FACETS OF FAST

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ABSTRACT

Function Analysis System Technique (FAST) development is sometimes omitted from value analysis (VA) studies of design and construction projects or given only token effort. The underlying rationale suggests that function identification and FAST depiction result in an output so generic as to be useless for subsequent deliberate creativity. This paper identifies the causes of (e.g., working at too low a level of indenture and focusing on parts rather than function), consequences of, and cures for, this misconception through demonstration of innovative and unexpected value improvement results through actual project illustrations, and examples of alternative function identification and FAST strategies.

THE CRUCIAL ROLE OF FUNCTION

The Problem: Shortcutting the Information Phase

Function identification and depiction are integral parts of the first, or information gathering, phase of the VA job plan. The second, or creative, phase of this job plan is dependent upon function identification and depiction because together they represent team consensus regarding the problem at hand and because they serve as a reference point for brainstorming and later evaluation of these brainstorming ideas.

Over time, the processes of function identification and depiction have been abridged or, in some cases, omitted from VA construction workshops. The reasons usually given for this include insufficient workshop time to permit team development of FAST depiction, a belief that little or nothing new may be said about the functions of development of FAST depiction, a belief that little or nothing new may be said about the functions of systems common to all buildings (e.g., structure, services). In our opinion, the decision to abridge the process is the result of working initially at too low a level of indenture or detail and confusing parts for functions. The consequences, all too often, are studies and proposals that are more akin to simple (but often dysfunctional) cost cutting than to value improvement.

Definitions of Function

Were two VA teams, one examining an elementary school and another examining a hospital, to commence their work on the presumption that the only functions of importance were those describing the systems aspects of the structural, enclosure, services, and finish and furnishings systems, then very likely their lists of identified functions and FAST depictions would be quite similar. This would be true almost without regard to the building type.

It is only when we seek to identify the functions of the sum of the systems and deal first with the building or project as a whole that we may begin to establish an understanding that will lead to value improvement. Project re-definition and innovation will seldom systematically occur merely by focusing on the individual parts or systems. As an example, the recently opened $40 million Crozier Wellness Center in Philadelphia is more of a health club than an acute inpatient care facility. This innovation was driven by the financial and lifestyle rewards of facilitating wellness (i.e., keeping people healthier longer and out of the hospital) and not by simply creating a bigger, better building for treating those already ill and in crisis.

Function in the VA Job Plan

The primacy of function in the overall VA job plan and in the information phase of that plan has existed from the outset of the development of the method. Function identification and, more recently FAST, are the distinctive elements that separate VA from random cost cutting - often done with little or no regard for the essential purposes of the project. Contrary to some popular misconceptions, VA is not a gigantic data base of the thousand or so really good ideas generated by past workshops; nor is it a quick and dirty way of taking money out of an over-budget job through material substitutions and quality compromises.

DESIGN, CONSTRUCTION, AND FUNCTION

Examples of Current Approaches to Function Identification and Depiction

The practices described here do not yet represent common or pervasive practice. Rather, they represent responses to the current paradigm of design and construction: comfortable habits that are both impediments to and opportunities for growth and change in value study practice. First, however, they must be recognized.

- Functions are identified only in relation to specification section divisions or project cost estimate trade breakdown.

  The team focuses immediately on the existing compartments into which the project has been defined. Alternative function descriptions from the standpoint of aesthetics, constructibility, or occupancy, for example, are neglected.

- Functions are identified but FAST depiction is omitted because of the limitations of workshop time.

  It takes time and effort to develop consensus through the arrangement and rearrangement of function relationships. Consensus is assumed but not made explicit or shared through a graphic medium.

- FAST depiction, if done at all, is limited to generic representation of major building systems.

  Closely related to the limited specification or cost breakdown identification issue mentioned above, the "when" or "as a result of" dimension is neglected in favor of critical path "how" and "why" logic. As a result, higher or lower levels of indenture leading to a better understanding of the project are overlooked.

