Example Application of Microsoft Excel

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Preface

This example application has been prepared by Airbus 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.

Microsoft Excel

1 Introduction

1.1 OVERVIEW OF THE TOOL FUNCTIONALITY

Excel is a flexible too which can be used for many purposes and in many different ways. A brief overview of the general functionality of the software is provided earlier in this Guide in Section 3.2. Since most readers will already be familiar with the general use and capabilities of the software, this will not be repeated here. However, some more advanced features, which readers may not have used before, are discussed in the example application below.

1.2 INTRODUCTION TO THE EXAMPLE APPLICATION

This example illustrates one potential use of Excel for safety analysis in an airline environment.

In a very small-scale flight operation it may be possible to perform the safety analysis using only paper reports and no formal analysis software, at least for some time. On the other hand, in a large operation, this is impractical and special-purpose data management and analysis tools become necessary. In between the two situations, a fairly simple approach using general-purpose software, like the one described here, may provide the transition from a manual system to a more advanced tool. The aim of this example is to show how some Excel functions can be used to make the data management and analysis task significantly more efficient and reliable than when done manually. Most organizations already have Excel (or a similar tool), which means that there is no extra cost in starting to use it more efficiently.

In the example, the airline has collected data on safety related events, and is inputting the data to an Excel table. We will follow, step-by-step, how Excel can be used at the different stages of the analysis process: data input, analysis, output, and application of the results. The example does not by any means try to be exhaustive in demonstrating Excel functions; the idea is to show some examples and to encourage the reader to discover more.

2 Input Data

It is assumed that the flight safety office receives the source reports (e.g. Air Safety Reports) on paper. The criteria for filing a report have been specified by the airline (and the aviation authority, as some of these reports may require Mandatory Occurrence Reporting to the authority). The responsibility of the flight safety office (and the Flight Safety Manager in particular) is to ensure that all reports are correctly processed, all concerns in them are addressed and all necessary corrective actions take place.

This requires two different analysis processes to be run in parallel: a case-by-case analysis to analyze all significant reports one by one, and another process to treat all the reports together for identifying any worrying patterns, e.g. problem airports.

In this example, the airline is collecting Air Safety Reports (ASRs), which all have a reference number in the format “nn/yy/ttt” where nn is a running number, yy is the year and ttt is the aircraft type. The reports come from different departments of the airline. The data need to be analyzed both case-by-case and with a longer-term cumulative perspective.

In order to provide a means to identify similar situation in the data, it is common practice to define a set of common keywords or descriptors. The keywords or descriptors can be very detailed items or rough categories, also depending on the quantity of the data and the chosen analysis method. They usually evolve in time, making it necessary to make updating them easy. In this example, the airline is using quite broad descriptors (like "crew meals quality" or "navigation database") and also inputs the flight phases during which the event was caused and took effect. For case-by-case investigation and follow-up, the airline needs to assign a responsible person for each event (i.e. report) and track the status of the investigation and agreed actions.

Data input should be fast, easy and reliable. A typical tabular display of the ASR data is presented in Figure 1.

