Project Delivery Evaluation

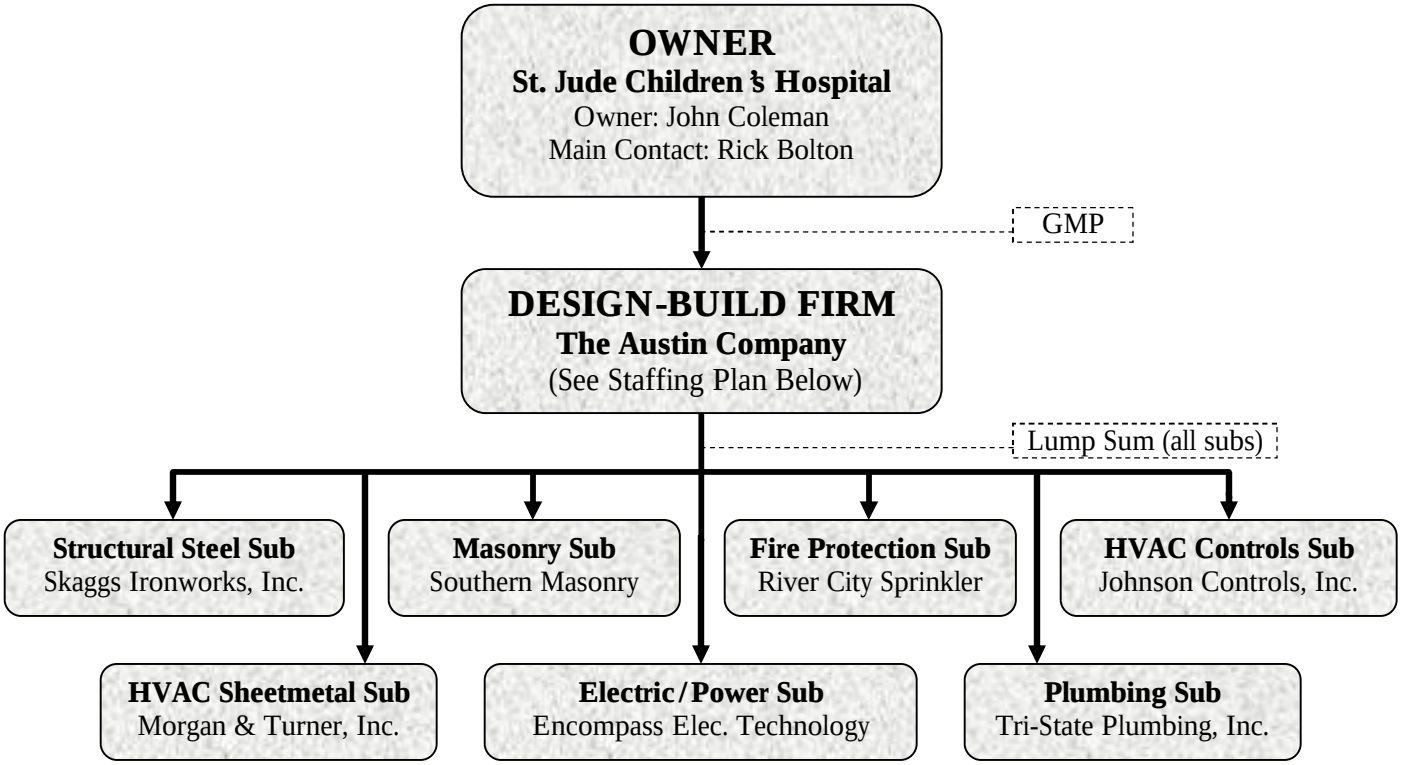
Executive Summary

The Austin Company has done a thorough job of analyzing Owner requirements, federal regulations, facility type and building methods and has come up with appropriate and successful ways to manage and control this project. A design build, GMP contract is in place between St. Jude and Austin and was the best choice for this project type and scope. The Austin Company is a fitting design-build contractor and has made sound decisions in the staffing and controlling of the job. They have also gone to great lengths to ensure proper coordination of the MEP trades. Overall, their preparation and management has led to a successful construction project so far.

Contracts

The contract between The Austin Company (D/B Firm) and St. Jude Children's Hospital (Owner) is a guaranteed maximum price contract for $30,488,990 total, which includes #29,038,990 for labor, materials and equipment as well as $1,450,000 for architectural and engineering services. The fee that the Austin Company will receive is 4.75% the cost of work with a 10% retainage withheld each pay period (retainage isn't necessary after the work is 50% complete). The Austin Company, in turn, has a lump sum contract with each of its subcontractors for varying amounts.