Pre-Design, Design, Construction, and Post-Occupancy Phase Functions

The facility creation and use life cycle presents different challenges for function identification and depiction. Rarely though is this entire sequence interrelated. As a result, creativity is limited by the very tool that should stimulate it. Typically, only the design and construction phases are the subjects of value studies.

Levels of Indenture

Within each of the life cycle stages, functions may be identified at different levels of abstraction, detail, or indenture. What may be at issue and basic in the conceptual stages of project development becomes a higher order consideration or a programmatic matter during later phases.

However, it should also be recognized that even from the conceptual perspective, every project has the predictable built in potential for renovation(s), adaptive reuse(s), and even eventual demolition - each with its own individual life cycle considerations.

Parts Versus Functions

Analytical approaches typically disaggregate a problem into its constituent parts. Certainly, a construction project may be so analyzed. The tendency however, is to remain locked into the conventional part by part description with the whole going unexamined. This might be considered analogous to designing and building a better typewriter: an exercise in quality without value.

A NEW APPROACH

Alternative Approaches to FAST Diagramming

The following are examples of alternatives to conventional approaches to function depiction in construction value studies: scope, operations, and project objective diagrams. They are but a few of the many options available. Each example represents a slightly different approach to function identification, and each resulted in some unanticipated and beneficial outcomes.

Scope Diagrams

This clinic renovation project involved a two level, 28,000 SF, masonry building, located in the southwest USA. It was originally constructed in 1910. The exterior of the building had gone through several renovations that maintained its aesthetic and physical integrity at a very high level. Similarly, interior renovations over the years had updated the interior construction to reasonable levels. Air conditioning was added sometime in the 1950's and the last major system improvement had been completed in 1980. This last improvement included a major update to HVAC and the interior electrical distribution and branch wiring systems.

Since the 1980's update the building was used as a outpatient clinic and regional administration office. Future use was projected to remain the same, except that the medical office area was expected to increase and the administration to decrease due to centralization programs.

In 1990 a study of life safety code requirements and standards revealed a number of deficiencies. A project was subsequently identified and budgeted to remedy the deficiencies. The work items required to correct these deficiencies (in function terms) were identified as:

Replace (electric) Vault
Remove Asbestos
Upgrade Alarms (fire)
Add Sprinklers
Add Lighting (emergency egress)
Duct Air (return)

The project was budgeted at $800,000 (approximately $30/SF). Preliminary design studies were initiated and a project scope document (equivalent to a schematic, or 15% design, package) was completed in early 1993. At that time the project cost estimate had increased to over $1.6 million. A VE study was subsequently conducted by a three person team over a five day period. Three days of the study were conducted on site and involved extensive interface with the user and operators.

Figure 1 represents the complete FAST diagram that was developed by the VE team on the current concept scope. This FAST clearly shows that the major costs for the project had been diverted from the original objective, "Improve Safety". The project now had three basic functions. One of the new basic functions, "Reduce Complaints", had been interpreted as being of such importance that the entire HVAC system was to be replaced. The scope of the replacement system was extremely complex and involved constructing two new, detached, central plant buildings (50 ton chiller, boiler and dual duct air handling unit in each).

Although much smaller in impact, a third basic function, or project objective, "Reduce Maintenance", had also been introduced.

The VE team used this diagram to clearly explain to the owner, operators and users where and for what exact purpose their money was going. Understanding the facts and being provided some realistic options, the VE team was able to identify alternates that refocused to the original objective but provided ways to satisfy the other new basic functions within the original budget of $800,000.

Some changes that were made included:

- Using roof top VAV units at existing AHU locations.
- Continued use of the existing chiller.
- Deleting the emergency generator (not a life safety requirement).
- Deleting additional roof insulation over a ventilated attic.

