

PRODUCT FAST DIAGRAM

G.E. (Jeff) Parker, CVS
Consultant
ARES Corporation
Richland, Washington



Jeff Parker is a Value Engineering (VE) Consultant with ARES Corporation in Richland, Washington. He received his Bachelor of Engineering (Marine) from the State University of New York Maritime College. His 27 years of experience include power plant operations, mechanical design, welding engineering, project management quality assurance, management, facilitation (specializing in VE) and conducting VE training.

ABSTRACT

This paper describes the process used to develop the Product Function Analysis System Technique (FAST) Diagram, hereinafter referred to as "the tool."

The paper provides a user with information to easily and correctly apply the tool! The basis for the tool is a VE technique called FAST diagramming. Instructions are included with the diagram and Resource Function Relationship Chart to allow a user, with minimal knowledge of FAST, to assign the resources required to accomplish a function.

INTRODUCTION

The tool, composed of a specific, product (deliverable) related FAST Diagram and a Resource-Function Relationship Chart, was developed to identify all resources (people, equipment, procedures, etc.) needed to accomplish a function/deliverable. Once resources have been identified by people assigned to accomplish the function, an activity based cost estimate can be developed for the function. The deliverable associated with the function is then shown on a Work Breakdown Structure (WBS) or related to a higher level deliverable, task, or mission. The cost for the deliverable can be related to the WBS and serves as support data for the WBS reporting.

Work Breakdown Structure Development

Current budget pressures and good management practices are driving the need for development of

Hanford Site Support Program planning documents that will withstand the scrutiny of independent reviews performed to validate the program budget requests. It is becoming very important that the supporting data in these documents be prepared, assembled, and presented in a simple, concise, and easily understood manner. VE has been discussed as a process that could be used to support development of these key functional elements.

In May 1995, the ICF Kaiser Hanford Company (ICF KH) VE organization was asked to provide facilitation support for a session chartered with developing a draft WBS for the Hanford Site Support Program. The session resulted in a detailed, third level WBS draft with examples of lower tier deliverables for the next lower levels, 4, 5, and 6. Figure 1 exemplifies a WBS down to the sixth level. The resulting draft WBS was to be finished after the session and included in the Fiscal Year (FY) 1996 Hanford Site Support Program Plan.

A number of follow-on action items were developed at the end of the session. One of those actions was to reconvene after the WBS was completed and develop high level FAST Diagrams for Level 3 elements of the WBS. Level 3 elements of the WBS include Utilities, Transportation, General Purpose Facilities, Services, Energy Management, and Program Integration.

High Level FAST Session

In early June 1995, a Hanford Site Support Program team was convened to develop a FAST Diagram for each of the Level 3 elements of the now completed WBS. As different Level 3 WBS elements were addressed, some additional or different team members were brought in.

One of the primary efforts during the June session was to facilitate development of a FAST Diagram for each of the Level 3 elements (Level 3 deliverables) of the WBS. Consequently, the output would be a FAST Diagram required to complete the Level 3 WBS deliverables. ICF KH Estimating (Jay Mills) participated in this effort. His focus was to determine if the budget being requested was supported by activity based cost estimates. To be fully supported required that the activities show support to the functions in the FAST Diagram, which in turn provide the basis for the deliverables in the WBS. As a result of these two needs, the team would be asked to focus on broad, high level function development and detailed function development with sufficient detail to allow identification of activities. Functions and FAST diagramming were not designed to identify actions/activity details.

After some discussions, it was decided to develop the required FAST Diagrams then use a concept commonly referred to as sheet music; what I refer to as Resource-Function Relationship Charts. (The Resource-Function Relationship Chart concept is a tool developed by Jerry Kaufman, CVS, of JJ Kaufman Associates, Inc.). The chart would be used to tabulate the resources (typically listed as organizations) required for the activities being performed and relate those resources (activities) to the function(s) being satisfied. With the chart as a guide, budget estimate details (separate supporting documentation) could be reviewed and/or organizations queried to determine if sufficient detail existed to support the estimate. This approach uses the Level 3 deliverables from the WBS to identify program functions and relates the detailed costs for achieving those functions; hence, achieving the deliverables.

PRODUCT FAST DEVELOPMENT AND USE

Development

The morning of the first day of the session focused on a high level FAST Diagram for the Level 2 element "Infrastructure."

