from third parties
- Tracking down crewmembers for events that should have been reported and are now being questioned by the FAA
- Lack of secretarial help
- Getting funds

Would like to do more (quotes):

- Thinking, long-range planning, taking a more proactive mode
- Work on the area ahead of incidents: look at near-misses
- Data analysis and risk management
- Reviewing data and trending
- Investigating and auditing
- Reporting, collecting more reports
- Track more, if the solution corrected the problem
- Work on communication procedures
- Communicate about the flight safety work objectives
- "Advertise" flight safety activities (internal publications, etc.)
- Communicate to the management about flight safety matters

- Making the safety newsletter better
- Researching, reading
- Line-flying

Clearly, too much time goes to routines, and not enough to long-term planning, lower level events and to improving the quality of work and outputs.

14) How could the safety management work in your company be improved (tools, data, methods, etc.)?

Answers:

- Automated database input tool
- Internal web site for information dissemination
- Need the ability to gather and present information electronically
- Computerize routine work
- Automatic tracking of status of safety concerns
- An affordable BASIS-like tool
- Computing horsepower
- FDA system like LOMS
- ACARS
- FDA done in-house, not by an airline partner like today. Should be PC-based like LOMS
- Airbus FOM package could be interesting
- Easy analysis tool, a learning system if possible
- AIRS *(two responses)*
- Replacing our existing air safety reporting system
- Funds for upgrading the electronic database
- Resources: office space, personnel, analysis tools, computers and software
- Faster connection system for our laptops, working away from the office
- LOSA, coming soon
- Real time FDA, instant feedback on daily flights
- Risk management tools to assess risks before flights; for decision making
- Additional tools and staff
- Benchmarking data for FDA
- Airbus data is most welcome
- Tools are in place, now I need some time and ideas how to use them best
- Working methods should be documented in manuals
- More interaction and understanding of the work of the PMI and POI
- Work on area ahead of incidents: non-events with potential outcomes
- Human factors and quality assurance programs
- More talking to departments proactively: “what are your safety concerns”
- Going to line stations, flying, talk to training
- Maybe have an office in the dispatch to better reach aircrews

- Get all types of events reported
- New incident reporting form, integrating several old forms
- Time for management training and external events
- Credit for working at home or enroute and coming less to the office
- Decentralizing work more to departments, more open non-protective culture between departments
- More rapid dissemination to line pilots
- Giving more feedback to people
- More open reporting culture
- Changing the blame culture

The proposed improvements cover better tools, new or improved internal processes and changes in the organizational culture.

15) Have you used the GAIN Operator's Flight Safety Handbook; is it useful?

Ten responses:

- Very useful: 2
- Used certain parts: 3
- Did not know about handbook: 5

Appendix C

Analysis of Implications for Analytical Requirements and Methods

This analysis attempts to respond to the GAIN Working Group B work plan goal that motivated the conduct of the study:

> *Identify and document analytical requirements and methods to support airline safety management processes and procedures, including:*
>
> *(d) Safety management **analytical processes***
>
> *(e) Safety-related **data***
>
> *(f) Hierarchy of analytical **tools** needed for an airline flight safety office.*

In order to address this goal we attempted to derive answers to the following questions:

Analytical processes:

1. Are the analysis activities well mastered, or could GAIN help? Especially concerning:
   - Higher level analysis (general, not case by case)
   - Integrated, consolidated analysis (all data and information from all sources together)
2. Are the specific analyses well done (case-by-case, tool by tool)?

Question 1 is taking a more proactive approach to safety management, something that FSMs said they would like to do more. Part of such an approach would be a regularly published safety summary[4].

Data:

3. Is there a right balance of data coming from inside and from outside of the company?
4. Is data collection successful (reporting culture, framework, confidentiality issues)?
5. Is data quality good?

Questions 3-4 are trying to map where and how GAIN could help.

Tools:

6. Are data storing, processing and analysis capabilities acceptable?
7. What are the routines that should be automated?
8. What are the activities that are not done, or are done with difficulty because of non-optimal tools?
9. Can we identify typical needs of big airlines, and of small airlines?
10. What are the factors that make the introduction and use of a tool easy or difficult? Which tools demonstrate these factors?

[4] A good safety summary would include incidents and statistics/trends, but also conclusions about the reporting culture and the limitations of visibility of safety threats with the tools used. The summary should integrate all data/information to general conclusions about the current safety situation, strengths and weaknesses, and propose improvement actions. The focus should be "high-level, long-term" instead of usual short-term detailed safety reports.

Questions 6-9 are mapping the activities that need (better) tools. Question 10 tries to find out the desirable features for successful implementation of a new tool.

