TECHNICAL ASSIGNMENT THREE
Alternative Methods Analysis
November 21, 2008

The Scripps Research Institute

Biomedical Research Building

Florida Atlantic University
Jupiter, FL

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. . . . at the forefront of biomedical science, a vital segment of medical research that seeks to comprehend the most fundamental processes of life . . . .

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Executive Summary

Overview

This technical report identifies key areas of this project which can be utilized in research with respect to alternative methods, value engineering, and schedule reduction. This was done by taking a closer look at problem areas of the project identified by members of the project team.

Constructability Challenges

This portion of the paper is dedicated to identifying the top three constructability challenges identified by members of the project team: late delivery of emergency generators & AHU's, safety compliance and small business requirements
Also included in the section are the top three issues faced by the design team: geographical dispersion of the design team, unknown site conditions and project delays.

Schedule Acceleration Scenarios

The activities identified in this section where acceleration techniques may be employed by the project team were identified by looking at the critical path of the project schedule, analyzing the biggest risks to the completion of the project, identifying what the key areas for accelerating the schedule if necessary and the cost of implementing acceleration. A major risk to the schedule of this project is associated with the lack of experience of many of the workers employed by various trades. Late delivery of materials poses a major threat to the schedule. Key areas to accelerate the schedule include Epoxy Finishes, HVAC Control Systems and MEP rough-in. The costs of accelerating these activities show up in Time & Material costs.

Value Engineering Topics

Value engineering on this project was minimal due to the experience of this owner, along with the technical nature of the experiments being done in the facility calling for highly technical systems. The only VE that took place was related to the redundancy of the MEP systems early in the design phase of this project.

Problem Identification

This section identifies problems with this project that are candidates for analysis in the continued research of this project. The issues include island MEP, epoxy finishes, emergency generators, building envelope, sculptural assembly and structural formwork. These problems are defined and ideas for change are expressed in this section.

Technical Analysis Methods

This section provides an outline of potential technical analyses to be performed in the spring semester. Island MEP Pre-fabrication, Redesign of the Emergency Generators of the project into a Co-Generation Plant, Roof/Building Envelope Redesign and a more efficient formwork system for the structural system, or an alternate structural system with a more efficient formwork procedure. These ideas are in very early stages and will become more defined in the proposal.

Constructability Challenges

The Scripps Research Institute Biomedical Research Building has many technical systems which require a high level of coordination between all members of the project team. This section looks at the top three unique and challenging constructability issues as viewed by members of the project team: Late Delivery of Emergency Generators and Air Handling Units, Safety Compliance and Requirements related to 15% Small Business (SBE) Utilization. The way these issues were handled by the project team is detailed in this section. Additional attention was given to the top three challenges related to the design of this project in this section. The challenges faced by the design due to how geographically dispersed the members of the design team were, unknown site conditions during the initial design and issues associated with delays due to site selection and change in code requirements do to the delays all created unique challenges in the design phase of this project.

Late Delivery of Emergency Generators & AHU's

The late delivery of the Emergency Generator and Air Handling Units presented major problems for the project team. These pieces of equipment drive many components of the mechanical installation process. Dealing with these issues took a lot of thought and planning to resolve the issues this created without altering the project completion date. Management devoted tremendous energy to effectively preplan the Emergency Generator installation sequencing along with the installation of the Transfer Switches. Even with the high level of planning it was necessary to utilize overtime to allow the project to accept the late delivery of the Emergency Generator without impacting the project completion. To compensate for the late delivery of the Air Handling Units the project management team had to make considerable changes to the construction sequence along with waiving factory testing of the AHU's to overcome the challenges presented by the late delivery of the units and complete the installation without extending the project completion date.

Safety Compliance

One of the largest challenges faced on this project came with Safety Compliance. This was due to the lack of trained craftsmen available in the area. Many of the trades employed workers who had been laid off as a result of the downturn in the housing market. These workers were not familiar with the strict safety rules associated with commercial construction projects. To deal with the issues this created, the CM employed two full time safety managers and required each trade to furnish a full time safety representative. This was coupled with the implementation of required training of all site personnel and the use of the Safety Task Assignment program to heighten awareness of the dangers associated with each task being performed. The level of experience of the tradesmen was not extremely high which added to the safety problems experienced on this project. Incentives to work safely were implemented in each building for each month without incident. This was taken further by some of the trades who implemented incentives programs on a monthly basis to give away prizes for working without incident. These measures became more effective as the project progressed and workers became more familiar with the tasks being performed.