Almost from the beginning, it was necessary to make a significant departure from typical function development. The departure was driven by the need to better define WBS deliverables in relation to the functions in the FAST Diagram. It was necessary to develop deliverable statements that represented scheduled and periodic activity results versus the more easily quantified end point deliverables typical with a

project or specific task.

A way to state a deliverable (i.e., maintained facility) was developed. It involved identifying the applicable function then changing the function from the present tense verb to the past tense verb. The past tense verb became an adjective for the deliverable. For example, the function maintain facility yielded the deliverable maintainED facility; the final deliverable and its condition resulting from a year of maintenance. Supporting functions, representing lower element deliverables, were then added to the Infrastructure FAST Diagram. It was noted that FAST Diagrams for subordinate WBS elements would probably be similar to the Infrastructure FAST Diagram.

The afternoon team focused on the Level 3 WBS elements "Transportation" and "General Purpose Facilities." It was during this phase of the session that the concept of a Product FAST Diagram began to emerge. At that point, the team began to develop functions and convert the functions to a list of deliverables for Transportation and General Purpose Facilities. As the list was developed, deliverables were reconverted to functions and used to replace functions in the Infrastructure FAST Diagram developed in the morning. Resource-function relationship was then identified using the resource-function chart. The chart was an eye opener due to of the number of resources that were often involved, the lack of clear understanding for why some resources were involved, the lack of understanding for what some resources "brought to the party," and identification of potential authority and responsibility conflicts between and among the organizations.

As a repetitive pattern developed, the functions in the Infrastructure FAST Diagram were modified making the diagram more generic. By noon of the second day, the FAST Diagram had become the Product FAST Diagram (the tool) shown in Figures 2 and 3. Once this was accepted, the team focused on testing the tool on other Level 3 WBS elements. Deliverables for the Level 3 element "Services" (Crane and Rigging, Fabrication and Programmatic Services), were identified and tested. The remainder of the second day and the third day were spent testing the tool on the Services functions and deliverables. At the end of the third day, the status of the session was presented to management. Although the tool was not the expected, typical FAST Diagram for each of the WBS Level 3 elements, management recognized the potential benefit of the tool and told us to continue tool development.

The fourth day became an opportunity to test the tool on personnel not involved with its development. The people assigned to the WBS Level 3 element "Utilities" were to develop their FAST Diagram. We began the fourth day with a briefing on what had been done and how it could be used. After explaining how the FAST Diagram was developed, how Utilities functions were substituted, and how the resource-function relationship chart worked, the session was opened for comments. Some time was spent working with Utilities functions/deliverables and trying them in the tool. The team had mixed feelings about the results in that some people felt it was a useful tool, while others felt that since it didn't "pop out an answer automatically," it was no different than what they were presently doing. Members of the Utilities team felt there was no time to use the tool as a check on their FY 1996 budget supporting data. Timing is everything. It appeared that using the tool to plan for the FY 1997 budget would provide a better, more fair, and beneficial test.

In spite of that mixed reaction, those who spent the previous three days developing the tool (most of whom were also responsible for projecting out year budgets) felt the tool could be very useful. It promoted a focus on deliverables, identification of required functions, and conscious thought about the resources involved in achieving the deliverables. Conscious thought given to identifying the involved resources would generate the information needed to support an activity based cost estimate budget. However, like their counterparts in Utilities, most participants were not convinced that applying the tool to the FY 1996 budget would be beneficial. They felt application of the tool to the FY 1997 budget would be more appropriate.

Use of The Results From The Tool

The original intended use of the Product FAST Diagram Resource-Function Relationship Chart was to clearly quantify what organizations (human resources) needed to be or are involved in activities necessary to accomplish the functions and achieve the required deliverables. With organizations identified on that resource list, it is possible to work with the organization to determine their activities, the extent of their involvement, and the estimated cost relative to their involvement. That intended use is still valid, however, the resource list can be expanded.

For maximum benefit, the Resource column can be expanded to include identification of other resources needed to accomplish the functions. A

more comprehensive list should include the identification of equipment that may be a necessary part of the activity. The list should also include procedures, processes, hardware, and software. Expansion of the resource list should create a better understanding of the activities involved in accomplishing the function, higher confidence in the accuracy of the estimate, and a baseline to work from when change is demanded.