Operational Diagrams

This example is from a project where VE was integrated into the planning and scope development of a project design program. At the very beginning of the project, the process involved a concentrated 10 day study during which design concepts and VE type alternates were presented to the owner/users in an iterative process. The process followed the VE job plan in that the first step is to gather all information and to identify functions and costs related thereto. The next step was to brainstorm alternates to meet the requirements, This was followed by analysis and the development of rough concepts. The rough concept is then fed back to the owner/user. This results in more information. The team then returns to speculation, analysis, development, and presentation. This process is reiterated until a final agreement on the project scope, form, content and costs are reached.

This specific example involved an assembly building for air to ground rockets. The facility size and budget were the main parameters with which the team started. The users had drafted a rough floor plan and had put together a wish list of features (e.g., air conditioning). The building was only 3,000 SF, but there was a considerable amount of pavement and site work in the budget and sketches.

In order to fully understand how to design the facility the team developed a FAST diagram focused on the process surrounding the total operation from receipt of components to deployment. Figure 2 represents the FAST that was developed and refined during the scope development. One unique aspect of this FAST, is that we were able to identify the "Mode of Transportation" involved during various stages of the operation. The transportation flow, shown at the bottom of the FAST could also have been attached to a time or schedule line.

Another unique aspect of this FAST is that, without making it too complicated, the reverse process and functions were also depicted by the dashed lines and arrows. The FAST could have been expanded to include all of the reverse process functions. To do this, disassembly functions would have to be added to correspond with each of the assembly functions. Following is a partial list of the assembly functions and the corresponding disassembly functions that would need to be added to the FAST:

Assembly Function	**Disassembly Function**
Stage Rocket	Restage Rocket
Charge Rocket	Discharge Rocket
Assemble Rocket	Disassemble Rocket
Program Rocket	Deprogram Rocket

One of the most important aspects of this FAST diagram was that it helped the design team communicate with the users and established a credibility bond between the design team and the user. One of the user's comments at the end of the scope development was "We were really pleased to see how 'fast' your design team was able to understand and logically layout our operation".

Project Objective Diagrams

In some cases, clarification of the project objectives is particularly revealing. In this example (Figure 3), the project involved facilities for transferring passengers from low occupancy vehicles (LOVs, i.e. single occupancy automobiles) to high occupancy vehicles (HOVs, i.e. busses). This process was to be built at a suburban location adjacent to a major freeway connecting with center city office and shopping. The project components comprised a quite large parking lot, a (relatively) small covered but unenclosed shelter for waiting passengers, and required access and egress drives and ramps LOVs and HOVs.

Approximately 83% of the total project estimated dollars were allocated to the basic function "transfer passengers". Approximately 58% of this 83% (or approximately 48% of total project costs) were given over to the secondary function "accommodate LOVs" (long and short term parking of cars). Approximately 35% of this 83% (or approximately 29% of total project costs) were given over to the secondary function "queue passengers". Based on the seemingly disproportionate percentage of project funds dedicated to a parking lot, the team examined more closely the justification for projected demand

and found that only roughly half of the total capacity of the lot could be fully justified at this particular location. Indeed, the survey data suggested that another facility, further away from the downtown area, was the more likely beneficiary of the excess capacity planned for this project.

However, even the "justified" portion of the demand calculation depended on fairly optimistic projection of increasing usage - a mix of suburban population growth and (more importantly) increasing public willingness to shed the private automobile in favor of demonstrably faster and cheaper public transit. With this in mind, the team again took note of the "all the time function" identified as "attract public" and, in the creativity phase, developed a series of ideas aimed at increasing both the reality and positive perception of security. In particular, the team suggested the transit project incorporate selected commercial enterprises at the site which would not only generate revenue (conveniences such as dry cleaners, fast food outlets, news stands, and the like) but would also provide the human activity on the site missing in the project proposed. This idea was not developed into a full proposal largely because of the absence of reliable cost data; nonetheless, it was contained in the final report as a partially developed proposal (PDP). At the presentation/implementation meeting, this PDP was rejected on the basis of having been previously found to be infeasible. Within less than one year from the study, local papers reported the transit authority had reconsidered the matter and had decided to implement the idea on a pilot basis.

