Collaborative Design Build Process Example

1.0 Introduction

The Glazer Children's Museum, a new museum scheduled to open in the spring of 2010, will provide a rich learning environment for children between the ages of birth to 10 years old. Through innovative, robust, deeply textured and pedagogically sound, age-appropriate offerings, the museum will gain a national reputation for an example of community and societal service and focus.

There are nine exhibition galleries that will be procured by the GCM in a design/build format. These galleries are:

- Our Village
- Cruise Ship
- My House, Your House
- Design + Build
- Engineers' Workshop
- Kids Network
- Get Moving
- Art Smart
- Safety Village

THE MASTER BUILDER

(From Design-Build Institute of America)
Design-build is an integrated delivery process that has been embraced by the world's great civilizations. In ancient Mesopotamia, the Code of Hammurabi (1800 BC) fixed absolute accountability upon Master Builders for both design and construction.
Master Builders accepted full responsibility for integrating conceptual design with functional performance. To assume anything less than complete accountability for delivering a project was unthinkable. Throughout each logistical undertaking, they commanded skilled craftsmen, procured time-tested materials, and controlled every aspect of the project. The Master Builder was (and is) the chief architect, engineer and builder molded into one. Today, however, there is a resurgence of the Master Builder approach in the new world. Informed owners have begun asking practitioners to take more than just an artistic (and more than simply a means and methods) interest in their projects. Underpinned by the work ethic exemplified by the ancient Master Builders, today's design-build process delivers striking examples of high value comprehensive projects.
The Master Builder, today called the Design-Builders, want full accountability for development and architecture, engineering and construction. By knowledgeably pursuing design quality, and by effectively controlling costs and schedule, a Design-Builder carrying on the tradition, makes certain that concept-to-completion is successful reality.

Successful development of this project will come from 'partnering' with a full-service exhibit fabrication firm with experience in large, structural components and children-focused interactive multi-media environments.

Entech Creative Industries has successfully completed a number of projects similar in scope, complexity, size and creativity. Accordingly, we have a significant amount of experience in the design and fabrication of projects of this nature and tried and true techniques for accomplishing the necessary tasks.

Uniquely distinct in our field, Entech possesses an extremely strong in-house technical creative staff. Along with professional, degreed engineers and technical designers, we have amazing creative talent coupled with a gifted fabrication staff.

Furthermore, the Design-Build format is that which we are most accustomed to working in. Design criteria development, modeling, technical design, calculations, submittals and reviews are standard and customary in our work. (We have extensive history in this nature of work and can make available a broad variety of examples.) The process that we lay out following is a standard approach for us in our typical projects.

2.0 An Important Aspect of Why This Project is Unique

There is however a notable element to this particular project from the so called 'get go'. That is the fact that GCM is a most able Owner with knowledge and capabilities in the nature of service that we provide that goes significantly beyond that of the more traditional Owner. With our extensive knowledge of this industry and its requirements, our review of the RFP and our meetings with the GCM staff, we know that the GCM staff is extremely knowledgeable in the content of the exhibitions and the exhibits. The construction of the RFP wherein the exhibit design direction is very clearly laid out is an easy indication of those facts. It is apparent to us that GCM knows what they want and how they want it. This is fortunate for the GCM organization.

Such in-house knowledge, coupled with that of the correct design-build partner who understands their role, will result in:

- Improved project timeline.
- Improved work product.
- Cost control.

In a following section, we will discuss these factors in more detail.

3.0 Our Role as Design Build Partner: Extension of GCM's Core Competency

In a sense, we view the GCM core staff as in the role of the Master Builder (see text box elsewhere for explanation of the Master Builder role). We believe that if the circumstances were such, the GCM core staff could largely develop this content in-house; the knowledge base is that deep.