The tool can also be used to analyze currently identified deliverables (present situation) and projected deliverables (future needs). It can also be used to list resources currently in use. The process of developing the resource list will also help identify revisions or modifications to current approaches that might be beneficial. For future projections, resources expected to be needed can be identified in advance and methods of accomplishment developed. See Figures 4, and 5, for examples of a function processed through the FAST Diagram and the related resources on the Resource-Function Relationship Chart.

The best application of the tool is in relation to a FAST Diagram representing a program or organization. Following development of the FAST Diagram, the user can pick out the functions for which activity-based costs are needed. The tool can then be applied to that function. When activity based cost estimates have been developed, return to the basic function (Function 1 on Figure 1) and convert that function to a deliverable. The deliverable can be located on the WBS and the cost included in the WBS backup data.

Developing a FAST Diagram for a program or organization not only identifies the functions needing activity-based costing, but also serves to determine if all the functions have been listed and unnecessary functions eliminated.

WBS USE OF PRODUCT FAST DIAGRAM

The significant WBS related benefit resulting from development of the tool is the concept of deliverable statements that relate to functions. Once the deliverables are identified and the tool rigorously applied, resources, and the activity-based costs related to applying those resources, can be quantified.

SYSTEMS ENGINEERING INTERFACE WITH FAST DIAGRAM

Originally, there were no intentions of showing a relationship between the tool and Systems

Engineering. However, using the Systems Engineering approach and using this tool as a method to support Infrastructure Programs' budget documentation appears to have a significant potential for duplication of effort. Both approaches attempt to identify functions needed to meet customer requirements. Both approaches yield deliverables that should correspond to the WBS.

The prescribed Systems Engineering methodology can be much more rigorous, time consuming, and costly than using the tool. Once the level of detail for functions, requirements, and alternatives are known, management must decide which approach or combination of approaches is best suited to building and validating budget documentation.

SUMMARY

In summary, the tool provides the user with a simple approach that can:

- Create clarity and definition for operational deliverables,
- Tabulate the identity of the resources related to achieving a function (and related deliverable),

- Help the user identify the activities and estimated costs for those activities, and
- Help create an activity based cost estimate that should withstand independent scrutiny.

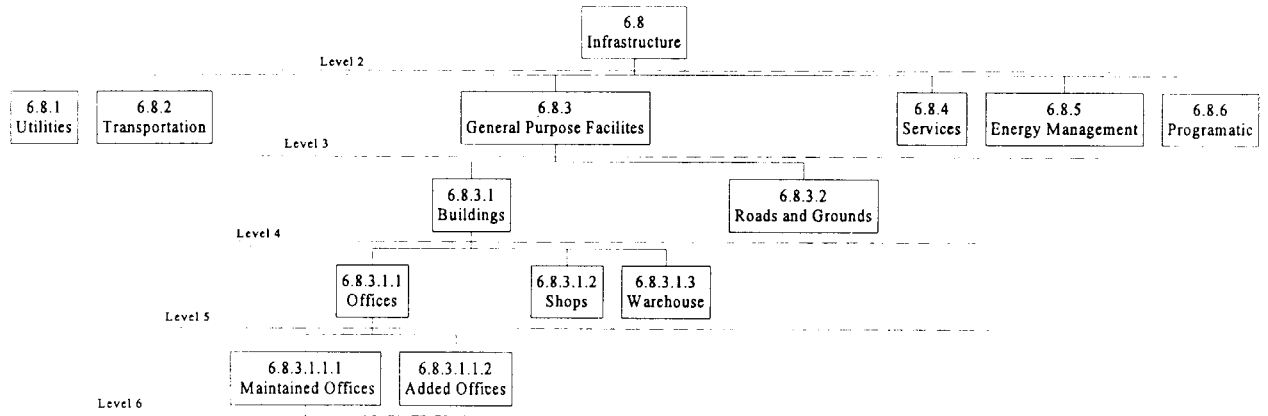
DEFINITIONS

FAST A logical, relational diagram that tests functions, shows the relationship between and among functions and provides a graphic model or display of the situation.

FUNCTION Anything that makes a product (deliverable) work or sell.

WBS (Work Breakdown Structure) - A multi-tiered framework which organizes and graphically displays elements representing work to be accomplished in logical relationships.