Project Organization Chart



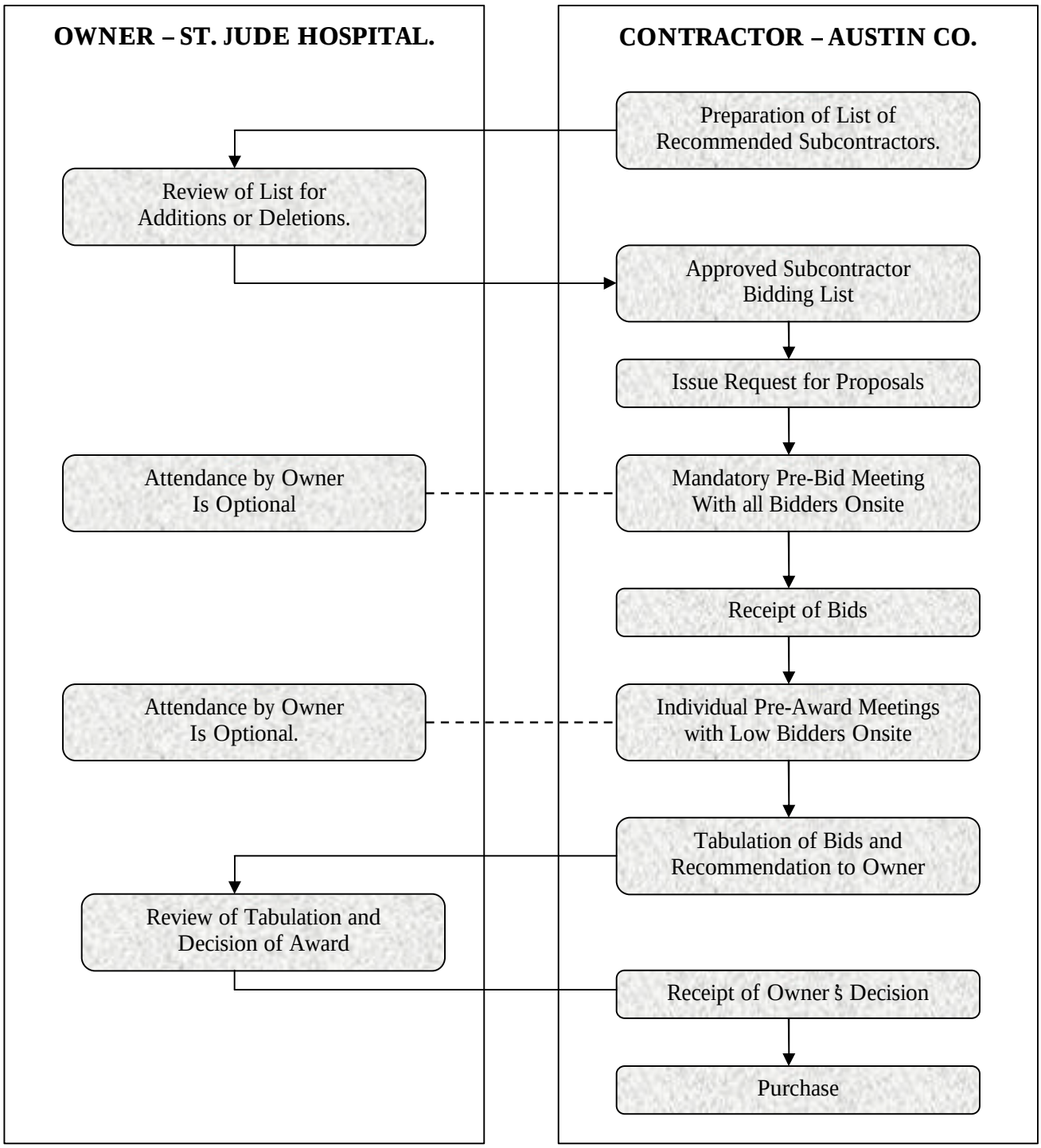
The contract terms are typical with only a few special requirements due to the nature of the project. Being a design-build project, the contract also includes an Architectural and Engineering Agreement which lays out the specific requirements and scope of design. In this case, since there isn't a separate design firm, the contractor is responsible for any errors or omissions in design. The contractor will provide A/E Professional Liability Insurance in the amount of at least $5,000,000 to cover these errors and omissions.