Small Business Requirements

The Palm Beach County Grant Agreement included language setting goals for SBE participation valued at 15% of the total project value. SBE's are similar in nature to M/WBE's but they are based on annual dollar volume and the Palm Beach County domicile. To meet the 15% SBE requirement the CM hired an outside SBE Consultant firm to assist in project buy-out and execution phases. The project is on track for 17.4% participation. Meeting the target 15% required a sizable effort from management. The CM conducted open houses, job fairs, outreach programs, and also assisted dozens of small businesses in the Palm Beach County application process, as well as assisting them with obtaining their SBE certification.

Geographically Dispersed Design Team

Having the design team spread out over the entire country presented unique challenges in the design of this project. The architects working on this project were working from Toronto, West Palm Beach and Pittsburgh. The Lab Planner and Owner are both based in San Diego, California. The Engineering team was spread out from Madison, Wisconsin, Gainesville Florida and Tampa Florida. To overcome these challenges members of the design team met together in person several times in San Diego, Toronto, Pittsburgh, and West Palm Beach. Weekly conference calls were used to coordinate and discuss the design. Web Ex File Sharing was utilized during these conference calls to distribute documents to all members of the design team.

Unknown Site Conditions

This project was initially designed for a site in West Palm Beach, Florida, but was later moved to its location in Jupiter, Florida. This decision created design issues. Time was required to re-design some of the systems to adapt to the new project site.

Project Delays

The change in site selection caused time delays which in turn created change in code requirements associated with those delays. The uncertainty of the site for the project and the time taken to select the site required additional time from the project team to get up to speed with the project after any lengthy delay. Additional time was also needed for researching code changes which occurred during the delays.

Schedule Acceleration Scenarios

Looking at the project schedule for areas in which acceleration techniques could be applied was done by considering: the critical path of the project schedule, risks to the project completion date, key activities that have the potential to be accelerated when necessary, as well as the costs of implementing acceleration techniques on this project.

Critical Path

The critical path of this project is largely driven by the following activities:

- **Structural:** *Formwork & Shoring for the Structural System*

The Structural System of TSRI Biomedical Research Building is a two way cast in place 10" flat slab with 14" drop panels, 24"x24" perimeter beams, and 24" square concrete columns which run to square spread footings which are 2' deep. Typical bays are 22' by 32'. The floor to floor height on the first floor is 18' and 15' at the other levels. The lateral system is comprised of concrete moment frames formed by the concrete columns and the flat slab. The mechanical penthouse consists of steel joists on 12" masonry. The horizontal formwork for the slabs and beams was all plywood and timber formwork constructed onsite. The vertical formworks for the columns were all steel forms which were prefabricated and bolted together onsite. The hand built plywood and timber formwork requires significant time to construct, and is unique for each area of the building due to the varying bay and drop panel sizes. Maintaining peak production rates with this activity throughout the structural erection is critical to staying on schedule for this project.

- **Exterior :** *Building Envelope & Curtain Wall*

The main building envelope system is comprised of a two coat stucco with EFIS finish coat over 8" reinforced CMU with 1½" Extruded Polystyrene Insulation on the interior, followed by a $1^1/_2$" airspace with $^5/_8$" unfaced GWB on $1^5/_8$" metal studs. In some places on the exterior corrugated metal panels were placed on the exterior with a continuous elastomeric vapor barrier over the 8" reinforced CMU wall rather than the stucco EIFS System. Roofing is made up of SBS modified bitumen roofing system applied over the top of a sloped concrete roof slab and rigid insulation with $^3/_4$" perlite on top of the insulation. The building envelope requires a significant amount of scaffolding to be installed around the building perimeter which requires time to erect, dismantle and move to the next location. Ensuring that these activities are completed on schedule is critical to enclosing the building to start installing interior finishes.

