Example Application of Aviation Quality Database (AQD)

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Preface

This example application has been prepared by Superstructure in conjunction with the Global Aviation Information Network (GAIN) Working Group B (Analytical Methods and Tools) (WGB) as one of a number of such examples of the use of analytical methods and tools described in the "*Guide to Methods & Tools for Airline Flight Safety Analysis*". The intent of these example applications is to illustrate how various tools can be applied within an airline flight safety department, and provide additional information on the use and features of the tool and the value of such analysis. GAIN WG B hopes that these example applications will help increase the awareness of available methods and tools and assist the airlines as they consider which tools to incorporate into their flight safety analysis activities.

Each example application of an analytical method or tool is posted on the GAIN website (*www.GAINweb.org*). Readers are encouraged to check the website periodically for a current list of example applications, as further examples will be added as they become available.

A.1 Aviation Quality Database

1 Introduction

1.1 OVERVIEW OF THE TOOL FUNCTIONALITY

The Aviation Quality Database (AQD) is a comprehensive and integrated set of tools to support Safety Management and Quality Assurance. Functional components include:

- Occurrence/Incident Report capture using customisable data entry forms and an optional Web Interface
- Investigation tracking and management
- Investigation Result capture, including Causal Factors, and the distribution of results
- Audit Program development including customisable check lists
- Audit scheduling and management
- Audit Result capture, including Causal Factors, and the distribution of results
- Corrective/Preventive Action tracking and management
- On line Enquiries for Occurrences, Investigations, Audits, Findings and Actions
- Management status and summary reports
- Analysis tools.

Features include e-mail interfaces, support for multi media attachments, customisable codes for analysis, interfaces to Word and Excel and full on line help.

Although used primarily by Airlines, AQD is also used by other sectors of the Aviation Industry, such as Airport Operators, Maintenance Organizations and Air Traffic Service Providers.

1.2 INTRODUCTION TO THE EXAMPLE APPLICATION

The following sections present a case study of how AQD is currently being used by a real airline. This airline is a domestic operator, which started operation only several months before the time of writing. The data shown in the example has been de-identified.

It should be kept in mind while reviewing this case study that AQD has a number of customisation facilities and configuration options that alter the way AQD can be used, including the values used for categorization. For example, AQD can be configured to not require the entry of Causal Factors if this does not suit the organisation, or should it wish to phase in their introduction. The Causal Factors can also be customised, allowing methodologies such as TapRoot and Boeing's MEDA to be adopted instead of the James Reason model codes referred to.

2 Input Data

Our two main sources of data for AQD are from occurrence reports or reports highlighting deficiencies that are reported both internally or externally, together with the outcome of any resulting investigation. The second is from quality or safety audits and other such inspections.

2.1 OCCURRENCES

2.1.1 Occurrence Reports

We use a series of paper forms to allow staff to capture and submit various Occurrences, both safety and quality related. These reports are then entered in to AQD as an occurrence report. We have not yet purchased the AQD Web Interface to allow report submission to be done electronically.

We have customised the categorization of these occurrences in AQD to suit the way we wished to analyse them. Our organisation presently utilises our regulatory Authority's classification for occurrences that are required to be notified to the Authority (mandatory occurrence type, or MOR, in flow diagram shown in Figure 1 below). In addition, we use a System Improvement Report to report on other occurrences and deficiencies within the organisation, and an Accident Report to report on Occupational Health and Safety occurrences. Both of these have various sub-categories (called Event Descriptors, and again customised to suit our needs) so that the reports can be further broken down for analysis purposes.

Once the occurrences are entered in to AQD, we make an assessment as to whether an investigation is required. If so, the functionality of raising an investigation is straight forward, and the investigation is assigned to an investigator that has been trained in this function.

The flow diagram shown in Figure 1 (from our existing procedure manual) details how this information is obtained, entered into AQD and attached to an investigation. The next step in this process, shown in the flow chart for Para 3.4 of the procedure manual in Figure 2 below, is described in the next section.

Two examples of occurrence reports for which investigations were raised are shown below, and will be followed through the process in the remainder of this example.

- Enroute from XXX-YYY, we were slowly overtaken by a B747 which was vectored around us direct to ZZZZZZZZ. Despite being progressively slowed both in cruise and descent, at ZZZZZZZZ we were directly behind and above the 747, and concerned with possible wake turbulence, we queried ATC as to the separation. The answer given was about 6 nm, although our TCAS indicated possibly less than this, and our descent profile was held purposely high. Shortly after, we encountered moderate wake turbulence, our aircraft rolling rapidly right. Roll was stopped at about 40 degrees AOB with full left aileron. The aircraft then rolled rapidly left to about 30 degrees AOB. Power was applied and the rate of descent reduced to depart the wake turbulence area. ATC were informed and the aircraft continued for landing. There were no injuries.

  Event Descriptor: "Operational incident, Other loss of control"

- During pushback from Stand 21, at the disconnect point, the tow bar safety pin sheared. The engineer on headset called for the brakes to be parked, but the captain, not realising that the pin had sheared, refused to park the brakes as the aircraft was still moving. The aircraft rolled forward over the towbar, and the radome was punctured by the tractor mirror frame.

  Event Descriptor: "Operational incident, Collision/strike - vehicle"

Both of these incidents were classified within AQD as severity – "major" but probability of recurrence – "low". They were therefore classified as low risk, but an investigation into both incidents was carried out.