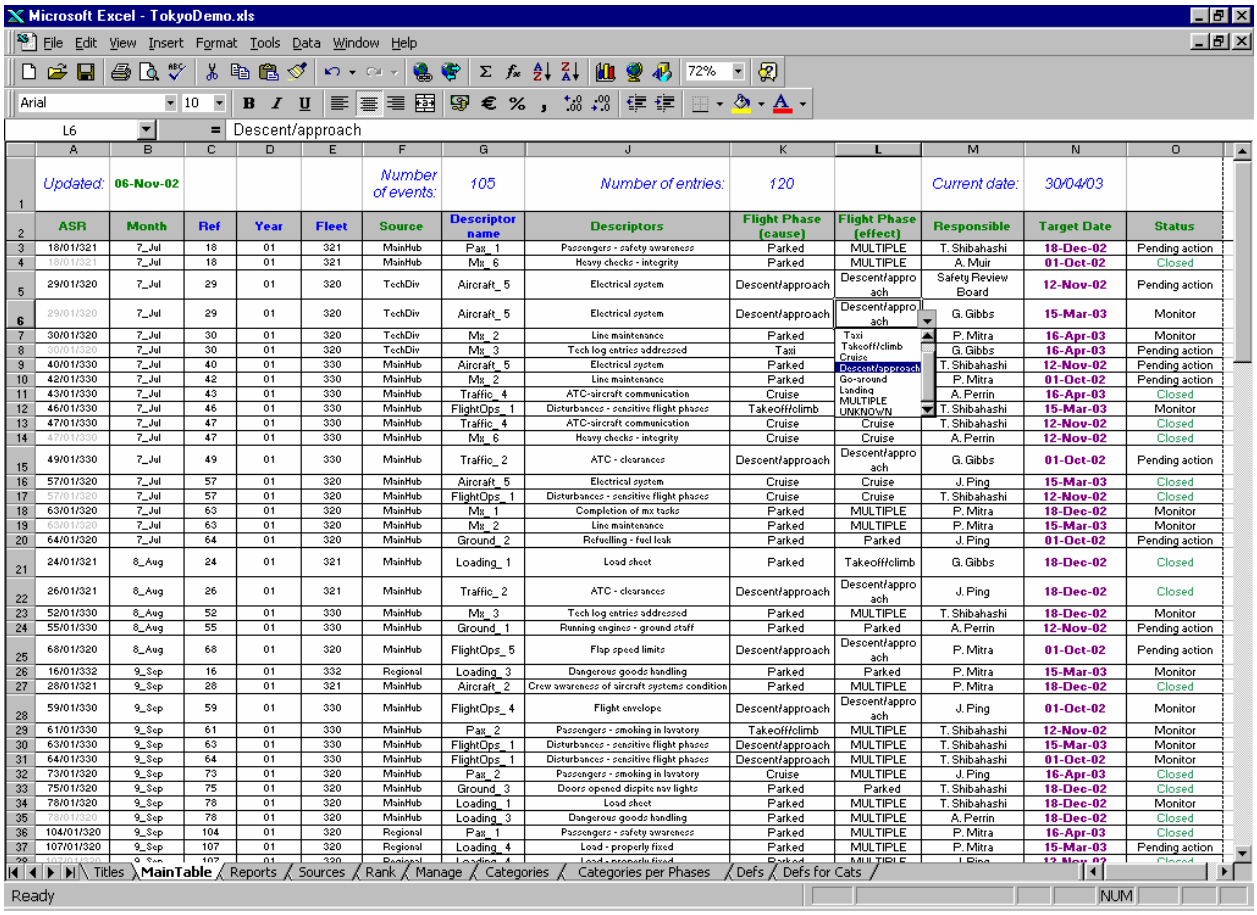

Figure 1 **Air Safety Report Data Table Showing a Drop-down Menu**

The data table shown in Figure 1 has been created using the following Excel features:

- Drop-down menus ensure fast and reliable entry for columns "month", "source", "descriptors", "flight phase", "responsible" and "status". In screenshot 1, the user is filling in the "flight phase" cell by picking "descent/approach" from the drop-down menu.
- The "descriptor name" is filled automatically by Excel based on the entry in the respective "descriptors" column (using the VLOOKUP command and the lists on a separate worksheet).

The database should contain all the information in such a format that the database can also be used for effective long-term analysis. One of the requirements is sorting the database in different ways. Sorting by aircraft type, event date or year would be difficult because the relevant information is embedded in the reference and not initially in its own column. To solve this, the reference number is automatically split into three respective columns. For example, the top row for these three columns contains the following formulas for extracting the correct parts of the reference number:

- =VALUE(LEFT(A3,FIND("/",A3)-1))
- =MID(A3,FIND("/",A3)+1,2)
- =RIGHT(A3,3)

All the options for the drop-down menus are specified on a separate worksheet which makes updating them easy (see Figure 2). The drop-down menus have been created using the command DATA/VALIDATION/ALLOW LIST and the lists have been defined on the separate worksheet using the INSERT/NAME/DEFINE command.