Another unique part of this contract is its discussion of the close-out procedure. There is an allowance of $110,000 in the GMP for contractor assistance during commissioning however, it is clearly stated that this does not include validation of the cGMP (current goods manufacturing practices; not to be confused with guaranteed maximum price) area. Validation is required due to the type of facility and is needed in the laboratory areas of the facility and is the responsibility of the owner. All other commissioning, start-up, testing,

adjusting, balancing and training of the Owner's personnel is the responsibility of both parties. The Austin Company has already hired Robert Naegele (a former Austin Engineer) as a Commissioning Consultant.

Subcontracted services are to be obtained in a typical manner. The diagram below illustrates the process for purchasing subcontractor services explained in the contract.

Procedure for Purchasing Subcontractor Services



Insurance requirements on this project are also fairly typical. The following is a list of the insurance required for The Austin Company on this project:

- Commercial Automobile Liability Insurance – mimimum $1,000,000
- Worker's Compensation and Employer's Liability Insurance – minimum $1,000,000 per bodily injury accident
- General Liability Insurance with the following minimums:
  - General Aggregate Limit of $2,000,000
  - Products Completed Limit of $2,000,000
  - Personal and Advertising Injury Limit of $1,000,000
  - Each Occurrence Limit of $1,000,000
  - Fire Damage Limit of $50,000
  - Medical Expense Limit of $5,000
- Umbrella Policy – Limit of $10,000,000
- Architect's and Engineer's Professional Liability Insurance – minimum $5,000,000

Builder's Risk Insurance is also required on this project and is the responsibility of the owner, St. Jude's Hospital, to provide. There is a $10,000,000 deductible per occurrence and The Austin Company is responsible for payment of the deductible.

There are no surety bonds required for this project nor are there any requirements for payment or performance bonds. However, there is one option in the way of bonds for the owner. The Austin Company has a separate corporation called Austin Holdings that acts, in a way, like a surety for the Austin Company. Austin Holdings guarantees the performance of all of the Austin Company's obligations. The owner has the option to either accept this guarantee or to nullify the guarantee by requiring the contractor to furnish a separate payment and performance bond.

Overall, the GMP contract is the best type for this project. The main reason that a GMP contract was chosen was due to the owner's need to know up-front what the total cost of the building would be. Since much of the funding for the project comes from donation and special funding accounts, St. Jude couldn't run the risk of having an unknown final amount. Especially since the laboratory facility contains many atypical systems and pieces of equipment, a maximum price needed to be determined. A lump-sum contract wouldn't have been suitable since the exact nature and extent of the work couldn't be determined in advance of construction. Another alternative, the unit-price contract would have been even less appropriate since the project was done as a design-build facility. The design documents weren't complete before construction started and, therefore, the contractor couldn't assess the project magnitude in terms of unit prices. Even worse still, from the owner's perspective, would have been a cost-plus-fee contract since the total cost wouldn't have been known until the very end of the project. A guaranteed maximum price contract was the only appropriate choice for the contract that incorporated both the unique building type and also the owner's necessity for a final cost number upfront.

The Design-Build was the best choice in delivery method for this project. Almost all of the projects done by The Austin Company are design build due to the increased ability to fast-track the schedule. Since Austin specializes in unique structures such as pharmaceutical facilities, airport hangers, newspaper plants, hospitals and manufacturing facilities, design

build has been a very successful approach for them. Many of their projects require purchasing of long lead items far in advance which would greatly slow the projects if they weren't done design build. To illustrate this, the following chart shows a breakdown of the schedules comparing design-build to design-bid-build. Notice that the bidding process puts the D-B-B schedule behind by 7 months. This can clearly be seen in the highlighted entries.