- **Interior:** *Walls, MEP Rough-in, Island Casework & Epoxy Tops*

The interior activities on the critical path begin with the construction of all interior and exterior CMU and Gyp Board walls. Ensuring that the walls are on schedule ensures that MEP rough-in can commence as scheduled. The most important activity on the interiors is by far the MEP rough-in. Without the MEP rough-in the other trades cannot complete their work. This becomes even more important due to the technical labs that comprise a large portion of the building. The casework with epoxy tops that creates the large work areas cannot be completed without the MEP rough-in following the installation of the first side of the island casework. Ensuring that the MEP trades are on schedule, helps everyone whose final work follows their rough-in. Any delay created by the late completion of MEP rough-in wastes time and money in the finishes of the following trades.

- **Mechanical:** *Mechanical Equipment Installation & Commissioning*

There are numerous mechanical systems on this project which must be delivered and installed on time to ensure that the commissioning of the systems can commence on time to verify that system installation and calibration is successful. Much of the technical lab equipment needs to be installed so that the MEP trades can make their connections to make the equipment operational. Also in areas with sterilizers stainless steel mod-walls must be installed. This installation is very time consuming. The mechanical systems for heating cooling and ventilation must be scheduled for delivery with adequate time for commissioning of the systems along with their controls. These labs have strict ventilation requirements to ensure safety to the scientists performing their research with various toxic compounds. In all cases the equipment delivery and installation is critical to many other trades, and to the overall performance of the building. Changes created by errors in delivery and installation of the mechanical equipment will create costly changes in scheduling and potentially to the overall project completion date.

Sterilizers and Dryers with Stainless Steel Mod Wall and Epoxy Finishes

Risks to Project Completion Date

The biggest risks identified by the project team relating to the project completion date include:

- **The availability of trained craftsmen**

The availability of trained craftsman is a recurring issue which affects all aspects of the construction of this project. This comes from the time it takes for the number of tradesman with the necessary skills to effectively perform the work to train those who are unfamiliar with the work that they are installing. The delays experienced due to the lack of trained craftsman can be found in production, quality and safety. As the project goes on the effect of the learning curve associated with repetitive work can be taken advantage of. This will result in faster completion of tasks due to the repetitive nature of the tasks; increased familiarity with the tasks being performed also increases the level of safety along with increased quality of the work being installed. But the time it takes to train the required number of workers to achieve required completion time of various tasks to the level of quality required on a project of this nature and ensuring that they are performing the work with the correct safety procedures is significant and is unavoidable.

- **Delivery dates of key equipment and installation durations**

The delivery of equipment such as Emergency Generators, AHU's as well as lab equipment such as Fume Hoods, Sterilizers, Tunnel & Cage Washers and Biological Safety Cabinets are all major concerns on a project of this nature. These pieces of equipment are very technical in nature and have extensive lead-time requirements which are durations promised by manufacturers who often commit to production times under the actual to sell their product. In most cases those making the promises have nothing to do with the real production of the products in question so allowing additional time over that promised by the manufacturer must be done to ensure that the equipment is delivered in time to ensure that the project completion date is not compromised. When issues occur with the delivery of key pieces of equipment it has an effect on many trades, most notably the mechanical trades. These pieces of equipment require a significant number of connections and in many cases finishes cannot be completed in equipment areas until the equipment has been installed which in turn requires management to rework the sequencing of the project schedule to compensate for the late delivery. To make up for the late delivery will also incur costs of working overtime to prevent further delays to the schedule.

Cooling Towers in Mech. Yard

Bulk Sterilizer & Tunnel Washer

- **Finishes**

The quality and accuracy of the finishes is extremely important from an owner standpoint. Ensuring that the project is completed on time and to the quality standards of the owner is extremely important. On any project the finishes are going to be effected by any delays that occur throughout the project. This means that many times it is at this stage of the project where acceleration scenarios will be employed. The reason that this becomes a risk to the completion of the project lies in the level of quality required in this type of work. Everything must be accurate from major construction activities that have already been performed from the start of the project. There is no room for error in the finishes. The finishes are what create the first impression of the building. Sub-par performance by finishing trades can make everyone on the project look bad. Punch-list items are created to ensure that the quality requirements of the client are met.