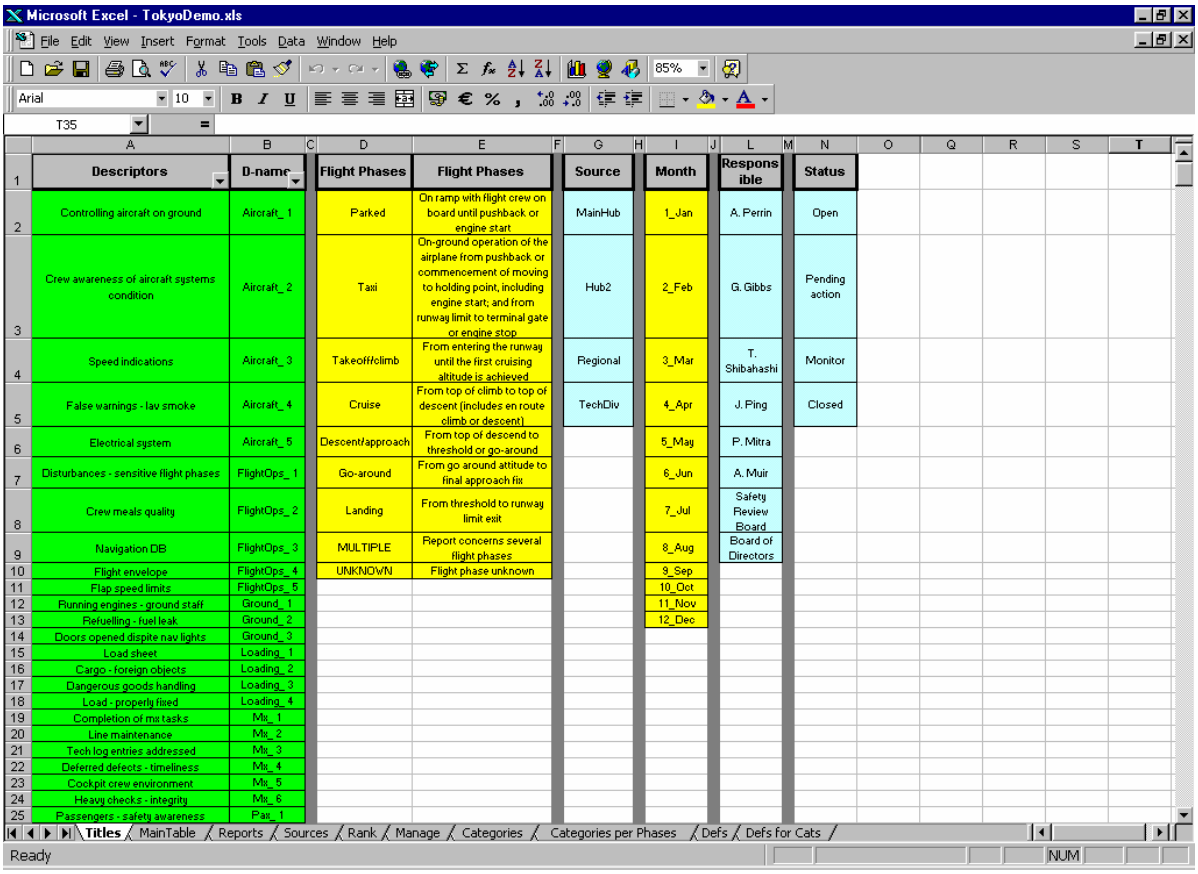

Figure 2 **Definition of Lists for the Drop-down Menus on a Separate Worksheet**

Additional features can be added to help data entry and spotting errors. In the example table, the same event may be entered several times to allow specifying different descriptors to the same event. To help visualize when the same report is repeated on two consecutive rows, the reference number on the second line will turn gray. Similarly, to help managing the data, target dates which have been passed turn violet and all closed items turn green. These features have been created with the CONDITIONAL FORMATTING function.

3 Analytical Process

The example table supports both case-by-case and long-term analysis.

3.1 CASE-BY-CASE ANALYSIS

The case-by-case analysis is in practice a technical investigation with several contributing experts from different parts of the airline, coordinated by a nominated responsible person. The process is straightforward but may take some time, and the challenge for the Flight Safety Manager is to monitor the progress.

The data table supports this process through the last three columns. These allow the user to specify who is in charge of the analysis (investigation), what is the agreed target date for closing, and what is the status of the investigation today. The user can either scan through the main table to check the status of specific reports, or use a dedicated monitoring table on a separate worksheet to get an overall picture of investigations (see Figure 3).

FOLLOW-UP OF ACTIONS PER RESPONSIBLE

Count of Month	Status				
Responsible	Closed	Monitor	Open	Pending action	Grand Total
A. Muir	2				2
A. Perrin	8	1		1	10
Board of Directors	1	1			2
G. Gibbs	9	5		7	21
J. Ping	18	7		2	27
P. Mitra	16	10		7	33
Safety Review Board	1			1	2
T. Shibahashi	8	10	1	4	23
Grand Total	63	34	1	22	120

To see related reports, double-click on numbers

Figure 3 **A Pivot-table for Monitoring Progress on Case-by-case Analyses**

The table has been created using the PIVOT TABLE command, and it has the advantage that clicking on any cell in the table will automatically create a new worksheet listing the events in question. For example, clicking on the cell “pending action” of “T.Shibahashi” containing the number “4” would create a worksheet listing the 4 reports pending action, for which T.Shibahashi is responsible (see Figure 4). This function is available for all pivot tables created with Excel.