A second set of questions addresses the higher-level basic needs for effective Flight Safety Management:

11. Can the airlines ***measure*** their safety and ***control*** it. This involves data, tools, culture, decision making, management support, follow-up.
12. Do the airlines have a ***strategy***[5] for managing safety? If yes, are they able to realize the strategy ***with the existing tools***?
13. What could be the different safety strategies? What are the current ones, conscious or not?
14. How do FSMs learn ***how*** the job is done? How do they create the strategy? Is this taught anywhere?

Finally, we can list some hypotheses that we believe would demonstrate effective safety management in those organizations where they are found to be true. Based on the interview results, we can evaluate which of these appear to be widely true in practice and which are not.

Hypotheses:

- Companies clearly indicate to their FSMs what the company safety strategy should be
- It is possible to get training which enables FSMs to create a flight safety strategy and implement it effectively
- FSMs have a clear safety strategy
- FSMs are aware of the tools and methods available to help them in their job
- FSMs have the management support to get the needed tools, training and workforce
- Good flight safety strategies can be adequately implemented with existing tools
- FSMs know how to get the best out of their tools
- FSMs have the time and workforce they need for adequate performance
- FSMs have time to do case-by-case studies and manage short term issues
- FSMs have time to do proactive higher level analysis
- FSMs have time to follow up previous actions

[5] The strategy is the ***way*** to manage safety. This is a choice, hopefully based on good reasoning. For example; one FSM could argue that ***active errors*** are not as critical as ***latent threats***, and choose detecting latent threats as his strategy. He would emphasize questionnaires and in-depth audits throughout the organization, but not implement Flight Data Analysis and similar tools, because in his opinion they mainly identify active errors. Another FSM might decide to concentrate on the statistical top three most deadly accident types and tune all his tools to detect precursors to those accident types, ignoring the rest. A third FSM might argue that everybody is just concentrating on problems, whereas his strategy will be to work on the positive aspects of safety, not doing any measurements, but investing a lot in training and discussions with pilots - communicating lessons learned about effective safety measures, etc.

Results

1. Are the analysis activities well mastered, or could GAIN help? Especially concerning:
   - Higher level analysis (general, not case by case)
   - Integrated, consolidated analysis (all data and information from all sources together)

This area is underdeveloped. Truly global safety summaries are not produced. Even shorter term event-based summaries are done only in less than half of the interviewed airlines. See footnote on page C-1 and Q9 on page B-5.

2. Are the specific analyses well done (case-by-case, tool by tool)?

This is almost the core business of flight safety offices. They analyze events and often publish event summaries and digests. However, it is not possible to answer this question based on the material collected through these interviews.

3. Is there a right balance of data coming from inside and from outside of the company?

Not possible to answer based on interviews.

4. Is data collection successful (reporting culture, framework, confidentiality issues)?

There seem to be significant differences in the reporting cultures of different airlines. Otherwise, the data collection seems to work acceptably with the basic channels (ASR, FDA, HFR), except that the work takes too much time and effort; it is too manual. Answers to Q13 and Q12 are very revealing. The lack of data standards and taxonomies makes the work more difficult. Confidentiality concerns are not mentioned as problems.

5. Is data quality good?

Incorrect data and English, inaccurate reports and not enough information are mentioned as problems with reporting. FDA is perceived positively, however acknowledging that often it tells "what" but not "why".

6. Are data storing, processing and analysis capabilities acceptable?

Data entry, checking, processing and analyzing data takes too much time and manpower. Tools do not support the easy creation of needed presentation formats.

7. What are the routines that should be automated?

Data entry, validation of data and correct language, data queries to third parties, tailored searches, trend identification, switching data from one application to another, updating between applications, creation of needed presentations and reports, data exchange between operators, follow-up of safety actions and status of safety concerns were mentioned.

8. What are the activities which are not done, or are done with difficulty because of non-optimal tools?

As previous answers indicate, existing tools being used by the survey respondents are not supporting basic FSM activities in an optimal way. Many airlines have difficulties in carrying out some activities, simply because the needed tool is missing; typically, it is not possible to do FDA without the related equipment and software. Other examples are air safety reporting, human factors reporting and interaction with other operators. Linking information from the ATC or the local civil aviation authority to the airline reporting system is an area where no respondents indicated that any tools were in use.

9. Can we identify typical needs of big airlines, and of small airlines?

Big airlines suffer more from the manual work linked to non-optimal tools and processes, such as correcting reports and searching relevant data. ***Small*** airlines need most of all funds for tools and resources in general. They also need outside benchmarking, and they have more concerns with building up the necessary skills, knowledge and experience, and guaranteeing anonymity and confidentiality.

10. What are the factors that make the introduction and use of a tool easy or difficult? Which tools demonstrate these factors?

The interviews do not provide much material to answer this question. However, it is clear from the previous answers that the tools have to be as automated as possible, compatible with each other, and support the creation of needed reports and presentations.

