

## Real Time Integrated Computer Tools for Value Engineering Events (Value Management Software Tools Set)



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### ABSTRACT

Pratt & Whitney has developed a set of computerized tools for Value Engineering Events. They put recurring tasks in a computer. They eliminate errors and save time. They prompt a standard methodology, analysis and documentation. This means that people focus on the problem; the methodology does not distract them. The tools are fast and accurate, so they maintain the flow of Value Engineering Events. They allow for interactive input during the event. The charts are ready to present to an Executive Review Board. The tools are an electronic archive of the events. They are continuously improved.

### INTRODUCTION

The first time I participated in a week long value engineering event I burned lots of midnight oil. I worked nearly 80 hours making charts and a FAST (Functional Analysis Systems Technique) model. Tired, I resolved to make a shortcut. The computerized charts that colleagues and I developed are the shortcut and more. They are also accurate. They provide a standard process and product. Pratt & Whitney uses them as interactive tools at Value Engineering events. We present them to executive review boards. Then we store them for later reference. And we continuously upgrade the tools.

The tools are in two principal groups:

1. A tool set covers all value engineering event elements except a FAST model.
2. A FAST Model chart is the remaining standard element of our events and is covered using a separate computer program.

### SUMMARY OF TOOL SET

The tool set has several interrelated charts which reside in a Microsoft Excel application with Visual Basic programming. The FAST Model tool is a pair of files, including a seed file, created by and used in the program, ABC Flowcharter, by Micrografx.

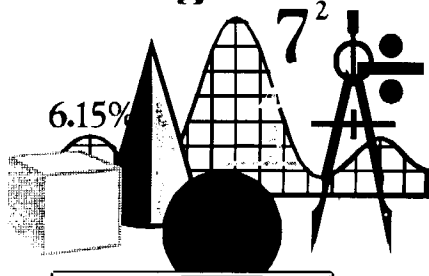
This section and the next outline the tool set in the Microsoft Excel application. The section following these two briefly examines the FAST modeling tool.

### LIST OF CHARTS IN EXCEL TOOL SET

Listed in order are the following charts and sheets in the Excel workbook:

1. Introductory chart and guide to the other sheets.
2. Chart for writing the title of the event, its date, and information on each of the event participants.
3. Three questions that, when answered, help the team focus on the event.
4. Scratch pad to keep notes for later use.

# Value Management Toolset Version 3.3 - CONTENTS -



[Click Here to Begin](#)

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Input Team Members	Brainstorm Session
Input Event Info	Surviving Ideas
Weighted Attributes	Proposals
Star Charts	NRE Calculation
Primary Functions, Hardware	Rate & Rank
Function Matrices	Summary

Figure 1. Introductory sheet of tool set lists within forwarding buttons the sections of the tool set. Depressing a button moves user to the associated section of the tool set and begins work on that tool.

5. Attribute definitions.
6. Paired comparison chart.
7. Attribute scale.
8. Star Chart(s).
9. List of the parts under investigation by the team.
10. Function matrix.
11. List of the team participants and their initials.
12. List of brainstorm ideas.
13. Brainstormed surviving ideas.
14. Proposal summary sheets.
15. Summaries of each of the surviving ideas.
16. Cost breakdown.
17. Rate and Rank Chart.
18. Summary.

## SUMMARY OF SHEETS IN EXCEL TOOL SET

1. The first sheet in the workbook is an introduction and guide to the other sheets. It contains the title of the tool set and the version number, the names of the authors, a copyright notice and several buttons that will advance the user to the various parts of the workbook.

2. The second sheet asks for the title of the event, its date, and the names of the event participants along with their company and department. The event's title automatically appears on all subsequent charts. The names also appear later.