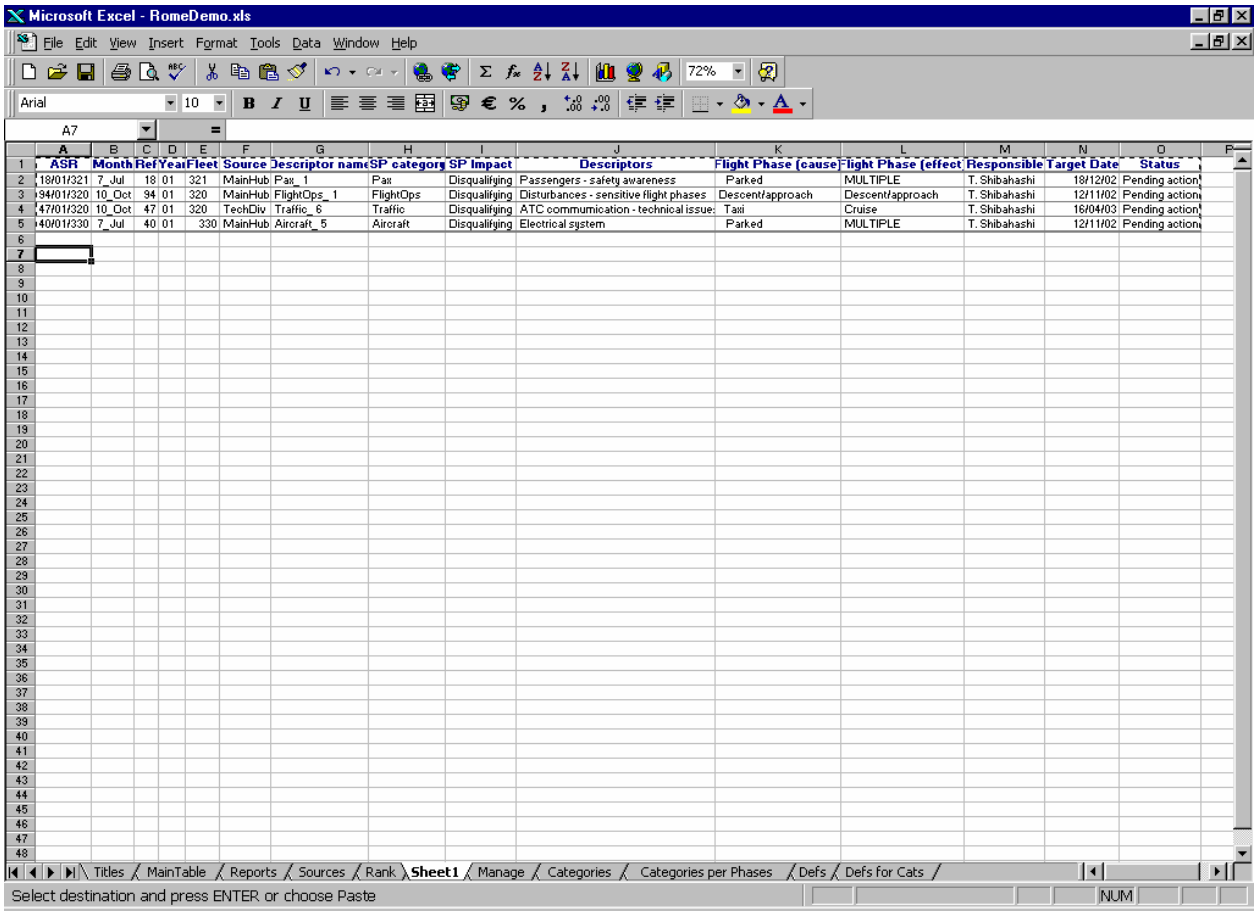

Figure 4 **Drill-down to One Cell in the Action Monitoring Table**

3.2 LONG-TERM ANALYSIS

Classically, the long-term analysis involves the flight safety manager directly. He/she has to use different sorting and visualization techniques to try to identify similarities between events, or other interesting matters in the safety data. This is hardly possible in a paper-based system. Usually this analysis is based on keywords or other descriptors, which is also the case in our example.