Design Build vs Design Bid Build Schedule Comparison

ACTIVITY	D-B	D-B-B
Start Construction Documents	8/6/01	8/6/01
Complete Construction Documents	2/22/02	2/22/02
Site Clearing	11/20/01	6/10/02
Building Pads	12/13/01	7/1/02
Foundations	1/29/02	7/29/02
Steel, Metal Deck	4/16/02	10/15/02
Precast	4/30/02	10/29/02
Roofing	5/14/02	11/12/02
Install Switchboards	6/26/02	12/18/02
Drywall	7/24/02	1/24/03
Roofing	8/21/02	2/21/03
Install Boilers & ACU's	8/28/02	2/28/03
Ceiling Grid	8/22/02	2/24/03
Elevators	8/28/02	2/28/03
Start Up Mech. Equipment	9/12/02	3/14/03
Pull Wire	9/19/02	3/21/03
Energize Electric Equipment	10/3/02	4/4/03
Terrazzo and Resinous Flooring	10/4/02	4/7/03
Lighting	11/7/02	5/9/03
Sprinkler Heads	11/7/02	5/9/03
Ceiling Tile	11/14/02	5/16/03
Casework	12/2/02	6/3/03
Final Paint	12/9/02	6/10/03
Mech. And Elec. Trim	12/13/02	6/16/03
Test and Balance	12/13/02	6/16/03
Carpet and Vinyl Tile	12/16/02	6/17/03
Punch List	1/2/03	7/2/03
Substantial Completion	**1/3/03**	**7/3/03**

Contractor Selection

The Austin Company was actually not the first choice for this project. St. Jude Children's Hospital actually had the design of the project started by another company (whose name is confidential). The first company was replaced because they were failing to complete the necessary scope of the project. The building was extremely under-designed when Austin came on the project. For example, Austin's electrical system was over two times the size of the system proposed by the original design firm. At this point, the owner was looking for an experienced designer to take over the process. Austin's experience in pharmaceutical

buildings weighed heavily in their selection for the project. Also, Austin's fast track, design-build experience would help get the project back on track.

There were no pre-qualified interviews nor has Austin done work for St. Jude in the past. Austin's history in designing projects of this type and scope as well as their excellent safety record and also their record for completing jobs on time and within budget were the primary reasons for their selection. In the pharmaceutical/laboratories department as well as in the safety in construction category, Austin has won many awards for excellence:

- *Division IV Safety Award*
  Awarded by: Lake County (IL) Contractors Association – 2001
- *Craftsmanship for HVAC and Electrical*
  Awarded by: Washington Building Congress – 1999
- *Special Commendation for Design and Construction of a New Building*
  Awarded by: Cornish Buildings Group – 1999
- *Partnership in Excellence*
  Awarded by: Associated General Contractors, Houston Chapter – 1998
- *Reduced Accident/Incidence Rate*
  Awarded by: Safety Council for Western Michigan – 1998
- *Outstanding Achievement in Accident Prevention*
  Awarded by: Aetna Insurance – 1996
- *Engineering Excellence - Highly Commended, Manufacturing Facilities Category*
  Awarded by: Institution of Engineers Australia – 1993
- *Excellence in Design*
  Awarded by: Illinois Council, American Registered Architects – 1992
- *Safety in Construction*
  Awarded by: ICI Pharmaceuticals – 1992
- *Excellent Performance in Design and Construction*
  Awarded by: ICI Pharmaceuticals – 1990

John S. Coleman, VP of Therapeutics and Production at St. Jude summed it up best when he said, "We selected The Austin Company for its track record for successfully implementing complex projects on time and within budget. Austin also has experience in building facilities that comply with stringent federal cGMP standards, which allow for a smooth building process."

Choosing subcontractors was a fairly straightforward process on this job. Lump sum contracts were used with all subcontractors, both union and non-union. All of the subs are from the Memphis area or are familiar with working in the area. Many of the more specialized subs are also very familiar with working on FDA regulated buildings, which seems to have helped this project run more smoothly.