The role of the Design-Build Partner as we view it in this case is essentially acting as an extension of staff of the GCM, who assumes the role the Master Builder. As staff extension, we, Entech, provide:

- Technical Design and Engineering (Entech provides in-house)
- Creative Design including Graphic Design (Entech provides in-house)
- Educational/Occupational Development Support (Entech provides in-house)
- Procurement (Entech in-house)
- Project Management (Entech provides in-house)
- Fabrication/Construction (Entech provides in-house)
- Testing/Documentation (Entech provides in-house)
- Installation (Entech provides in-house)
- Startup and Burn-in Testing (Entech provides in-house)
- Warranty and Service Support. (Entech provides in-house)

We view our role as almost an extension of the GCM core staff in providing these functions. GCM has been very clear in the RFP as to what the vision is for the content of the elements including their performance and a number of salient characteristics beyond for that matter.

Accordingly, we expect a great deal of interaction with GCM although that is purely at the prerogative of GCM. We are fully capable of progress on the project without such input and will take full responsibility regardless of its presence or absence but, since we believe this will be a collaborative effort, we will make ourselves available.

The following Figure 100 illustrates at some level the view we take of our role as extension of GCM's intrinsic competencies.

Figure 100: Building Upon GCM's Vision with GCM

3.1 Capitalizing on the Built-In Advantage of this Project

As previously discussed, this is a special project made so by the existence of the deep knowledge base of both the Owner and ourselves. As mentioned before, correct application of this knowledge can be expected to result in:

- Improved project timeline. (Schedule)
- Improved work product. (Scope)
- Cost control. (Cost)

This is effectively a rendition of the fairly well known "Project Management Triangle" illustrated in Figure 200. The following is excerpted from (http://en.wikipedia.org/wiki/Project_Management_Triangle) for the purposes of making the point.

Figure 200 – The Project Management Triangle

"The Project Management Triangle is a model of the constraints of project management. It is often used to illustrate that project management success is measured by the project team's ability to manage the project, so that the expected results are produced while managing time and cost. ..... The discipline of Project Management is about providing the tools and techniques that enable the project team (not just the project manager) to organize their work to meet these constraints.

The point is this: In many projects, the Owner, for a variety of reasons, does not recognize their importance or pivotal role on the Project Team. In some instances this is for lack of prior experience while in others it may be for other reasons. In each case for whatever the reason, an improperly engaged Owner becomes, in the hackneyed cliché, its own worst enemy.

In this case the Owner clearly has the knowledge and willingness to actively engage in the collaborative PM process. This will facilitate efficient, reasoned decisions that can be well expected to result in optimized outcomes.

We've developed our costing based on our interpretation of the RFP as directed. This, of course, permits GCM to evaluate each cost proposal in an apples-to-apples fashion. As can be understood, in evaluating such a refined package there will necessarily be a tension in the estimating between the literal interpretations vs. the 'figurative' interpretations. This is a balancing act in cost estimating. Inasmuch as the package presents as at a fairly high level, we've biased our view to the literal interpretations.

In plain speak, we've costed what we saw and understood. However, as any competent developer would, we have a number of suggestions on meeting the spirit of the content, at the same or higher performance levels, for less cost and in certain circumstances, much less cost.

Accordingly, we expect that, if the successful responder here, that we will have a series of meetings in advance of the primary works effort that we've called "Budget Alignment" meetings(s).

4.0 The Process We Will Follow for the GCM Project

As we interpret the work delineation in the Request for Proposal (RFP), the work breakdown structure is in the following primary components:

- Phase I – Broadly Titled as DESIGN DEVELOPMENT

Which includes in broad terms (and will be discussed in more detail following):

- SOW/Budget/Timeline Alignment with GCM
- Exhibit Content Design Completion
- Graphic Development
- Media and Programming Design and Pre-Production
- Fabrication Shop Drawings

In executing Phase I, the services we provide are largely in the areas of, but not limited to, the following:

- Technical Design and Engineering: We will provide technical design and engineering services associated with the design of the project. These services, which will be elucidated below include technical development, design and analysis normally associated with such services. This includes the design of the interactive sand the control systems

for them if necessary.

- Creative Design: The Entech team will include experts in aesthetics, cladding/theming materials selections, surface development and coating systems. We have an extensive background in a broad variety of materials and systems related to this area can make extensive use of this experience here. This includes the graphic design of the signage and all of the thematic elements.