Potential to Accelerate the Schedule

The project team identified areas in which to accelerate the schedule should the need arise. The areas which hold the most potential include:

- **Epoxy Flooring & Epoxy Wall Finishes**

The only way to accelerate the epoxy finishes is by adding overtime, extra crews, work 2nd & 3rd shift, and utilizing additional equipment in preparing the surfaces. The problem experienced with the epoxy finishes is related to the amount of time it takes to prepare, place and cure. During this process all over activities in the area cease until the process is complete.

- **HVAC & Building Control Systems**

To accelerate these construction activities selective overtime hours were implemented at key times throughout construction. Incentives were offered to the fabricator of the sheet metal ductwork for early delivery of materials. This process ties directly into the next and possibly the most effective way to accelerate the schedule when needed.

- **MEP Trades**

By accelerating the MEP rough-in in any area possible it helps out all other trades that close in following the rough-in of these trades. Having the MEP trades work overtime to ensure that they have all of their work in place and inspected by the time the other trades are ready to close in ensures that the flow of work is not interrupted causing delays and impacting the scheduled completion date of all trades which follow this work. In the lab areas on this project there were numerous delays caused due to the fact that the MEP trades had not completed their rough-in work when the other trades were ready to complete their finish work in the areas. Exhaust rough-in for Fume Hoods not being completed on time held up the ceiling crew who was waiting to finish ceiling grid and install ceiling tiles. The casework installation was greatly impacted due to the MEP rough-in not being completed on time. Delays associated with this issue caused the casework installer to work overtime and weekends to recover the time lost because of these delays.

Costs of Implementation

Accelerating any activity comes with cost implications. Working overtime to recover lost time due to delays is how schedule acceleration was handled on this project. In most cases overtime costs are priced into approved change orders. In some cases overtime is handled on a time and materials basis with approved and signed timesheets as backup.

Value Engineering Topics

The only value engineering on this project occurred early in the design phase. The focus topic of the value engineering occurred with respect to the redundancy of certain MEP systems on the project. The owner participated in the VE process. The owner was made aware of the impacts associated with each VE decision. The decision making for all VE ideas fell to the owner. The owner made the final decision after discussion of the risks associated with each decision between the owner, design team, and the construction manager was conducted. Standby Chillers, cooling towers, boilers, air handling units, and exhaust fans were deleted. 75% redundancy and load shedding was accepted in lieu of N+1 redundancy. The owner did not accept VE items which were related to corrosion resistance in chemistry labs and air handling unit interiors.

The reason VE wasn't a major priority on this project can be attributed to the highly technical and potentially dangerous activities which will occur in this facility. The owner has other facilities of this technical nature and knows what it wants. The cost is not as important as the quality of the systems that ensure that safety to the researchers.

Scripps is the largest, private, non-profit scientific research organization in the world. Scripps stands at the forefront of basic biomedical science, a vital segment of life. The Scripps Florida campus (Three buildings 350,000 SF total) will focus on drug discovery and technology development. These facilities incorporate chemistry/biology labs, Vivarium labs, Nuclear Magnetic Resonance (NMR) labs, BSL-2 and BSL-3 labs, automation and advanced robotics research labs, which aim to push the boundaries of modern biomedical research in each of these areas. TSRI has a campus in La Jolla, California which consists of fourteen laboratory buildings with more than 1,000,000 SF of space which overlooks the pacific. TSRI is internationally recognized for its research in areas which include immunology, molecular and cellular biology, chemistry, neurosciences, autoimmune diseases, cardiovascular diseases, virology and synthetic vaccine development. A major area of study which TSRI is immersed is the study of the basic structure and design of biological molecules. TSRI is among the world leaders in this type of research.

Bio-Safety Cabinets Installed in Vivarium Research Laboratories

Problem Identification

This section identifies problematic areas of the design and construction of The Scripps Research Institute Biomedical Research Building with the intent of developing effective analysis methods of technical building systems associated with the issues to improve the project quality with respect to decreasing construction duration, decreasing construction waste, increasing energy performance, cost savings, maximizing system efficiency with the end goal of providing increased project value to the owner. Employing methods which enhance the sustainability of this project will have many positive impacts on a project of this nature.