The descriptors can be used in combination with the basic event data (month, phase of flight, a/c type) to create useful tables and charts for making the analysis. First approach is to create a table where issues are ranked based on number of reports per descriptor, sorting the list from the highest count to the lowest. Another way is to follow the number of events per descriptor each month, visualizing a monthly trend.

Figure 5 shows a chart constructed by combining the information about the descriptor category and the flight phase. Excel offers many options for visualizing the data this way and the options to use depend on the exact needs of the analyst.

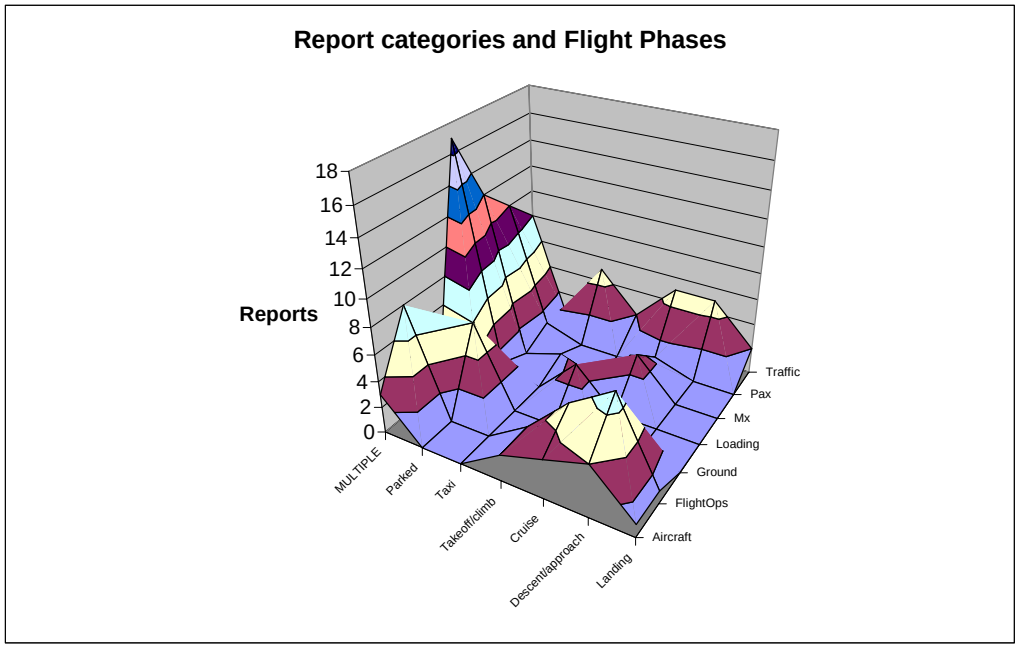

Figure 5 **Analysis by Combining Different Data Fields**

Data can also be analyzed simply by studying the main data table with the help of the DATA/FILTER/AUTO FILTER command. This function allows the user to specify a filtering criterion for each column and show only rows (events) which fulfill all filtering criteria. An important difference between analysis using the auto-filter and using the pivot tables is that the auto-filtering is a one-time action leaving no trace for later consulting (unless manually carried out each time) whereas the pivot table is a permanent source, and can be specified to update itself automatically each time the file is opened.

4 Tool Output

The tool can be considered to have two kinds of outputs. The most valuable output are the different tables and chart which can be used for analyzing the data. The second kind of output are the charts and tables which are used in safety reporting and communication.

All these outputs can be specified using all the versatile graphical functions of Excel; for example bar charts, pie charts, 3D charts and graphs. It is also possible to automate the creation of regular safety reports/communications to a high degree, by creating the analytical elements with Excel pivot tables and then inserting them to a ready template using a specific Excel MACRO. This only leaves the analyst the task of commenting the results. In fact, Excel is so flexible, that many people use it for presenting results from other safety tools.

Typically, a safety communication would include a set of standard charts and tables (usually showing some parameters as a function of the time period). These would then be commented by the analyst. Occasionally some issue could be highlighted with the help of additional charts, graphs or tables. It may be necessary to create several different (standard) safety communication reports addressing the different needs: management, operational units, and aviation authorities.

5 Application of the Analysis Results

The analysis results often point to some actions which are considered necessary for maintaining an acceptable safety level. The timely implementation and effectiveness of the measures can then be followed using the same database: the former through the “status” column, or the latter by ensuring that similar events do not re-occur at an unacceptable frequency.