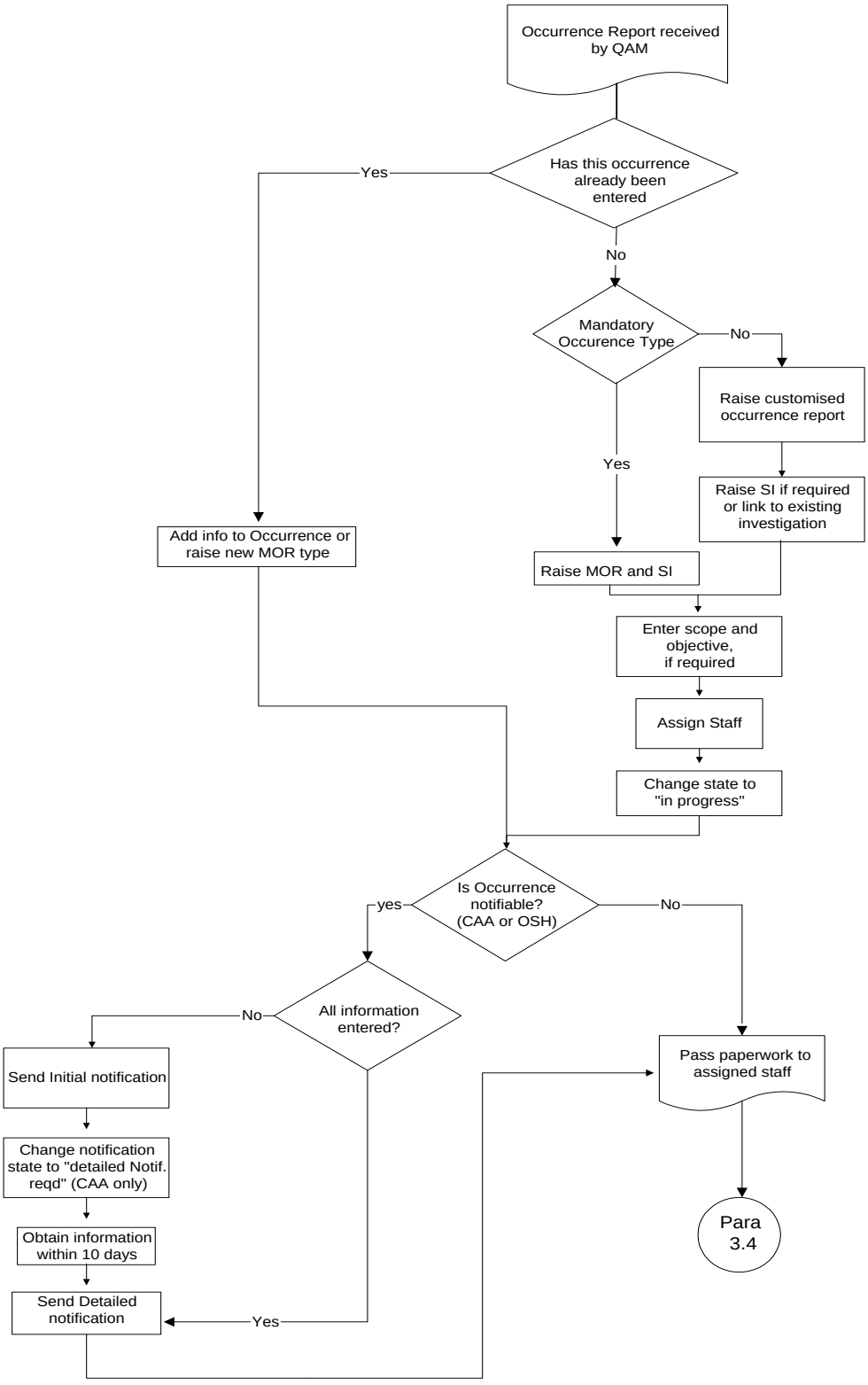
Occurrence Report received by QAM
Has this occurrence already been entered
Yes
No
Mandatory Occurence Type
No
Raise customised occurrence report
Yes
Raise SI if required or link to existing investigation
Add info to Occurrence or raise new MOR type
Raise MOR and SI
Enter scope and objective, if required
Assign Staff
Change state to "in progress"
Is Occurrence notifiable? (CAA or OSH)
yes
No
All information entered?
No
Send Initial notification
Change notification state to "detailed Notif. reqd" (CAA only)
Obtain information within 10 days
Send Detailed notification
Yes
Pass paperwork to assigned staff
Para 3.4

Figure 1

2.1.2 Investigations

Once the investigation was conducted, the report was entered into AQD using a customised Word template, which automatically picked up some of the information from the AQD database. At this point the Findings and corresponding corrective Actions were also entered in to AQD. As part of this process, Causal Factors were identified, using the James Reason model. We have configured AQD to record Casual Factors as we find that this approach is advantageous - users are forced to classify the Causal Factor before being able to record the Action, which is important for effective determination of Actions. The Causal Factors are also very important for subsequent analysis, as shown in Section 3 below. We have found that consideration should be given to training staff who are entering Causal Factors so that a standardized classification is used to increase the value of the output data.

Shown on the next page is a flow diagram outlining how the investigation results and findings are entered, how the relevant authorities are notified and the closure of the investigation. Although the investigation may be closed, the action items continue to be tracked separately through to closure, which is shown on a subsequent flow chart.