- Media and Software Content Design. This includes all of the hardware, firmware and software design necessary as well as the pre-planning of any production work which will be finalized in the Phase II work.

- Phase II – Broadly Titled as FABRICATION, INSTALLATION AND STARTUP

This includes in broad terms:

- Fabrication, Installation, Startup, Testing, Warranty and Service

THIS WILL BE DISCUSSED IN MORE DETAIL FOLLOWING:

4.1 Phase I Design Development Process Discussion

We propose to execute the work of Phase I with three "Milestone Submittals" and a review/approval of each. These are milestones are:

- SOW/Budget/Timeline Alignment Review and Re-submittal
- Preliminary Design Development with Review/Approval
- Detailed Design Development with Review/Approval

This process is customary and standard on medium to large projects and systems in industry. The origin of this process is in the defense industry where defense contractors like Boeing and Lockheed-Martin among others still practice this process. At one point, given designs were designated as being % (percent) complete (typically at 30%, 60% and 90%) but this was later changed as overly ambiguous and the submittals simply named (i.e. Concept Design, Preliminary Design, Detailed Design and As-built. Historically the 100% submittal was considered the As-built condition submittal.)

In this process, each submittal builds upon the one before and is measured against design criteria initially developed in during, in this case, Preliminary Design Development.

NOTE: The existing work product received as part of the RFP package is significantly more than sufficient for Concept Design which easily permits movement directly into the next phase, that of Preliminary Design. Note that it is possible that a case could be made to skip Preliminary Design however we believe that it would be unwise to do so. There are still a fair amount of areas to be delineated in enough detail to make the PDR (Preliminary Design Review) submittal worthwhile albeit significantly shorter in duration than it would be otherwise without the significant RFP development.

Following is a discussion of the major characteristics and activities of the design development phases. Note that this is not meant to represent a comprehensive listing of all activities and listing.

4.1.1 SOW/Budget/Timeline Alignment Review and Re-submittal (if necessary)

We intend to have this meeting to coordinate our current thinking with that of the GCM project team and establish/confirm SOW/Budget/Timeline. We will have at that meeting as a minimum the Entech PM and assistant, the Entech Chief Engineer, the Entech Creative Director and the Entech Project engineer. We anticipate that it may be several meetings and will cover significant ground and produce an extensive action item list.

Coming out of this meeting(s), we will resubmit a description of the itemized SOW responsibility matrix, cost and schedule.

Note that this meeting(s) may not be necessary depending upon how GCM elects to proceed on this project. Inasmuch as we believe there are opportunities to savings on the project, we recommend this engagement to GCM.

4.1.2 Preliminary Design Development with Review/Approval

The deliverables proposed for being due at the conclusion of Preliminary Design Development for the project are as follows:

- Design Criteria Document
- Preliminary Design Technical Drawings (Engineering Design Drawings) and Calculations
- Final Facility Input Matrix

The logistical process is expected to include the following meetings:

- GCM/Entech – Post-Submittal Design Review Meeting

4.1.2.1 Design Criteria Document

The design criteria document will set out the criteria by which the design will be executed and judged as acceptable. As a minimum, the document will cover:

- Performance specifications for the system/item.
- Codes and standards for use in the design if applicable.

This document, which can be revised in subsequent phases within limits, becomes the standard against which all design review submittals are measured.

4.1.2.2 Preliminary Design Technical Drawings

In accordance with the design criteria, we will execute technical drawings that will describe the design in terms of dimensions and framing and control schemes. Proposed facility interfaces will be defined in the preliminary submittal of the facility input matrix.

The preliminary technical drawings are typically considered as “engineering design drawings” (as opposed to shop drawings which come in the subsequent submittal.) They show significant detail in terms of addressing how the mechanism/item and structure is to be built and operated and relevant details. The physical interface with the facility is nailed down.

The control system wiring and logic approach is also well delineated in this package from a high level standpoint. This includes all of the AV, lighting, controlled or controllable DOF’s and effects.