11. Can the airlines ***measure*** their safety and ***control*** it. This involves data, tools, culture, decision making, management support, follow-up.

The limited coverage of safety tools did not appear to be commonly understood or was neglected. This could severely handicap the FSMs in their ability to assess the current safety level of their airline operation. Airlines using a combination of data sources, like air safety reporting, flight data analysis and confidential reporting are in a better position to understand their safety situation.

Given the limitations on ***measuring*** safety levels, it becomes less relevant to discuss the ***control*** aspects of safety management. It seems that even the current tools can support a good measurement of safety, when their limitations are understood and the price of high manual workload is paid, and the airline management is perceived as supportive of safety actions. However, some respondents indicated that follow-up on safety actions – the verification that actions are implemented and that they bring the desired improvements – could be improved.

12. Do the airlines have a ***strategy*** for managing safety? If yes, are they able to realize the strategy ***with the existing tools***?

Airlines that have a real safety management strategy (not just a defined safety mission) seem to be extremely rare. But when there is a strategy, the existing tools appear adequate to enable the airline to implement its strategy effectively.

13. What could be the different safety strategies? What are the current ones, conscious or not?

See footnote on page C-2 for some examples of possible safety strategies. Even when limited to a realistic choice of a safety strategy, there are still several quite different possible alternatives. In the real world, very few airlines have a clear safety management strategy – among the 15 interviewed only one had a fully articulated strategy. The unwritten and perhaps unconscious strategy of the others is something like: "try to find safety problems in the areas most visible with the existing tools, try to launch actions to fix those problems. Communicate about safety to pilots; follow what's happening outside."

14. How do FSMs learn ***how*** the job is done? How do they create the strategy? Is this taught anywhere?

Many FSMs get very limited advice about analytical procedures to follow in carrying out their duties. There may be a safety mission statement (which is quite obvious anyway), but detailed strategy is often missing. The interviews do not indicate if any training anywhere addresses the strategy issue.

Validation of hypotheses:

- Companies clearly indicate to their FSMs what the company safety strategy should be ***NO***
- It is possible to get training which enables FSMs to create a flight safety strategy and implement it effectively ***NOT ANSWERED***
- FSMs have a clear safety strategy ***NO (EXCEPT VERY RARELY)***

- FSMs are aware of the tools and methods available to help them in their job ***NOT ALL***
- FSMs have the management support to get the needed tools, training and workforce ***NO***
- Good flight safety strategies can be adequately implemented with existing tools ***YES***
- FSMs know how to get the best out of their tools ***NOT ANSWERED***

- FSMs have the time and workforce they need for adequate performance ***NO***
- FSMs have time to do case-by-case studies and manage short term issues ***GENERALLY YES***
- FSMs have time to do proactive higher level analysis ***GENERALLY NO***
- FSMs have time to follow up previous actions ***GENERALLY NO***

What kind of image can be drawn about the FSM activity based on the extent to which these statements were found to be true? The first three statements are the necessary conditions for having a strategy. Their overall outcome suggests that most FSMs do not have a clearly defined flight safety management strategy, whatever the answer to the second statement would be. The next four statements are about the tools. Their message is that having the right tools makes a big difference. Once you have the tools, you can implement your strategy, even with the existing tools. But you have to be aware of the existence of the tools. The last four statements are about the resources. They indicate that generally FSMs have time to do short term actions ("fire-fighting") but not address longer term issues, nor do effective follow-up of safety actions.

The typical FSM is thus a person who may have the basic tools, but is trying to manage safety without a clear strategy to guide and prioritize analysis activities, lacking resources, concentrating on short-term actions, and not having the time for longer term projects, higher level analysis or follow-up.

Appendix D

List of Acronyms

AASES	ATA Aviation Safety Exchange System
ACARS	Aircraft Communication Addressing and Reporting System
AERO	Aeronautical Event Reports Organizer
AIRS	Aircrew Incident Reporting System
AQD	Aviation Quality Database
ASR	Air safety report
ATA	Air Transport Association of America
ATC	Air traffic control
AVSiS	Aviation Safety Information System
BASIS	British Airways Safety Information System
DFDR	Digital flight data recorder
FAA	Federal Aviation Administration
FDA	Flight data analysis
FOQA	Flight operational quality assurance
FOM	Flight Operations Monitoring
FSF	Flight Safety Foundation
FSM	Flight safety manager
HFR	Human factors report
IT	Information technology
GAIN	Global Aviation Information Network
LOMS	Line Operations Monitoring System
LOSA	Line oriented safety assessment
NTSB	National Transportation Safety Board
PC	Personal computer
PEAT	Procedural Event Analysis Tool
POI	Principal Operations Inspector
PMI	Principal Maintenance Inspector