The following example shows the Findings, Causes and Actions from the first occurrence noted above.

Finding: F28-03

Our Boeing 737 encountered quite severe wake turbulence, following a 747 in descent, despite being correctly separated.

Department:	***Flight Operations***		
Entered By:	***Name removed***	*Date Discovered:*	***99/99/99***
Category:	***Safety Related Concern***	*Severity:*	***Major***
Rule Ref:		*Likelihood:*	***Low***
Manual Ref:		*Risk:*	***Low***

Cause: 1

There are no wake turbulence separation minima set for aircraft in descent.

Person/Org:	***ATS Provider***
Category:	***Organisation Factors***
Item:	***Inadequate specifications/requirements***

Action: **A32-03** *Due: **99/99/99***

The ATS provider is to issue an instruction, requiring controllers to advise aircraft of possible wake turbulence in the situation where a medium aircraft is following a heavy.

Type:	***Preventive***	*Status:*	***Closed***	*Registered On:*	***99/99/99***
Department:	***ATS provider***			*Closed On:*	***99/99/99***

Action: **A33-03** *Due: **99/99/99***

Airways will bring this up during the next user meeting, to ascertain if operators wish to have a wake turbulence minima imposed on them in such cases.

Type:	***Preventive***	*Status:*	***Closed***	*Registered On:*	***99/99/99***
Department:	***ATS Provider***			*Closed On:*	***99/99/99***

Para 3.4 continued from Para 3.3

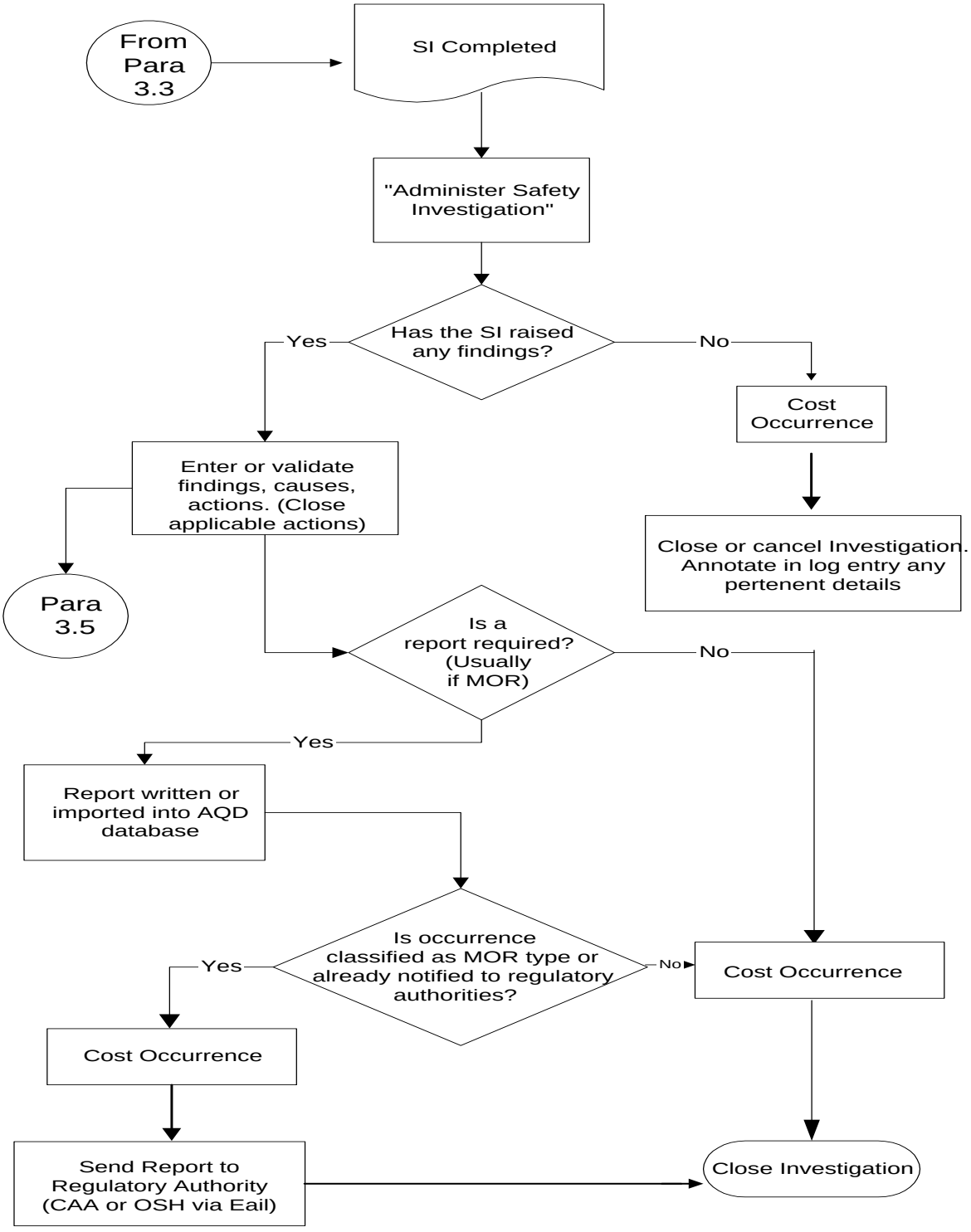

Figure 2

The second occurrence was investigated jointly by ourselves and our contracted ground handling agent. The outcome was that the tug was inadequate for the task and the towbar had unacceptable wear on the coupling. These were raised as findings within their system and were not included in ours. However, an additional finding regarding cockpit to ground communications was raised by ourselves and is shown below:

Finding: F36-03

Ground handling agent do not have an emergency stop command to be used during pushbacks.