In the preliminary design phase, we will are able to create CAD models of the elements using our CAD design tools, and AutoCAD and AutoDesk Inventor (a full parametric solid modeler). Use of these tools also provide for easy interface into our analysis programs including RISA and ALGOR in the event that we need to calculate stresses and responses for some of the more intricate systems.

As noted, in executing work of this nature, we typically utilize a combination of advanced stress analysis programs coupled with hand calculations for our structural analysis. It is uncertain at this point whether any FEA will be required if frame analysis will prove sufficient. At any rate, the CAD model will easily transfer into to our ALGOR, which is our primary FEA tool. Our primary frame analysis tool is RISA.

At this stage of the design, all major decisions have been identified and made. Thus mechanism and member framing and sizes have been selected and shown with typical details. The means and methods selected for the interior and exterior surfaces have also been drawn and specified including typical details. The majority of coloration is either specified or developed on color boards.

All facility interface issues have been decided and detailed. These are included in a facility input matrix that delineates the structural and MEP interfaces required of the base building

4.2.1.3 Final Facility Requirement Matrix

The final facility requirement matrix will detail the structural and MEP requirements of the facility. This is the information that the base building architect/engineer will need to finalize is construction documents for the general contract. (The facility input matrix defines the requirements of the base building from the standpoints of structural and MEP. In other words, the facility input matrix defines the details required to be part of the base building CD's so that the facility general contractor will provide them. We will also suggest here a load-in strategy for the installation. This may influence the base building construction time-line in terms of closing in the building, (i.e. it may be necessary to leave penetrations in walls), painting, carpeting and erecting internal ancillary structures.

4.1.3 Detailed Design Development and Review/Approval

The deliverables proposed for being due at the conclusion of Detailed Design Development are as follows:

- Detailed Design Drawings
- Fabrication/construction and installation specifications
- Draft of Operations and Maintenance Manual
- Plant and Site Acceptance Testing Program

The logistical process is expected to include the following meetings:

- Detailed Design Review Post submittal Meeting

4.1.3.1 Detailed Design Drawings

The detailed design drawings are shop drawings permitting all of the elements to be fabricated in their entirety. The drawings are at a level to go into shop fabrication with – they are "Shop Drawings". The specifications cover fabrication methods and installation requirements.

These drawings include the control system fabrication drawings, schematics and wiring diagrams. The control system logic flow is also included however the programming of the logic flow into the signal processing device (for example), is a function of the fabrication phase.

4.1.3.2 Construction and Installation Specifications

The construction and installation specifications work with the shop drawings to outline the methods and practices to be utilized in fabricating and installing the system.

4.1.3.3 Draft of Operations and Maintenance Manual

The draft of the operations and maintenance manual and program illustrates the proposed contents and preliminary write-up of the completed operations and maintenance manual and program, which will come only at the completion of the fabrication and installation phase.

4.1.3.4 Plant and Site Acceptance Testing Program

The Factory and Site Acceptance Testing Program specifies the factory and site based testing program that will be executed to assure compliance of the design with the design and performance criteria developed in the Concept Design Phase.

4.2 Phase II Fabrication Discussion

Emerging from Phase I, all of the requisite documentation is in place to move into the Procurement, Fabrication, Installation and Startup of the work.

Entech will oversee and coordinate all aspects of the work as is our responsibility to GCM with full transparency of the matter to the GCM core staff.

Our intention is utilize both an in-house building and outsourcing strategy for the content. We know now for example that for the following elements we will outsource.

A/V Design/Media Production/A/V Software Development. We will Technomedia of Orlando, Florida for this work. http://www.gotechnomedia.com/

Graphics Production. For the production of the graphics that we will design in-house in conjunction with GCM. We have three primary resources we use for the production of graphic elements. These resources are:

- Don Bell Signs, Port Orange, Florida
- Signs Now, Kissimmee, Florida
- Office Signs Pro, Sarasota, Florida

Other Resources: There are a number of exhibits in the design that are being replicated at some level. In those cases, we will look to the original builders if it makes sense to do so. Alternatively there are a number of small skilled shops that make fine product and certain of these exhibits will lend themselves to being procured by us through those parties. We are not out to build everything ourselves necessarily. We are out to collaboratively deliver the finest vision we possibly can for GCM.