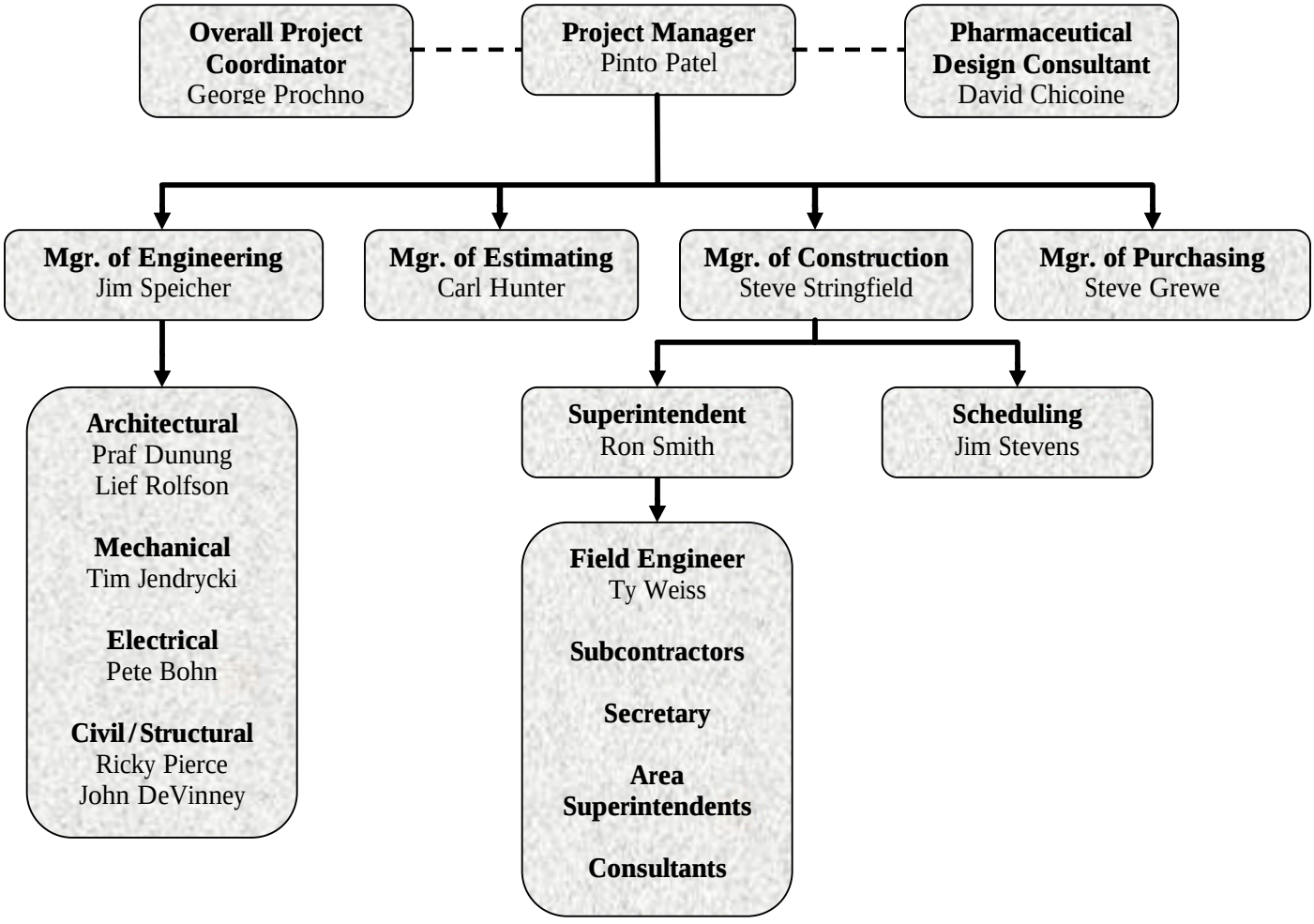
Staffing Plan

Due to the fact that The Austin Company is the both the designer and builder for this project, the staffing of the project takes place both in the design office as well as out in the field. The Project Manager, Pinto Patel, is assisted by two other people due to the

complexity of the building. The Overall Project Coordinator, George Prochno, is similar to an Assistant Project Manager and much of what he handles has to due with scheduling coordination. Ther is also a Pharmaceutical Specialist, David Chicoine, who used to be the head of the Architectural Department at Austin and recently switched to his current specialty in pharmaceutical production. He ensures that the building meets the strict cGMP codes and regulations and was primarily of assistance during the initial design stages when the material and personnel flows were first being determined.

The Chart below shows the overall staffing for the Austin Company both onsite and in the home office. All the onsite team members (i.e. the Superintendent and Area Superintendents, Field Engineer and the Secretary) are on the job full time. The in office team members might have any number of jobs at any given time and the overall executive time dedicated to this particular project fluctuates depending on those numbers.

Overall Austin Company Staffing Plan



Design Coordination

Due to the complexity of the building and the number of systems involved in this facility, coordination is of the utmost importance on this project. Although there are no

requirements regarding MEP or system coordination in the contract (most likely because the designer and builder are a single entity), Austin realizes the importance of coordinating MEP and other systems and has made significant efforts in coordination thus far.