Lab Island with Epoxy Tops

- **Island MEP Pre-fabrication**

A recurring issue throughout the project in each building was associated with MEP rough-in at the island casework in the laboratory areas. These issues caused delays which affected the finishing trades, in particular the casework installer. To remove this issue from the construction sequencing pre-fabrication could be used to research labs on the 2nd and 3rd floors. These floors critical path was largely driven by the Islands in the research labs. The installation of the Island Tube Supports followed the framing of the walls and installation of flooring under the areas to have casework. Once the tube supports were installed the Casework could be installed on one side of the supports and left open on the other for the MEP trades to rough-in the Laboratory services required at each island. This was a major hold up at many points throughout the project. The same problems were experienced with the overhead service carriers installed on this project. Whenever hold ups occurred with the rough-in of these islands the casework contractor was delayed in installing the other side of the island casework, leading to delays in setting the epoxy tops, sinks and metal shelving for each island. One option that may have helped to alleviate these coordination issues would be prefabricating the MEP rough-in with the Island supports, lifting them into the building, bolting them down and installing the casework may have been a viable option for this system which could reduce cost and installation time as well as reducing the impact on the finishing trades.

- **Epoxy Finishes**

The epoxy finishes on this project were very time consuming. The areas receiving epoxy floor and wall finishes could not have any other activities occurring in them from the time they began preparing the surfaces for epoxy, all the way through curing. This caused logistics problems for getting equipment and materials to the areas of the building that they were needed. The nature of the activities occurring in these labs requires that they have these epoxy finishes. Looking into alternative finishes that may achieve more timely installation or ways to improve the curing time of the epoxy finishes would be an option for alleviating the problems created due to these finishing activities.

- **Emergency Generators / Co-Generation Plant**

This project had issues with late delivery of the diesel emergency generators. Due to the fact that these systems are not called into operation often a redesign of this system to function as a natural gas Co-Generation Plant to operate at peak hours when energy is more expensive would be a more effective use of the money being spent on the generators for this project. The Co-Generation Plant would also have the ability to finance itself through power savings.

- **Photovoltaic's**

The sun being as strong as it is in Florida provides a very powerful power source that could be looked into to incorporate into the energy savings of this project. This could also tie into the Co-Gen plant for power production during peak hours to assist the utility. This technology could be coupled with white roof technology to gain added efficiency and energy production when applied in the right manner.

- **Roof/Building Envelope energy savings**

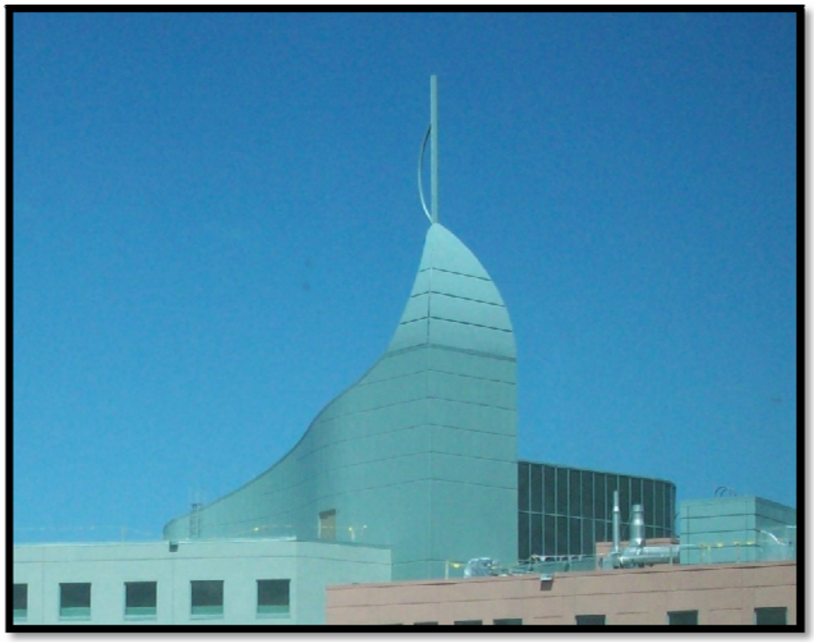
The cooling load of these buildings is very substantial not only due to the climate, but also to the pressurization requirements for the Laboratories. By optimizing the performance of the building envelope by looking into more efficient solutions would be helpful in reducing the cooling load on the building and potentially reducing the size of the mechanical equipment. Possibilities of a pre-cast enclosure system would be viable on a project of this nature because there are no complicated curved façades on the building. White or Green Roof technology may produce significant savings in energy by reducing heat gain in the extremely hot summer months while also mitigating the heat island effect caused by dark roofing materials. This option along with the next category could be taken farther to look at achieving LEED certification of the project, and all of the advantages in energy savings to be gained through application of sustainable technology to this project.