3. The third sheet asks the three questions that, when answered, help the team focus on the event.

The three questions are the following:

1. What is the problem we are about to resolve?

## Sample Value Engineering Event WEIGHTED ATTRIBUTES PAIRED COMPARISONS

		B	C	D	E	F	G	H	I	J	Attribute	Score	Percent (Weighting Factor)
Pair Weighting Factor	A	A1	C1	D1	E2	A2	A1	H1	A1		Cost	5	7.2
		B	C1	D2	C4	B3	B3	H2	B1		Reliability	10	14.5
			C	D3	C2	C3	C3	C2	C1		Compatability	13	18.8
				D	D1	D3	D2	D3	D1		Color	16	23.2
					E	E3	E3	H1	E1		Acoustics	9	13.0
						F	F2	H3	F2		Performance	4	5.8
							G	H1	G2		Weight	2	2.9
								H	H2		Schedule	10	14.5
									I		Operability	0	.0
										J			

1. LOW
  2. MEDIUM
  3. HIGH

Figure 2. The program highlights errors in the paired comparison matrix. The highlight disappears when the user corrects the error.

2. Why do we consider this a problem?
3. Why is a solution necessary?

The sheet then provides space for the team to list barriers that are perceived to impede progress and which the team will ask the Executive Review Board to remove. The sheet also has space for the measurable goals and objectives which the team proposes in the context of the answers to the three questions.

4. The fourth sheet is a scratch pad to keep notes for later use. The user can store comments and data from the team and use that information later in the appropriate place or archive it as is. We use this sheet to avoid losing ideas or relevant data.

5. The fifth sheet is a list of definitions of attributes, which are the key characteristics of the design at the center of the event. The attribute titles are automatically placed in the next three charts and others.

6. The sixth sheet is the paired comparison chart. Its primary purpose is to establish the relative importance of several key characteristics -- called attributes -- of a product.

The method of arriving at the relative importance or weighting factor of the various attributes is to

compare each attribute to every other attribute one at a time. In other words, one pair of attributes at a time is weighted -- hence the term: paired comparison. The results of the paired comparisons are then summed, resulting in a score total for each of the attributes. The scores are then normalized to total 100; i.e., the sums are given a final score equivalent to their percent of the total score. This method of arriving at weighting factors is generic to the paired comparison form whether done manually or electronically.

The tool set checks the input for errors. When errors are corrected or none exist the tool then calculates the scores and weights.

7. The seventh sheet is the scale for use in the next sheet. It quantifies each of the attributes. The user specifies the values for the scale for each attribute. Whereas the paired comparison determines the relative importance of each attribute compared to one another, this sheet scales the meaningful value of each attribute on a scale of 1 to 10. Additional copies of this sheet may be added to the workbook if needed.

Pratt & Whitney plans to further automate this sheet.