It was apparent from the type of building that a considerable effort would need to be dedicated to MEP coordination. During the design phases, it was fairly easy to coordinate design documents since all of the designers and engineers work off of the same files in the same office. Initially, the designers/engineers held weekly meetings to make sure that the systems were being integrated as efficiently as possible and to address any concerns. Once the design was significantly underway and the construction was beginning, all MEP trades as well as the drywall contractor were involved in the onsite coordination process which Austin started in April (as the steel was being erected). Weekly meetings were held until a completed coordination drawing was created in late August. In the meetings, the following format was generally adhered to in order to make the most of each meeting:

- Upcoming scheduled activities and information.
- Review of past weeks coordination and discussion of problems or concerns.
- Initial coordination (or previous week's) drawing reviewed and discussion ensues.
    - Austin Company superintendent discusses general needs and concerns
    - Subcontractors take turns answering other's questions and posing their own.
    - Austin Company wraps up discussion making sure all questions were addressed.
- Information flow is addressed. Contractors request or trade needed information for next week's activities.
- Next week's meeting time and location are determined.

The final plan was created on CAD and each contractor had a responsible team member sign off on the drawing. This method is highly regarded by all the workers onsite since it not only helped avoid most of the coordination problems in the first place, but has also helped resolve site problems quickly when they do happen.

When an issue comes up on site, the contractors know to first check the coordination drawing to make sure that everyone has installed their equipment properly. This has saved a lot of time for the Austin team since the subcontractors have been able to work out the problems amongst themselves, without taking the extra time of the field engineer and superintendent. Amazingly, there have been no coordination issues with MEP or steel that have caused a delay in the schedule to date, however some of the team members still wish they had started the onsite coordination process sooner.

Since this is an FDA regulated facility, there are numerous tests and certificates that will be required before and during commissioning. PSI has already been hired to complete the soil and concrete testing throughout the project. BSL3 (Bio-Safety Level 3) underground lines were inspected as they were installed and great care was taken in the documentation of the location of those lines. The City of Memphis Fire Marshall has completed several inspections and the Shelby County Code Enforcement has been onsite regularly. Thus far, the facility has passed all inspections. The chart below shows the main system tests that are required.

Systems Testing and Code Requirements

SYSTEM	CODE REQUIREMENTS/TESTING
Sitework – Concrete Paving	Austin must hire a testing agency to test all concrete to ensure 4000 psi at 28 days.
Sitework – Decorative Fencing	Setbacks and gate openings to be inspected by Memphis Fire Marhsall.
Concrete – Cast in Place	Austin must hire a testing agency to test all major pours and report 7 and 28 day compressive strengths (3000 to 4000 psi depending on element).
Metals – Structural Steel	Austin must hire a testing and inspection agency to inspect and report on all high-strength bolted and welded connections.
Communications System	Will be tested and inspected for proper functioning within St. Jude Campus system.
Fire Protection System	Life Safety Code (NFPA-101)
Security System	Will be tested and inspected for proper functioning within St. Jude Campus system.
MEP System	1994 Standard Plumbing and Mechanical Codes, ANSI, ASME, ASTM, AWWA, Underwriter's Laboratory, NSF, ASHRAE
Electrical System	1996 Electrical Code, NFPA 70
Environmental Control System	Must follow cGMP standards and FDA regulations.
General	Standard Building Code (SBCCI 1994)

St. Jude has also hired a commissioning consultant to organize and control the commissioning process and the overall quality of the project. All quality control and health/safety systems must be tested and inspected before the building can be turned over to the owner. This includes testing and inspection of the environmental control system, MEP systems, security systems and card readers, fire protection system, etc. Special tests must also be completed to ensure proper pressures between rooms and proper air quality in cGMP areas. The cGMP areas of the building must also be validated before use, but this is the responsibility of the Owner after that section of the building is substantially complete.

Project Controls

Cost on this project is mainly controlled by the Project Manager, Pinto Patel and the Superintendent, Ron Smith in bi-weekly or sometimes monthly meetings. The Cost Report is reviewed in detail at these meetings to make sure that there have been no significant overruns and also to study trends to predict future cost problems. Thus far they have not employed cost loaded schedules or other more recent cost control methods. Austin has requested that detailed cost information and methods be kept confidential.

The schedule is handled by Jim Stevens who, as is evident from the staffing plan, is the only one working with the schedule. He attends meetings onsite to go over the schedule and upcoming activities with the Ron Smith. Other than these meetings and updating the initial Microsoft Project schedule, no schedule control methods have been used. Thus far, there

have been a few delivery delays but luckily they weren't for critical path items so the schedule could simply be overlapped more than planned, rather than delayed.