- **Storm Water Management / Gray Water irrigation**

This climate region experiences frequent downpours on a daily basis. This water could be captured into a grey water treatment system and used for distribution for flushing of toilets in the buildings as well as for irrigation of the extensive landscaping on this site.

- **Sculptural Spiral Assembly**

The spiral assembly for Building B was very problematic for the construction team. This was mainly due to the design of the spiral. The design incorporated straight panels into a curved wall assembly. The most effective way to deliver this piece of the project would be having the design and construction of this spiral done through a design build process by the subcontractor.



Building B Sculptural Spiral

- **Structural Formwork**

The formwork for this project was all built by hand for the structural system selected. This formwork proved to be a very high percentage of the cost of the structural system. By identifying an alternate formwork system which may prove to be more efficient and less wasteful the potential for significant cost savings may be realized.

- **Day-lighting**

The building has motion sensors in all interior rooms along with a timer system, but does not take into account day-lighting in any areas. By incorporating day-light sensors into the lighting system significant energy savings may be realized due to the large windows in the Laboratory areas of the building.

Technical Analysis Methods

This Section is committed to identifying four core thesis investigation issues from the problem identification section of this report. In depth analysis of these issues will be conducted in the spring 2009 semester. This section is comprised of critical issues research, value engineering analysis, constructability review, and schedule reduction/acceleration.

- **Technical Analysis I:** *Island MEP Pre-fabrication*

The first analysis I would like to perform refers to the buildings Laboratory Islands from the problem identification section Island MEP Pre-fabrication. By pre-fabricating the MEP with the island tube supports for these islands. This analysis presents the opportunity to study schedule and cost impacts of employing prefabrication to this piece of the project.
For this analysis it will be necessary to consult with the mechanical designer/contractor as well as the casework installer to verify that this type of method would be applicable to this project and also to obtain schedule and cost information for this method.

- **Technical Analysis II:** *Emergency Generators / Co-Generation Plant*

The second analysis I would like to perform refers to the buildings Emergency Generator system from the problem identification section Emergency Generators / Co-Generation Plant. By redesigning the generator system to a natural gas turbine co-generation plant cost, payback, and schedule impacts will be examined.
For this analysis it will be necessary to consult with various mechanical systems designers and manufactures to identify the most efficient equipment along with the most efficient installation and testing of this type of system. Communicating with the mechanical contractor who would be installing the connections to such a system will also be necessary for this analysis.

- **Technical Analysis III:** *Roof/Building Envelope energy savings*

The third analysis I would like to perform refers to the building envelope system from the problem identification section Roof/Building Envelope energy savings. By modifying either the building façade envelope or the roof envelope a cost and schedule analysis for the alternate system will need to be performed along with considering impacts on the mechanical system.
For this analysis it will be necessary to consult with a structural engineer to determine the impacts on the structural system for alternating either of the systems. It will also be necessary to consult with a mechanical contractor to consider the impacts on energy savings and systems sizing based on the performance of the building envelope with the proposed changes.

- **Technical Analysis IV:** *Structural Formwork*

The fourth analysis I would like to perform refers to the formwork and structural system of the building from the problem identification section Structural Formwork. By selecting a more efficient formwork system, or an alternate structural system that has a more effective formwork system cost and schedule impacts will be examined.
For this analysis it will be necessary to consult a structural engineer as well as formwork manufactures and field installers of these systems to ensure accuracy of analysis results.