Department:	***Ground handling agent***		
Entered By:	***Name removed***	*Date Discovered:*	***99/99/99***
Category:	***Safety Related Concern***	*Severity:*	***Major***
Rule Ref:		*Likelihood:*	***Medium***
Manual Ref:		*Risk:*	***Medium***

Cause: 1

This was omitted during the development of the computer based manual, as it was not recognized as being necessary.

Person/Org:	***Unit Mgmnt/supervisory (Acft Operator)***
Category:	***Local Error Factors***
Item:	***Risk misperception***

Action: **A42-03** *Due:* ***99/99/99***

Ground handling agent are to develop and advise *operator* of an emergency stop command to be used during pushback for abnormal occurrences.

Type:	***Corrective***	*Status:*	***In Progress***	*Registered On:*	***99/99/99***
Department:	*Ground handling agent*			*Closed On:*	

2.2 AUDITS

Our annual audit program has been set up as a series of Audit Modules within AQD. These modules are then activated when due (using the AQD scheduling tools) and are assigned to trained auditors. The audit check lists have also been set up in AQD. Rule references, Manual references and ISO categories have been assigned to each checklist item, thereby preventing this from having to be done at each audit. The checklist can be modified at any time, but has the advantage of providing a stable base so that each subsequent audit is carried out against similar guidelines.

When preparing for an audit, we use AQD to view all the relevant data for the department about to be audited. This includes all Findings and Actions raised during and since the last audit, including as a result of investigations into occurrences.

After the audit has been conducted, the audit report is entered into AQD, along with any Findings that were raised during the audit. The process for identifying the Findings and Actions follows standard audit practices. AQD however uses the same Causal Factor process for audits as it does for investigations, and therefore Causes are identified as well. This means that the Causes from both processes can be combined for analysis.

The following flow diagram shown in Figure 3 details how our organisation handles the audit process. Not all steps are done within the AQD system – those that are done using AQD are marked with an *.