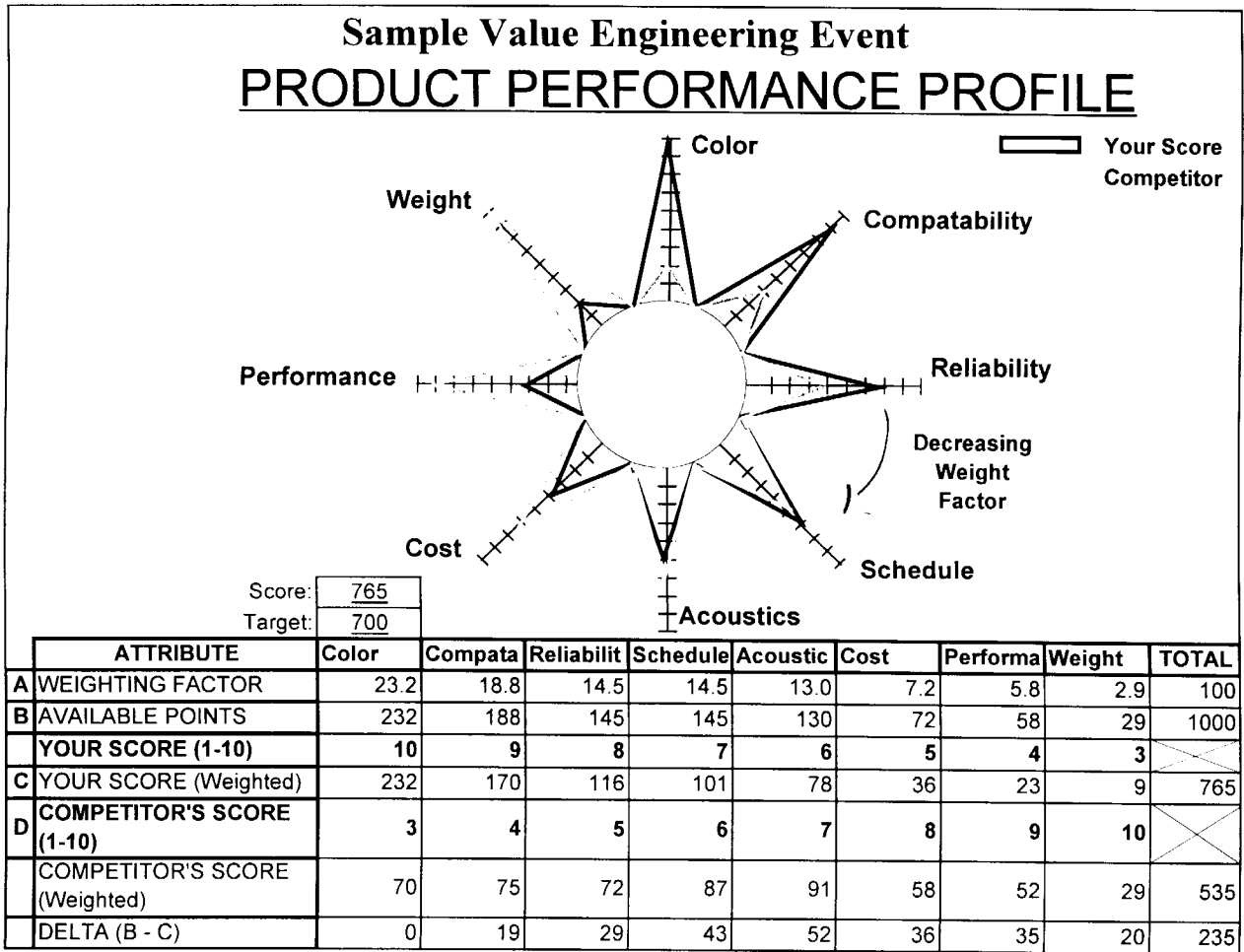


Figure 3. This example of a Star Chart shows two stars, one more than on standard star charts, but common in the computerized tool set, which can also create additional star charts.

8. In the computerized star chart the Attributes are automatically sorted with the attribute of greatest weight or importance appearing at the top right of the star. The next highest attribute in weight appears clockwise from the first and so on in a clockwise direction. In the table on the chart the attributes appear by weight in descending order from left to right. These physical arrangements facilitate the decision making process of the team by creating a visual reference of the relative importance of the attributes.

Two products may be compared on one chart. See the example in Figure 3. The computerized Star Chart also has two stars, whereas manually prepared charts usually have only one star.

Additional Star Charts are easily added by pressing a button on the first Star Chart.

The stars are limited to eight rays. The visual basic software will accommodate more rays, but the corresponding axes are fixed at eight, which -- so far -- has been adequate.

9. The next sheet is a list of the detail parts (or subassemblies) under investigation by the team. It lists the corresponding primary functions of each part (or subassembly). These help build a fast diagram.

10. The next sheet contains a function matrix. The information from the previous sheet automatically goes into it. It can then be dimensioned for cost, weight or another significant attribute.

Up to two additional Function matrices may be added automatically with the press of a button on the sheet of parts and their functions. Each function matrix dimensions only one attribute.

11. The next sheet is a list of the team participants and their initials. The names get automatically copied from the second sheet, then the user adds corresponding initials. It is used in the brainstorming phase to record in shorthand fashion the originator or champion of an idea.

12. The next sheet is a brainstorm idea list. Initials placed in the initials column automatically recall the

idea maker's full name per the previous sheet. The user records Gut Feel Indices (GFI) as the team generates them for the various ideas. The sheet auto-calculates average GFI's for each idea.

13. The next sheet creates a list of surviving ideas based on their GFI score. The team sets the cutoff point. The highest scoring ideas automatically survive the cut. The sheet also has a button for creating proposal summary sheets of surviving ideas.

14. There usually are several proposal summary sheets. One surviving idea is detailed on each summary sheet.

15. The next group of sheets is a summary of the surviving ideas. These sheets tabulate the scores of the surviving ideas and their impact on the attributes identified on the sixth sheet, which is the paired comparison weighted attributes.