Appendices

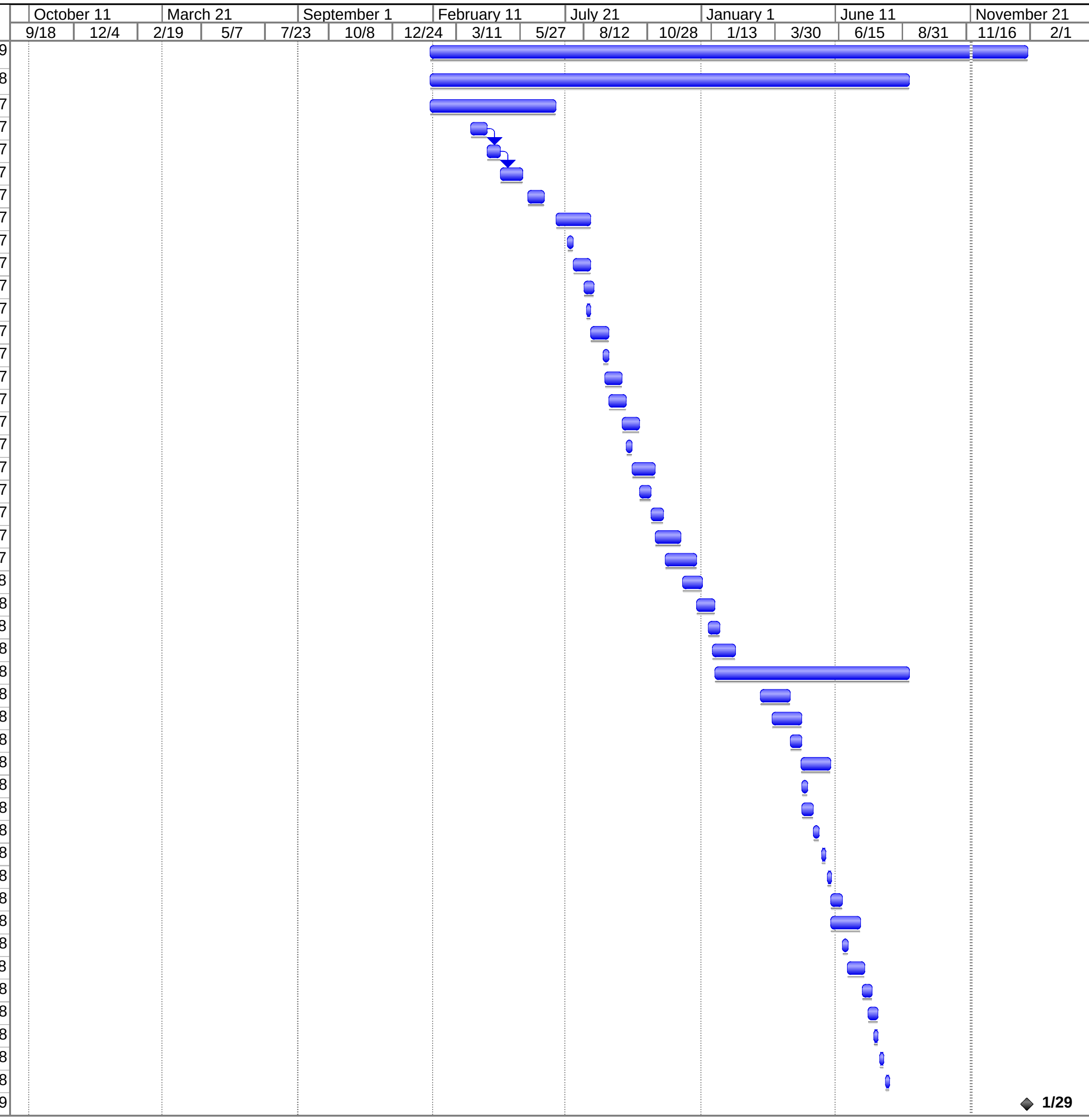
Appendix A

Critical Path Schedule

Adam Houck
Construction Management
November 21, 2008

THE SCRIPPS RESEARCH INSTITUTE
Biomedical Research Building
Critical Path Project Schedule