THE FUTURE

Design Intent and VA Studies

Since at least the late 50s, and continuing to the present, design professionals have focused (and rightly so) on the development of a wide array of programming tools to help establish and document project scope, components, and relationships. Certainly VA might be viewed as another approach to programming or as a method of program validation and confirmation. It has been common wisdom for some time that VA is best accomplished, at the earliest, at about the 35% design stage. The argument made was that until the design reached this point, VA was useless since the team would be, in essence, VA-ing a blank sheet of paper. Yet on many projects (particularly large complex projects or projects that, for various reasons, have lingered in the design phase for an unusually long period of time), a 35% commitment to design can represent an almost insurmountable potential redesign obstacle to VA proposal implementation. The authors' experience suggests that much earlier studies are extremely beneficial, notwithstanding the "blank sheet" phenomenon. The primary benefits realized from early on studies include communication of scope among a sometimes large and diverse group of decision makers and design professionals (team building), early identification of a wider range of project alternatives (before everything gets written in stone), and creation of a basic programming (function) consensus (if one does not already exist) or validation of the program (if one does exist).

Impact of Electronic Integration of Building Process on VA Studies

It is probably not possible to overemphasize the importance of the impact of these developments on VA. Design and construction simulation and CALS (most recently an acronym for commerce at light speed) are but two quite broad and closely related areas of integration research where the computer will play an increasingly large role. The use of common shared data and tools in real time will radically alter the nature of design processes and "documents" as well as designer and constructor coordination and contract administration.

Value studies may be conducted over vast distances and involve greater numbers of team members. Information can be more readily shared, creativity more richly stimulated, and evaluation more comprehensively conducted. Issues of constructibility and implementation can be more thoroughly explored through computer evaluation of alternative erection sequences and evaluation of a broader range of impacts.

Areas for Further Research

As a result of developing the ideas advanced in this paper, certain other notions (digressions) have been recorded and are placed here as a stimulus to additional thought about the many potential facets of FAST. These brainstorming ideas are offered in the hope that others may build on and improve this exceptional tool.

- A Graphic or Visual Equivalent of FAST: This would depend, of course, on a prior development of a visual equivalent of the traditional noun and verb function descriptions. The power of such a tool might be in its ability to overcome differences of spoken and written language and in more precise (unambiguous) translation of intent into the built environment.

- FAST for Children: The great appeal of FAST is its ability to communicate function relationships through diagrams. A good writer and illustrator together might be able to develop a primer to communicate the whole of the value approach. In the hands of children, who knows what might develop?

- A FAST Forum and Exhibit: There are currently a number of techniques that share at least a distant kinship with FAST: flow charts, mind maps, bubble diagrams, affinity diagrams, signage systems, and the like. Many of these are highly specialized and "industry specific". Assembling them into an exhibit might not only be visually interesting - their developers, users, and beneficiaries might also enjoy the shared insights.

- Three Dimensional FAST: FAST has always been something done on a piece of paper - a flat two dimensional plane defined by the "how-why" and "when" axes. Admittedly, more mileage might be gotten by exploiting the "up" direction of the "when" axis (assuming that "why" is customarily "down"). But, is there an axis perpendicular to the Flatland in which we currently exist? What additional function information could it communicate? Who, what, and where perhaps? Perhaps it could be just a more sophisticated way of depicting levels of indenture.