The quality of this facility is strictly monitored since quality is not only a top owner priority but is also federally regulated. Since The Austin Company is extremely familiar with projects requiring these specialized quality standards, most of the team members in the office and on Austin's staff onsite are already aware that they need to be especially conscious of quality concerns. One control measure used was to educate the subcontractors as to how they can better control the quality of their workmanship and also relay to them the specific quality issues that pertain to their trade. For example, one of the main issues in the lab is cross-contamination between lab spaces and contamination due to construction. They are using a special sealant at all fixtures, utility boxes, wall openings, etc. and a code official inspects every time a room is closed off from the others. The site itself is kept very clean and organized which helps minimize contamination of materials before installation. Other than that, the FDA and other regulatory agencies specify to what extent quality is to be managed.

Security is extremely important on this project. The area of Memphis in which the project is located has a high crime rate and some of the team members have stated that even they aren't very comfortable walking back to their cars at night. In order to alleviate some of the security concerns, Austin has hired a security guard service that guards the parking lot during working hours. The guard checks vehicles in and watches over them while the workers are onsite. The site is kept locked at night and even sometimes during the day. They also have an ADT security alarm system set up on the trailers. They have had one break in to date, but luckily nothing was taken. Overall, their security control methods seem to be effective.

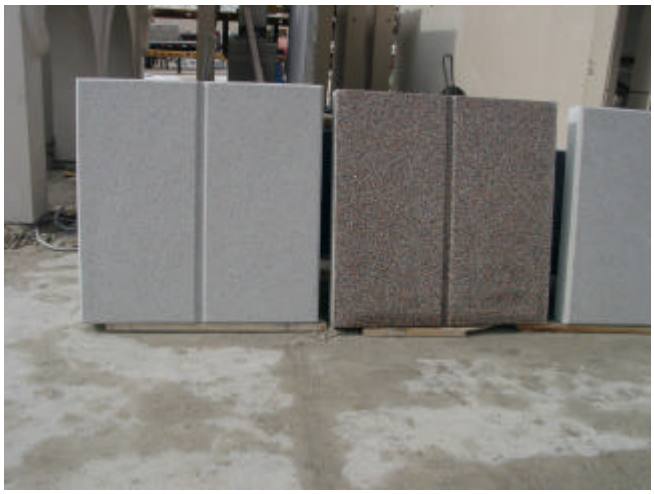
Safety is, of course, a top priority onsite. Ron Smith, the superintendent, brought a safety program that was extremely successful on his last project and the team has adapted it to fit the needs of this project. A four page safety policy (expanded from OSHA regulations) was given to every worker who comes onsite. Each worker reads and signs the policy and is then put through a site safety program in which all the main rules and regulations are covered. After they have completed this, they are assigned a sticker number. They put that sticker on their hardhat so other workers can identify a person who hasn't been through the safety program. Overall, the program is working well and there have only been two minor accidents on site to date.

Building Systems Analysis

For the most part, Austin has thoroughly investigated alternative building systems and has drawn what seems to be the best conclusion from the given information. Some systems were so clearly defined by either St. Jude or FDA regulations that there was no room for consideration of alternative systems and methods.

Architectural

Much of the architectural design was dictated by the existing Campus and the Owner's requirements. The façade is made up of pre-cast wall panels and an aluminum and glass curtain wall system.



Precast Panel Color Samples

Alternatives for the architectural façade weren't considered in too much detail since the owner needed a specific look that would integrate this facility with the other buildings. Precast panels were chosen since they are relatively easy and quick to install and, due to the design build nature of the project, could be manufactured long in advance. The architects were trying to design a sleek building that could house technologically intense laboratory and manufacturing spaces while not looking like a factory.

Colors were chosen to compliment the rest of the campus (see picture above) and the use of both strip and slot windows were chosen to break up the monotony of the cGMP area. Another advantage of the system chosen is weather protection. There are very few caulk joints due to the size of the panels which limits the number of potential leak locations. Because this building is extremely sensitive to water infiltration (i.e. humidity and environment is strictly controlled), this weather protection was a very valuable aspect of the façade system chosen.

Several alternatives could be considered, but none of them would have worked as well in this building. Using cast in place concrete for the walls would've taken longer and there isn't adequate room onsite for the trucks to pour that volume of concrete. Using strip windows all the way around the building wouldn't have made the building as aesthetically pleasing. Different materials such as granite or stone would've looked nicer, and perhaps had a more consistent finished appearance, but would have greatly increased cost. Overall, the façade chosen is the cheapest and most efficient for this type of structure.

Structural

This three story, structural steel facility has a moment frame design which allows both freedom in design and meets the earthquake zoning requirements for the area. An auger cast pile foundation system was used to support the building.