4.2.1 Quality Assurance Program

Entech Creative Industries has a written Quality Assurance Program that we operate under which includes engineering and technical design. A copy of this program is available upon request.

Entech Creative Industries is a TUV approved UL-508A approved panel shop. Accordingly our interactive controls will be submitted with UL stickers affixed.

4.2.2 Factory Acceptance Testing Program

All of the exhibits will be Factory Acceptance Tested in the plant prior to being shipped into the field. This FAT program is developed in Phase I.

4.2.3 On-Site Activities

At the appropriate time, Entech will mobilize its and its vendor's forces into the field for installation. We will be responsible for all aspects of shipping, installation, startup and burn-in testing.

Additionally we have the responsibility of training and service as well as our warranty obligation.

The details of the installation plan emerge in great detail during Phase I work.

5.0 Project Staffing and Resources Plan

From a staffing and resourcing standpoint, we propose to approach this project in the standard manner by which we customarily approach large, complex integrated projects of this nature. We will designate a dedicated project team with defined roles and responsibilities. A rudimentary organization chart is illustrated in Figure 300.

Figure 300 – Short Form Organization Chart

The key positions of this team are as follows: (CV's for the noted individuals are supplied under separate cover.)

Project Manager and Assistant P/M. The project manager is accountable for everything pertaining to the Entech project and makes sure that all necessary decisions and actions are being taken at the proper time. Among other duties, the project manager identifies and arranges for the necessary resources to meet the project's declared targets and gives priority to the interests of the project. The project manager reports to the Chief Executive Officer at Entech Creative Industries.

All day-to-day project communication is to and from Entech Creative Industries is through the project manager. As can be seen on the organization chart, the Entech project team will be lead by the Project Manager. Entech's project manager will be the point of contact for the entire team and the client. During the project, there will be direct free information flow between parties on both Entech's team and the client, but it is our expectation that the initial contact is through the PM and that the PM is "in the loop" with all information exchange. Likewise, we envision coordinating and working through a main point of contact on the client side of the project team. [Mr. Bill Holden will be the project manager for this project.]

To ensure that the project maintains adherence to the performance criteria while maintaining the schedule and budget, there will be multiple pre-designated discrete client input points (like specific design reviews). Inasmuch as we view our role as an extension of staff there will also be day-to-day input and availability of the design team to GCM.

Project Engineer and Technical Design: The project engineer is responsible to the project manager for the technical development of the project. The project engineer is the PM's technical advisor and responsible for executing much of the technical work in developing the project. This includes interfacing with the engineering department and working with the Director of Engineering in deploying engineering resources to the project. The project engineer is responsible to the PM for assuring that deliverables are progressing through the engineering function in the planned manner and to the satisfaction of the project team. [Mr. Steve White, P.E. will be the project engineer for this project.]

It is important to note that the Project Engineer is not the sole engineer working on the project. Rather, he is effectively the project liaison to the engineering department and will necessarily have a broad base of technical knowledge about the project. The engineering department, which will execute the engineering work, is departmentally staffed with a Director of Engineering (responsible for administration of the department) and a Chief Engineer (professionally responsible for the entire integrated design) as well as the balance of the departmental staff. [John Marhoefer, P.E. is the C.E.O and chief engineer of Entech Creative Industries.]

Project Creative Personnel. Entech will supply two primary personnel for creative work on this project. These persons are Mr. Chris Stapleton and Mr. Terry Shistle. The Entech creative team is responsible for the development of:

- Consistent and resonant thematic design
- Graphics
- Configuration, Massing and Layout matters
- Et al.

The creative development will necessitate the production of color boards and a sample program.

A general look at the division of labor breakdown consistent with the WBS form illustrated in the Bid Form (with amplification) is as follows in Figure 400:

Figure 400 – Division of Labor Illustration pre Bid Form WBS