FIGURE 1
CLINIC RENOVATION
FAST DIAGRAM
ORIGINAL DESIGN CONCEPT

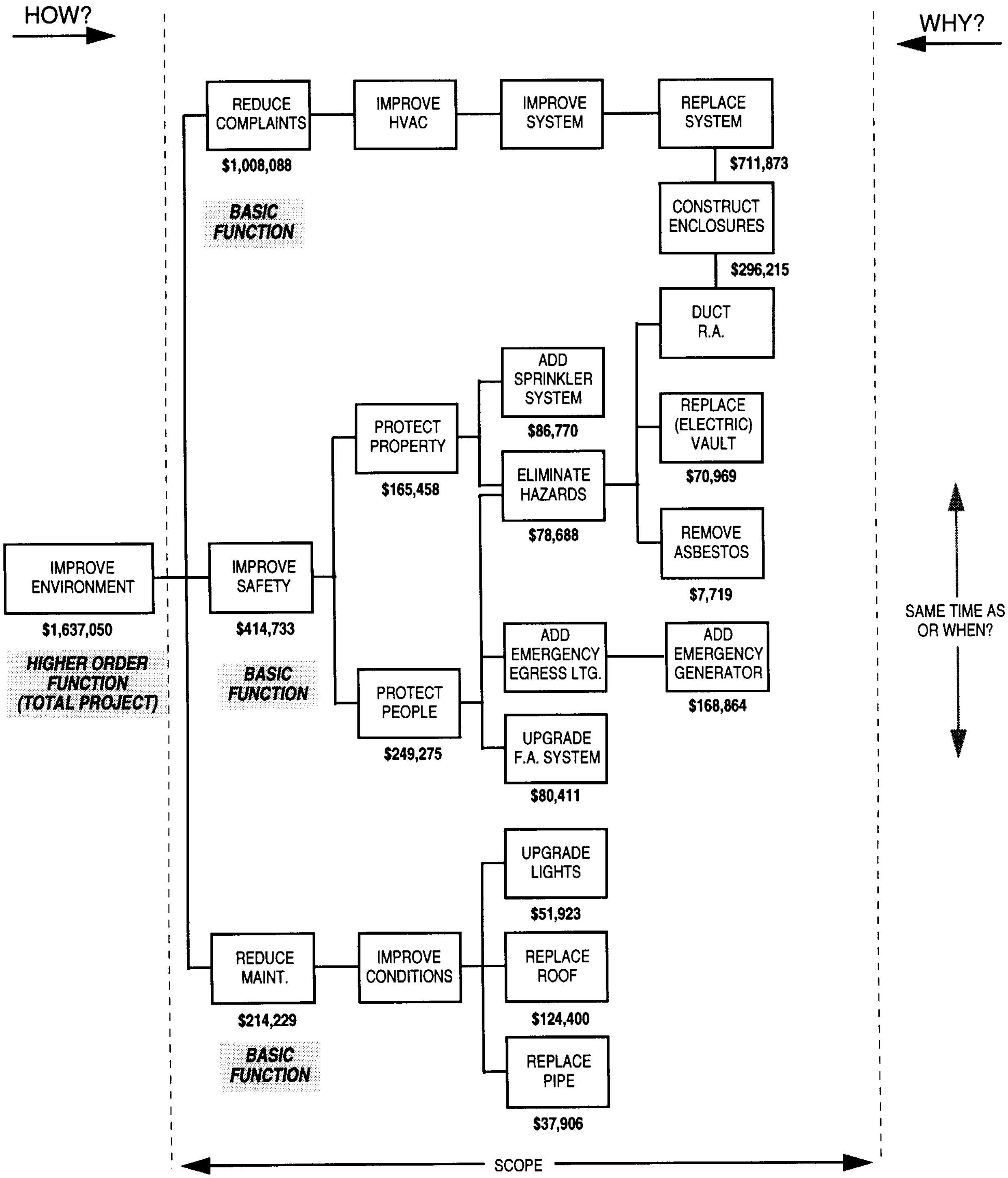

FIGURE 2