Example WBS - 6 LEVELS



Product FAST Diagram

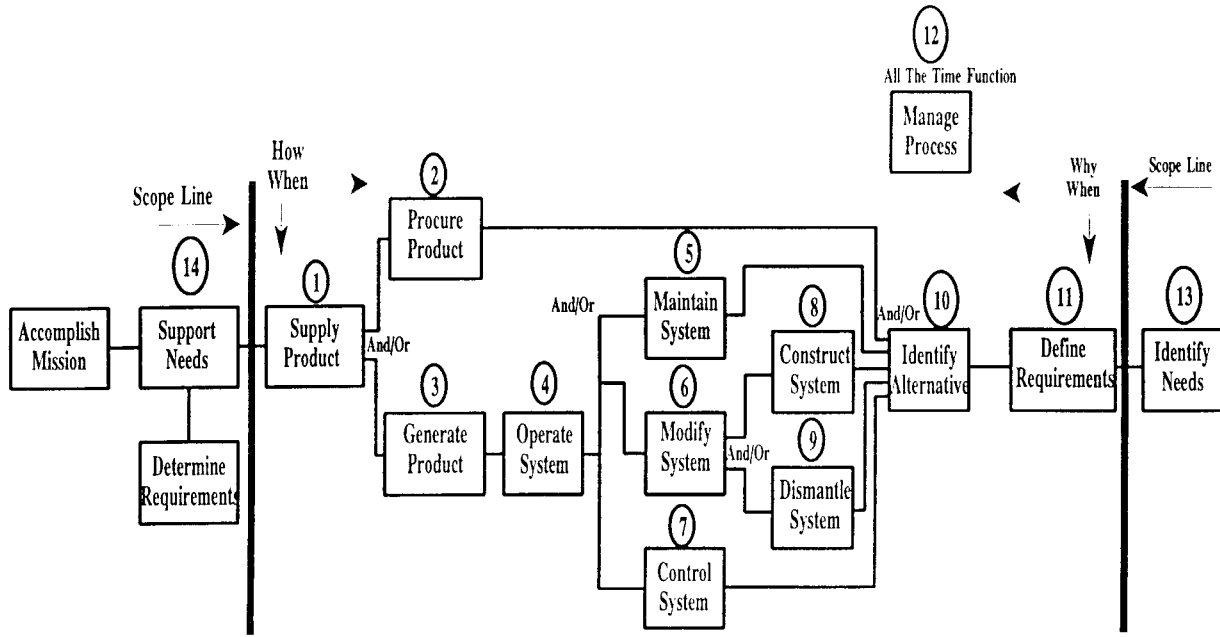
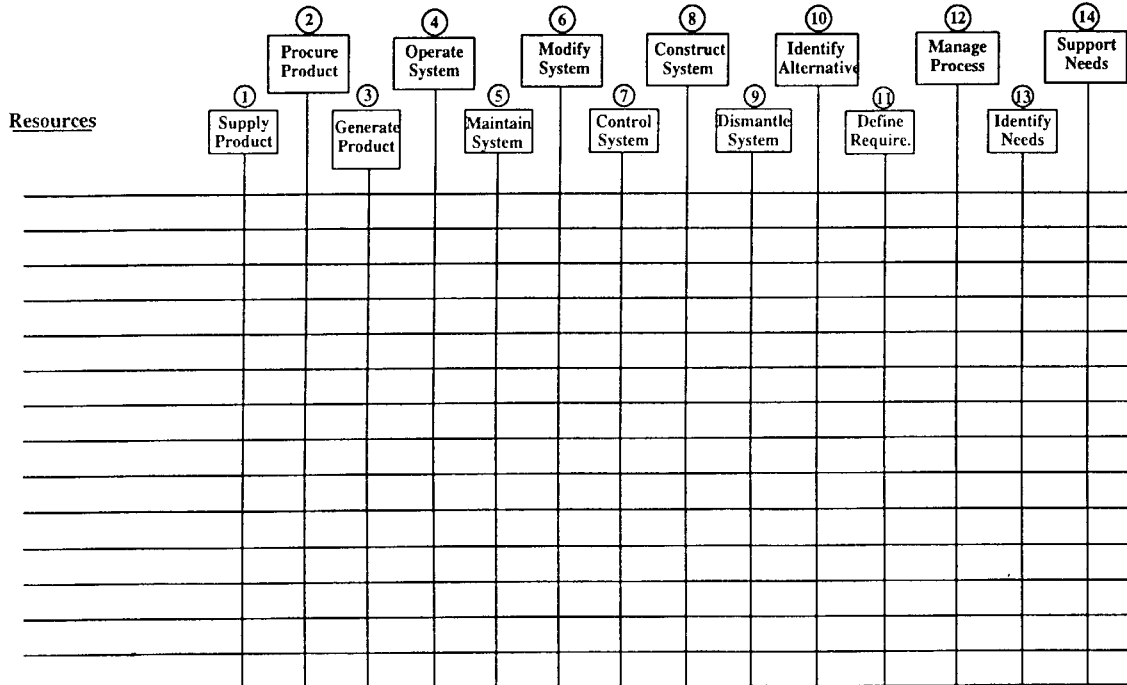