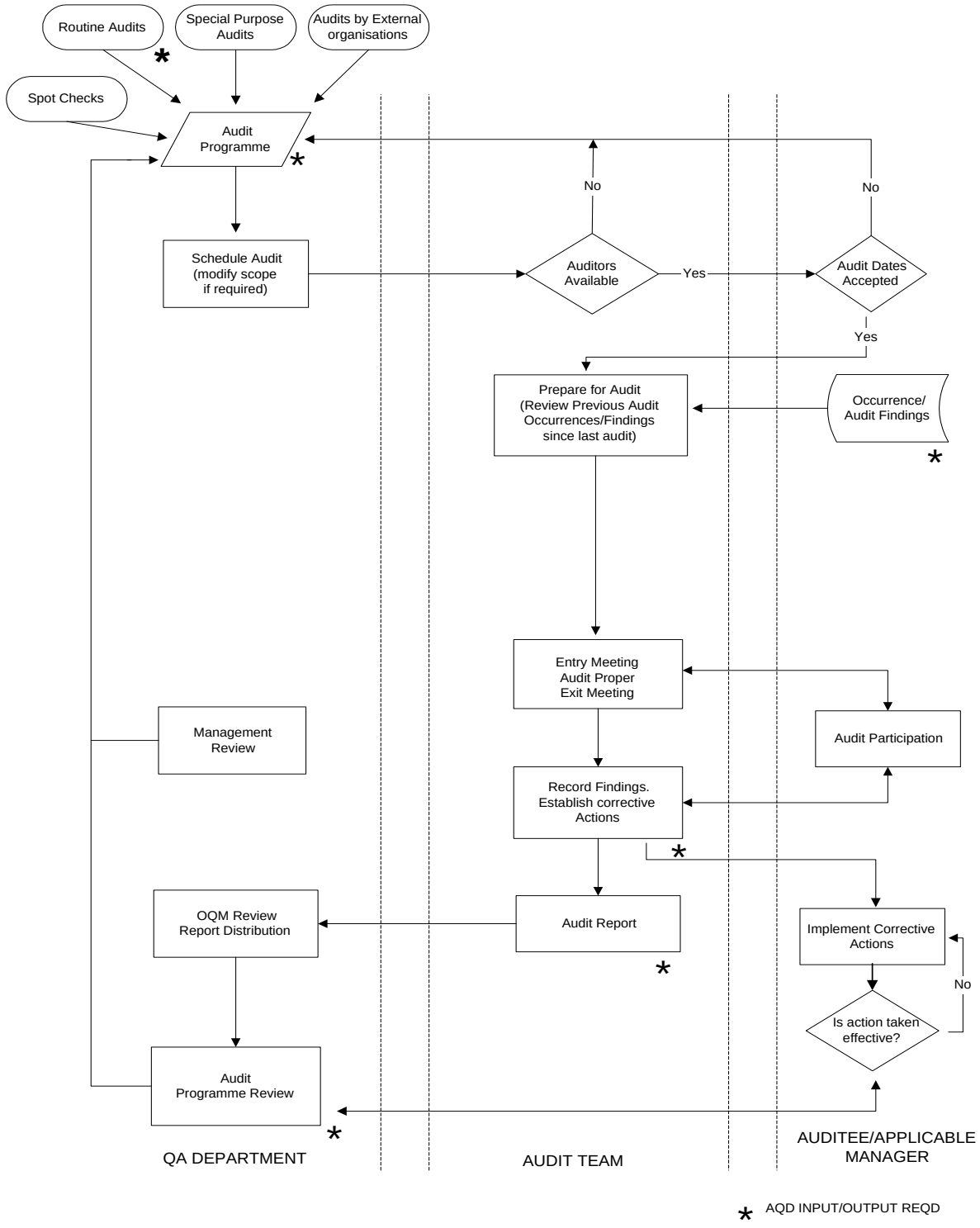

Figure 3

Actions that are entered into AQD from all sources are treated in the same fashion, and are tracked using the AQD reports until evidence is received that the action can be closed.

When the action is closed, it is still the responsibility of the responsible manager to monitor and ensure that the action is being effective in preventing a recurrence. This is also backed up during audits, in that all actions raised against the auditee since the last audit are assessed during the audit for effectiveness. The following flow diagram from our manual, shown in Figure 4, details the action closure process we have adopted.

Para 3.5, continued from Para 3.4

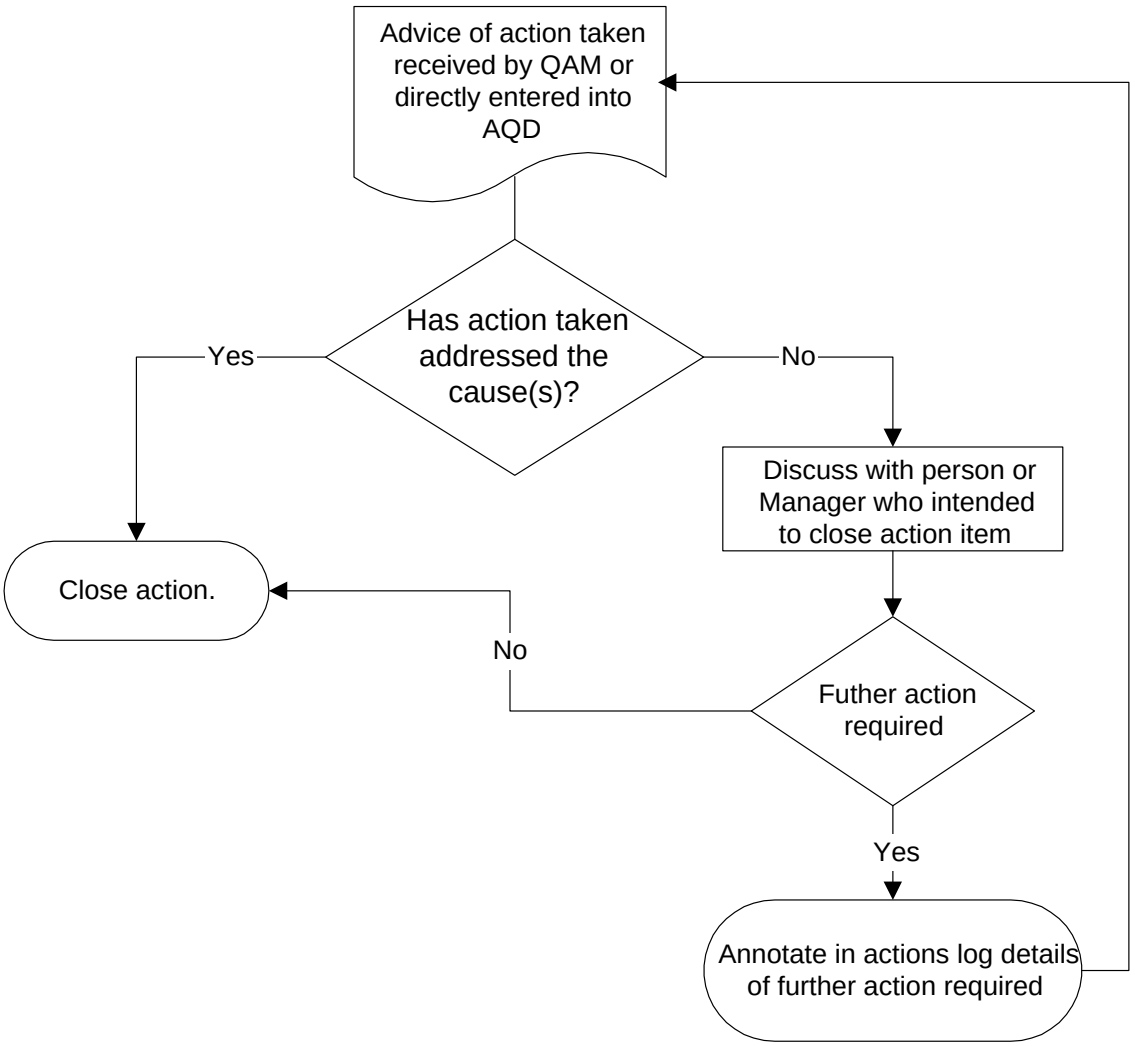

Figure 4

3 Tool Output and Application of the Results of Analysis

On a monthly basis we monitor our Occurrences by type to look for trends, or unexpected peaks. Shown below in Figure 5 is the form we use to request the graphs, while Figure 6 shows the output we receive:

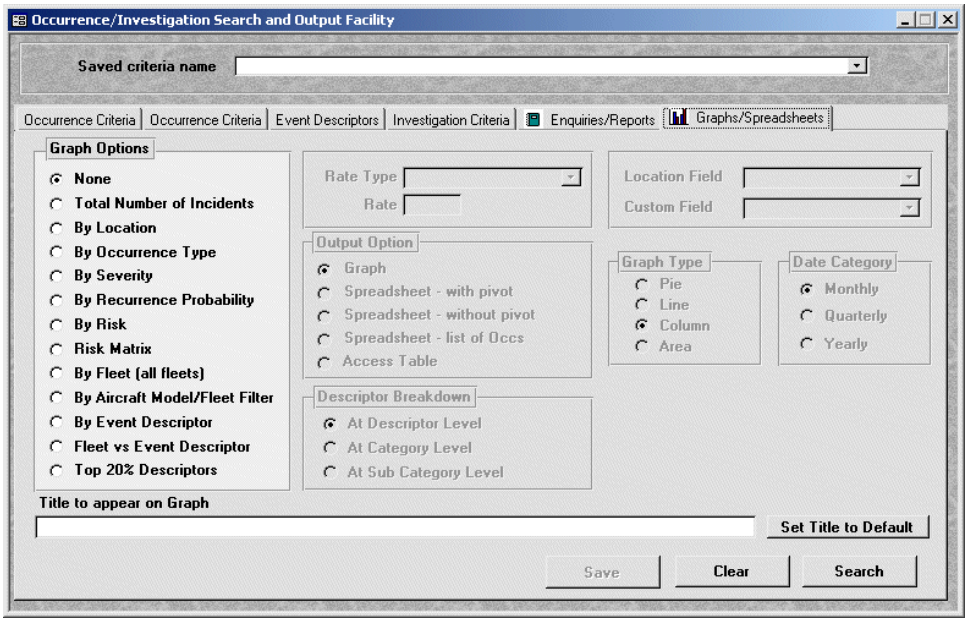

Figure 5

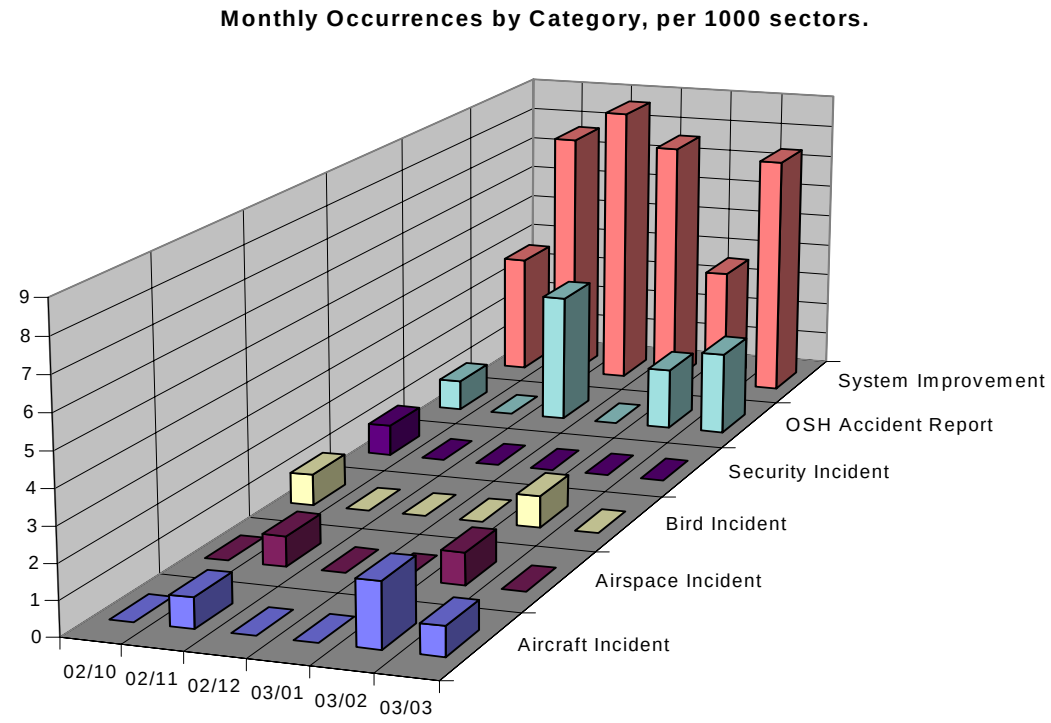

Figure 6

As can be seen our System Improvements are our main category of occurrence. We then analyse this by Event Descriptor to ascertain if there are any areas in this category that are of concern. The chart is shown below in Figure 7.