ROCKET ASSEMBLY FACILITY OPERATIONS
FAST DIAGRAM

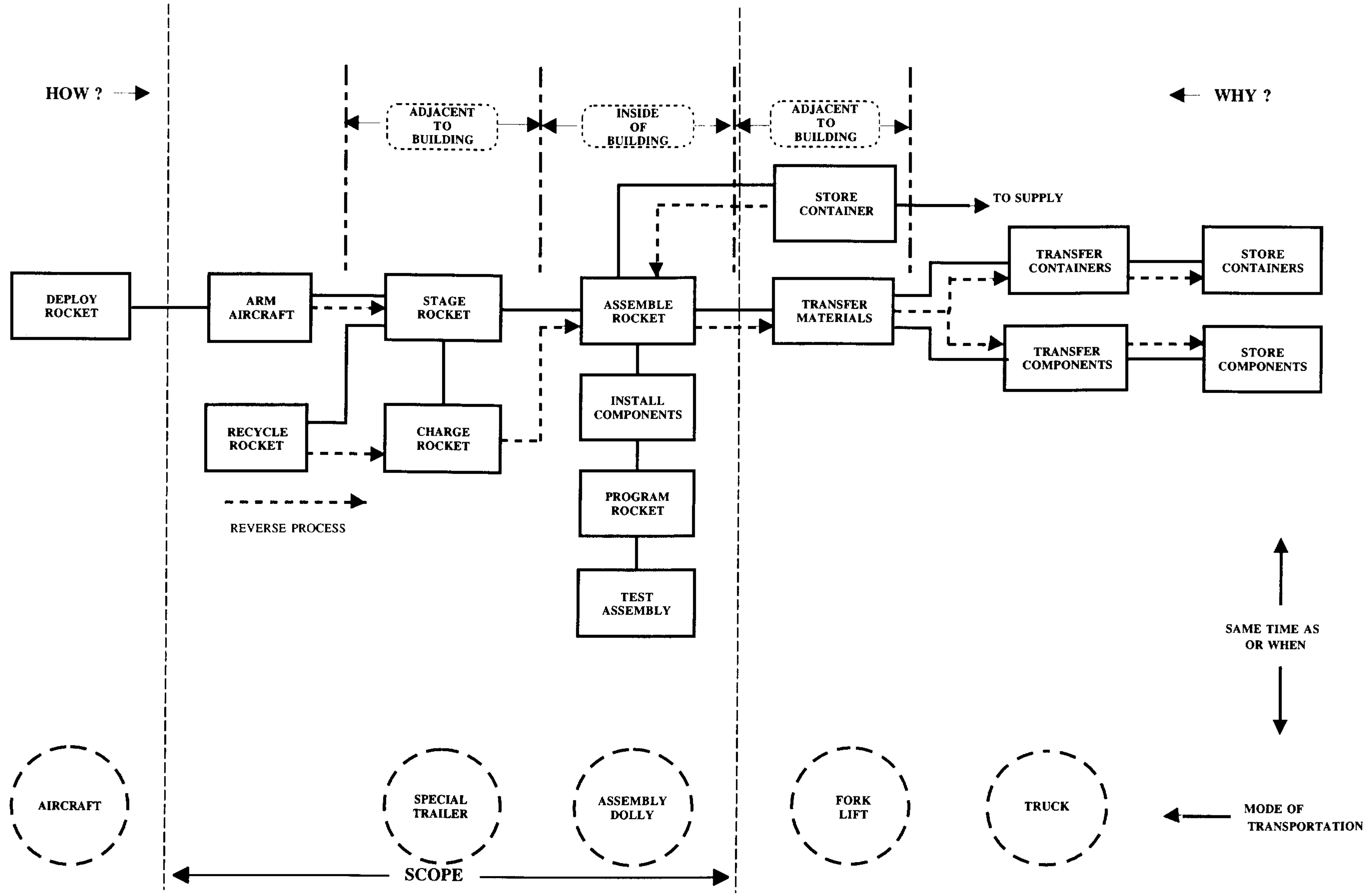

FIGURE 3
PARK & RIDE FACILITY
FAST DIAGRAM