16. The next group of sheets determines the cost breakdown and approximate sum of non-recurring expenses (NRE). They provide data that is fed into the previous sheets for calculating cost.

17. The six top scoring ideas are compared in the next to last sheet, the Rate and Rank Chart. It serves a function similar to the star chart, but compares several brainstormed ideas for new or revised products and analytically identifies the best choice. Each of the ideas is scored (from 1 to 10) relative to each of the key attributes. The scores are then multiplied by the weighting factors of the associated attributes. These products are summed and the totals ranked. The idea or ideas with the highest totals are then recommended to the Executive Review Board for approval.

18. The final sheet is a summary. It is used to list important conclusions, action items, and additional notes for reference.

The charts employ over 1200 lines of Visual Basic programming code. Many elements of the charts are not typical spread sheet elements, and are more complex.

### SUMMARY OF FAST MODEL CHART

A FAST Model (Functional Analysis Systems Technique) is a method of relating functions of a product in a logical pattern. It helps to identify secondary functions and focus design activity on critical path functions. Each function is defined by a verb noun pair where the verb is active and the noun represents something measurable (Example: increase temperature). The verb-noun pairs are arranged in flow chart fashion according to their relationships per guidelines of SAVE International. Associated with the functions are costs and other dimensionable attributes that can be placed in one or more matrices at the

bottom of the model. See Figure 4 for an example of a FAST Model.

Pratt & Whitney's Product Center Engineering group for Externals, Controls and Nacelles uses two files to generate fast models: 1) a seed file and 2) a palette file. The seed file contains the basic format including a few imported graphics. The palette file contains the basic flowchart shapes adapted to the unique features of a FAST model.

### OVERVIEW OF BENEFITS

The Charts are incorporated in computer programs for several significant reasons, most of which add up to people focusing on the problem for which the event is convened and not on the mechanics or methodology:

- Computerized tools place repetitive tasks in the domain of the computer, thereby eliminating error and standardizing the methodology for doing analysis and getting conclusions.
- The computerized charts enhance the flow of Value Engineering Events.
- The computerized charts allow for interactive input.
- The charts facilitate presentations.
- The tools serve as an electronic archive of the events.
- Computerized format of the tools facilitates their continuous improvement.

### BENEFIT DETAILS

Computer usage eliminates error that invariably occurs in repeated manual tasks such as summing scores in paired comparisons, product performance profiles, gut feel indices, FAST model dimensioning and so forth.

Computers naturally do sequential tasks. They also do them the same way every time unless programmed otherwise. Computerized tool sets therefore may standardize methodology. Ours does. Standardization is an important element in streamlining and accelerating business operations.

Our computerized charts enhance the flow of Value Engineering Events because of their speed and accuracy. Time is not lost waiting on hand calculations or copying information from one chart to its follow-on chart. Events are not interrupted or backtracked due to computational errors.

The computerized charts allow for interactive input via laptop PC or projection TV viewing. The value engineering event team has two choices in this regard: 1) input data on a laptop to verify the accuracy of computations and record data while a traditional



At Pratt & Whitney all professionals have access to a desktop personal computer with access to a company wide web and browser. Most employees have a PC at their desk. Thus retrieval and viewing of centrally archived files allows ready review of information from past events.

Computerized format of the tools facilitates their continuous improvement. The software accepts upgrades and new charts. New or altered charts constitute revisions and improvements to the standard process.

The use of real time integrated computer tools for value engineering events improves productivity in the events themselves. They allow focus more on the event and less on mechanics by standardizing methodology and reducing diversions created by errors and non-value added time. They also reduce the time spent preparing a presentation for the executive review board because they create charts during the events themselves that are essentially ready, as is, for final presentation.

The set of tools are new, having been used in their early stages in late 1995. We have evolved the tool set continuously ever since. We plan additional upgrades to increase its power, flexibility, efficiency and effectiveness.

#### CONCLUSION

Pratt & Whitney benefits from the use of these tools. We have significantly reduced the time spent on non-value added portions of value engineering events. Estimated time savings alone at Pratt & Whitney equate to about a half million dollars per year. In addition our events flow more smoothly due to fewer errors. And we have an electronic archive of each event. The information is in a standard format so searching for data is straightforward and simple.

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