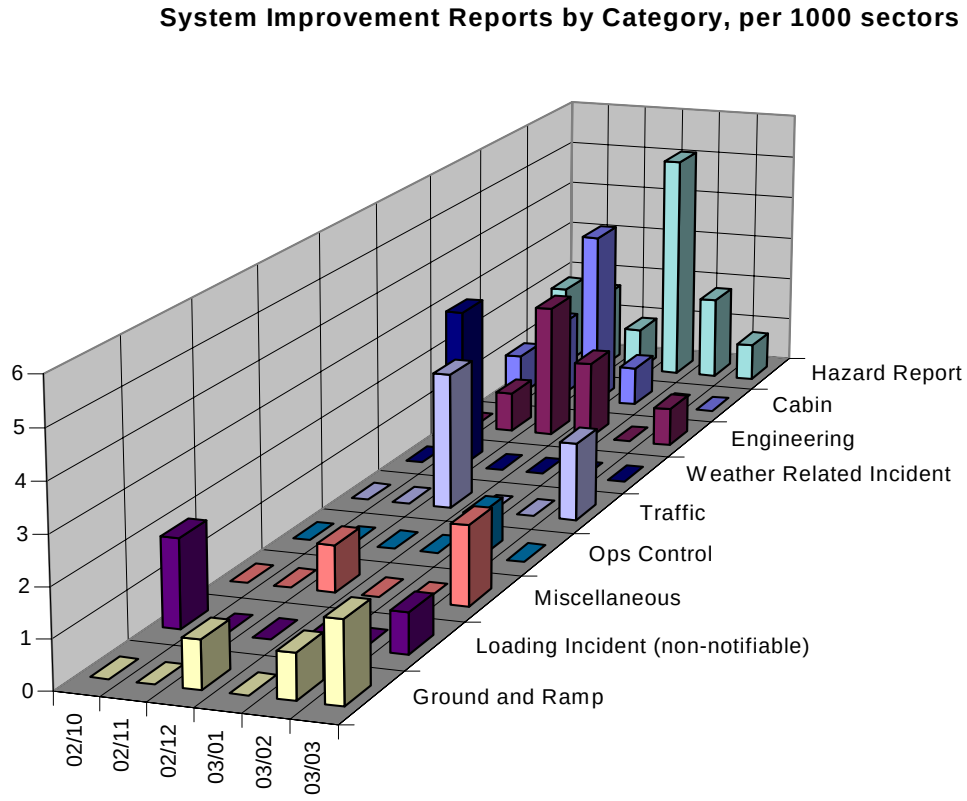

Figure 7

As can be seen by this chart, the hazard reports, which are the pro-active reports, are steady, but could be improved. The only other category which is giving concern at this stage is ground and ramp incidents, which are increasing and are being monitored. Miscellaneous reports, due to there higher than normal occurrence, were individually assessed, but there were no common incidents evident.

We also look at causal factors that are allocated with findings. The predominant output used is a Pareto analysis of the causal factors, which highlight the 20% most common causal factors. Figure 8 shows the form used to generate causal factor statistics.

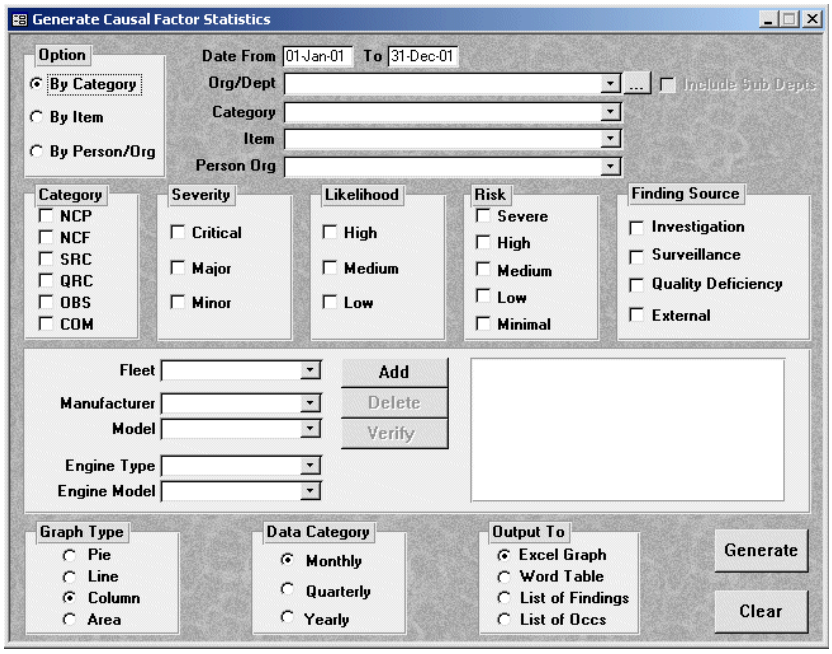

Figure 8

The following graph (Figure 9) shows the resulting output:

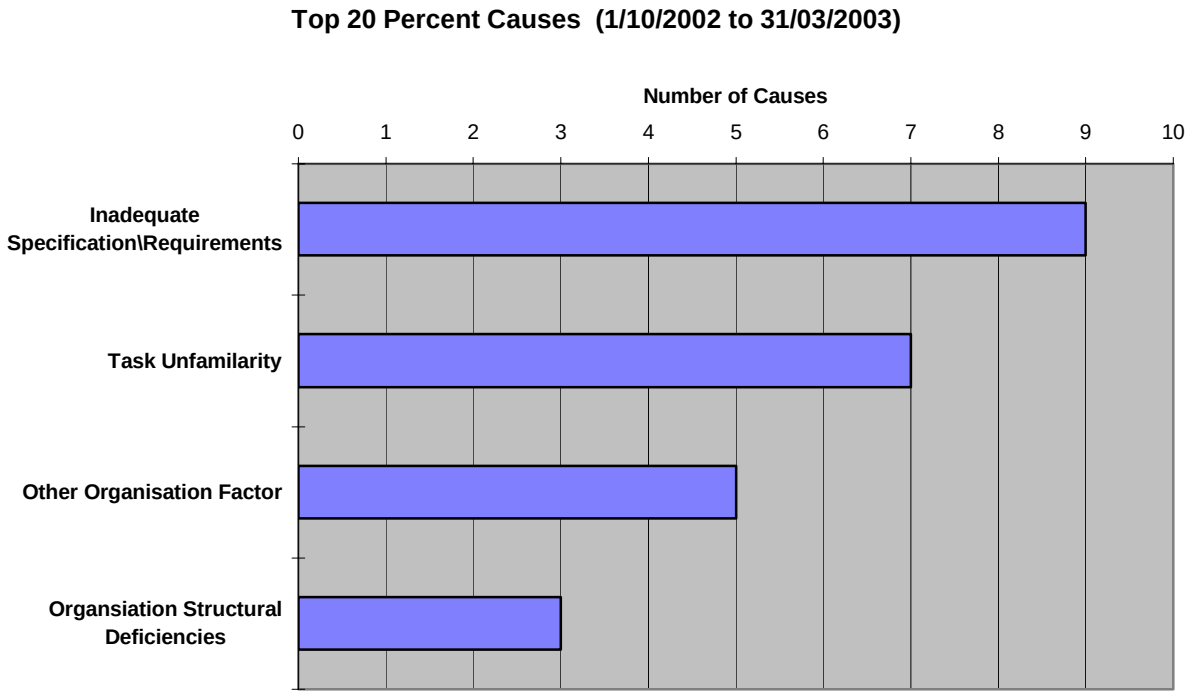

Figure 9

This highlights that at present our main issue is inadequate specifications or requirements. This can be further broken down to see where in the organization these issues are occurring. Figure 10 below shows a breakdown of causal factors against persons or organizational levels.

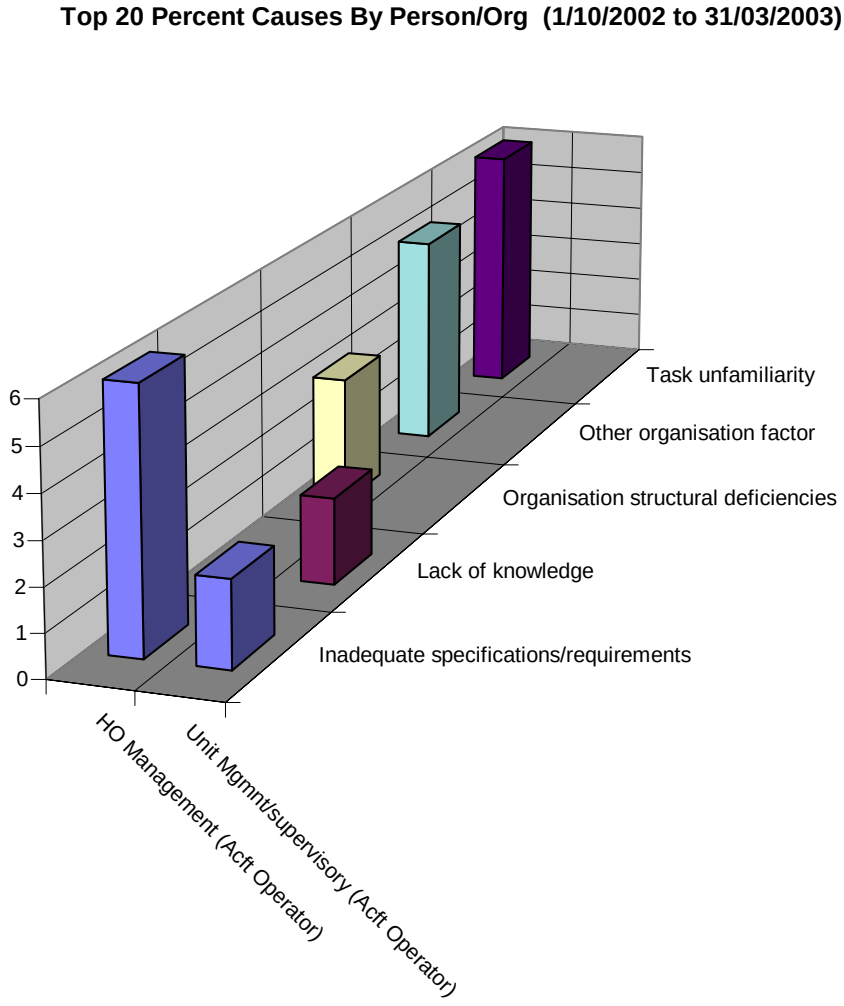

Figure 10

As can be seen, the main area of inadequate specifications is with head office management. This chart also shows that task unfamiliarity is also a high factor in head office management. As our organisation is in its infancy, these results are not surprising, but must be considered by management. These graphs were therefore presented and discussed at our monthly Quality, Risk and Safety Meeting and action plans have been put in place to address these. Any major actions arising from this meeting are documented in AQD to be managed along with the Actions arising from audits and investigations.

The implementation of these action plans will hopefully result in a reduction in the number of causal factors in this area – AQD will be used to produce a trend over time for a given causal factor to illustrate the degree of success.