One alternative to this design would be a lateral bracing system rather than a moment frame system. This is system could have been designed to meet the earthquake zoning requirements, but would most likely compromise the look of the building since it would interfere with the glazing.

The auger cast pile foundation system was chosen on a least cost basis. Due to the subsurface conditions, certain foundation types were simply not an option. One alternative would have been to over-excavate the unsuitable soils and replace them with a structural fill material. However, this is significantly more time consuming and more expensive in the long run. The cost and time restraints easily dictated the use of auger cast piles.

Electrical

The electrical system is a simple radial power distribution system with a standby generator for life and safety loads. Lighting varies by the function of the area of the building. Office areas have a mix of parabolic troffers and dimmable incandescent down lighting. Lighting in the cGMP areas are sealed, recessed troffer, fluorescent lighting per USFDA standards.

The FDA and other standard laboratory requirements limited the degree to which alternative systems could've been considered. For example, in the FACS cell sorter room, the machines use the same light wavelength as that of a fluorescent light fixture. The placement of high equipment and shelving also limit the possibilities of using perimeter lighting. Limited ceiling space directly effected the configuration of the lighting systems and the USFDA lighting level requirements are stringent. Due to restrictions such as these, the choice for the lighting system was limited.

The power system is the simplest, most reliable system for power in the designed load range (2000 to 2500 kVA) and for the size of this particular facility. The main priorities of the owner dictated that Austin choose the cheapest and most reliable system that meets all FDA regulations and allows for necessary redundant systems.

Mechanical

Approximately 1/3 of the building costs are due to the mechanical system and equipment (see picture to right). Special equipment includes pressure and environmental controls to maintain room conditions, air classification requirements in certain lab spaces, and specialized lab service piping for cGMP areas, including fittings for compressed air, nitrogen gas, carbon dioxide gas, steam, purified water and liquid nitrogen tanks.

Sheet Metal Ductwork Installation

Main priorities here were size of system and quality of equipment. Again, FDA and St. Jude regulations determined most of the equipment design and type. One alternative might have been fiberglass ductwork rather than traditional stainless steel due to its resistance to corrosion. However, the increase in cost due to installation and material and the inflexibility of the ductwork in such a small plenum space made traditional sheet metal ductwork seem to be the more attractive option.

In some cases, alternatives were a matter of choosing how many redundant systems to include. To an extent, this was regulated by code requirements, but where there was a choice, Austin overdesigned to help ensure the quality of the facility and safety of the personnel. For example, each air handler in the cGMP area has two fans. One of the chillers and one of the cooling towers are also on emergency standby power. Although this increases both the equipment cost and the electric cost, Austin felt this was the best alternative in this case. The alternative would have been reducing costs and including just the minimum amount of mechanical equipment.

Other Systems

The fire alarm system, security system and communication systems were all designed per St. Jude Campus requirements. Since these systems are integrated into the overall campus systems, certain types and specified manufacturers were required so no alternatives were considered.

Construction Methods

Methods used on site are appropriate for a site with such restricted space and high quality concerns. Mobile cranes have been used to erect the steel (see picture below, left) since there is basically only one staging area (i.e. it would've been more difficult to have a stationary crane try to reach both the staging area and the entire building).

Steel Erection by Mobile Crane

Typical Plywood Forming and Bracing

Grade beams were used to support the perimeter wall system during construction and wood and plywood formwork were used to construct the grade beams. Other modular formwork was used (steel framed panels with plywood faces) to construct the perimeter foundation walls and retaining walls. Many of the forms could be reused throughout the project (see picture above, right). The scope of the project and the lack of repetition didn't necessitate the use of elaborate forming systems, so alternatives weren't considered.

Precast panels were installed by cranes stationed in the street on the south and west facades and on the project site for the north and east facades. The panels went up very quickly and the cranes proved to be the fastest and most reliable way to erect them. Hoists would've been another alternative, but since the building is only 3 stories, using cranes was most efficient.

The team leaders from the Austin Company have chosen not to dictate to the contractors the majority of the means and methods used onsite. It has been Austin's experience that the contractors doing the work know what the most efficient techniques are. They do, however, determine the general flow of work on the project. Again, the facility requirements have dictated the flow of work and, therefore, most alternatives simply couldn't be considered. The flow has been from west to east on both the exterior and interior of the building since the cGMP area of the building must be turned over to St. Jude before the office area. The

interior work began on the second floor since the elevated slab was poured before the slab on grade. This was due to the extent of underground work that needed to be completed before the slab on grade could be poured.