Figure 2

Resource - Function Relationship Chart



Note - Resources include but are limited to identifying organizations, individuals, equipment, software, hardware, procedures, and processes. There may be some overlap. However, the apparent overlap is usually levels of detail within an organization. For example, both the organization's procedures and equipment might show on the list. The tool user will have to be careful to avoid duplication as the costs are listed and summarized.

Figure 3

PRODUCT FAST DIAGRAM INSTRUCTIONS

DISCUSSION AND APPLICATION

Discussion

- FAST Diagram

The Product FAST Diagram, the tool, consist of two parts. Part 1 is the FAST Diagram (Figure 2). Part 2 is the Resource-Function Relationship Chart (Figure 3).

Functions 1 (Supply Product), 2 (Procure Product), and 3 (Generate Product) are used to relate functions to deliverables. (In FAST diagramming parlance, the first function to the right of the left scope line is the basic function.) Functions 1, 2, and 3 are unique to the particular deliverable from the WBS. These functions are changed to reflect the different deliverables being addressed.

Functions 4 (Operate System), 5 (Maintain System), 6 (Modify System), 7 (Control System), 8 (Construct System), 9 (Dismantle System), 10 (Identify Alternatives), and 11 (Define Requirements) are functions designed to focus the tool user on the resources and activities being applied or needed to achieve Function 3.

Function 12 (Manage Process) is an all-the-time function. (In FAST diagramming parlance that means it occurs more than once in the diagram.) The focus here is to identify the resources and activities that will be used to manage production of the deliverable (i.e., manage all the functions from right scope line to left scope line). Management within the resource organizations is not included here. This is intended for overall management of the effort; overall management such as a project manager versus an engineering discipline manager.

Functions 13 (Identify Needs) and 14 (Support Needs) are out of scope but can significantly impact the in scope effort. The team needs to know what is behind them, why they are needed, and any customer specific limitations or preferred methods. If possible, the key members of the team (key contributors) should be involved with the customer as needs are identified and as the customer develops the

intended use of the deliverable. If, in fact, the requirements have not changed and the approach being used is the most efficient, great! However, in this world of changing demands and requirements, that is often not the case. This is an opportune time to establish an approach to evaluate the requirements to determine if they have changed, and to evaluate the activity(ies) to determine if they should be changed. It is also an appropriate time to question if the deliverable is in fact needed. Ask the customer why? True, the customer should have thought of that when they concluded Function 13, but it is worth asking. There is nothing worse for morale, and possibly reputation, than to spend a lot (sometimes lots) of time creating or improving a process to satisfy a function or to provide a deliverable that is not needed.

- Resource-Function Relationship Chart

Part 2 (Figure 3) of the tool is intended to allow identification of the resources needed to accomplish the functions on the FAST Diagram. Resources are listed to the left. To help focus on what you are getting from the resources, you might want to list (in brackets) the specific sub-deliverables those resources will provide. (Deliverables can be documents, signatures, tools, parts, whatever.) Use as many sheets as you need to contain the entire list. The best approach seems to be to work your way across the graph from right to left in reverse numerical order.

Evaluate all the resources against each of the functions. Indicate below the function, across from the resource, if the resource applies to the function. It may be helpful to use a coded indicator (circle the intersecting lines) to indicate the relationship of the resource to the function. For example, an empty circle might mean review only. A half-empty, half-filled circle might indicate approval. A completely full circle might indicate who is responsible for achieving that function. No circle indicates that the resource is not needed for that function. For other resources such as procedures, a square might be used. Make up your own code as needed. Document your code at the bottom of the graph.

Application

- FAST Diagram

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