ID	Task Name	Duration	Start	Finish
1	**TSRI Biomedical Research Building**	516 days?	Thu 2/8/07	Thu 1/29/09
2	***Construction***	413 days?	Thu 2/8/07	Mon 9/8/08
3	Foundations	108 days?	Thu 2/8/07	Mon 7/9/07
4	Form & Shore Deck 2nd Floor	14 days?	Thu 3/29/07	Tue 4/17/07
5	Form & Shore Deck 3rd Floor	12 days?	Wed 4/18/07	Thu 5/3/07
6	Form & Shore Deck Roof	19 days?	Fri 5/4/07	Wed 5/30/07
17	CMU Interior/Exterior Walls 2nd Floor	14 days?	Wed 6/6/07	Mon 6/25/07
16	CMU Interior/Exterior Walls 1st Floor	30 days?	Tue 7/10/07	Mon 8/20/07
12	Erect Scaffolding @ South Elevation	5 days?	Tue 7/24/07	Mon 7/30/07
13	Stucco @ South Elevation	15 days?	Tue 7/31/07	Mon 8/20/07
39	Install Air Handling Units @ Penthouse	10 days?	Mon 8/13/07	Fri 8/24/07
14	Erect Scaffolding @ West Elevation	3 days?	Thu 8/16/07	Mon 8/20/07
15	Stucco @ West Elevation	16 days?	Tue 8/21/07	Tue 9/11/07
7	Erect Scaffolding @ North Elevation	5 days?	Wed 9/5/07	Tue 9/11/07
40	Install Indust. H20 Heater/Softener @ Penthouse	15 days	Fri 9/7/07	Thu 9/27/07
8	Stucco @ North Elevation	15 days?	Wed 9/12/07	Tue 10/2/07
41	Plumbing Main Connections @ Penthouse	15 days	Fri 9/28/07	Thu 10/18/07
9	EFIS Finish @ North Elevation	5 days?	Wed 10/3/07	Tue 10/9/07
10	Windows/Curtain Wall @ North Elevation	20 days?	Wed 10/10/07	Tue 11/6/07
42	Install Vac Pumps/Receiver Tank @ Penthouse	10 days	Fri 10/19/07	Thu 11/1/07
43	Install DHW & IHW Heaters @ Penthouse	11 days	Fri 11/2/07	Fri 11/16/07
11	Windows/Curtain Wall @ East Elevation	23 days?	Wed 11/7/07	Fri 12/7/07
44	Conduit/Wire connections to Mech/Plumbing Equipment @ Penthouse	28 days	Mon 11/19/07	Wed 12/26/07
28	Gyp Board 3rd Fl RESEARCH 1	18 days?	Mon 12/10/07	Wed 1/2/08
45	Electrical Connections @ Penthouse equipment	16 days	Thu 12/27/07	Thu 1/17/08
36	Lab Flooring 3rd Floor Research 2	10 days	Thu 1/10/08	Wed 1/23/08
29	Install Fume Hoods 3rd Fl RESEARCH 1	20 days?	Tue 1/15/08	Mon 2/11/08
46	Startup & Commissioning	167 days?	Fri 1/18/08	Mon 9/8/08
30	Install Island/Lab Casework 3rd Fl RESEARCH 1	26 days	Thu 3/13/08	Thu 4/17/08
33	Install Island/Lab Casework 3rd Fl RESEARCH 2	26 days	Thu 3/27/08	Thu 5/1/08
31	Install Island/Lab Epoxy Tops 3rd Fl RESEARCH 1	10 days	Fri 4/18/08	Thu 5/1/08
18	Install Island/Lab Casework 2nd Fl RESEARCH 1	26 days?	Thu 5/1/08	Thu 6/5/08
32	Deck Mounted Fixtures @ Epoxy Tops 3rd Fl RESEARCH 1	5 days	Fri 5/2/08	Thu 5/8/08
34	Install Island/Lab Epoxy Tops 3rd Fl RESEARCH 2	10 days	Fri 5/2/08	Thu 5/15/08
35	Deck Mounted Fixtures @ Epoxy Tops 3rd Fl RESEARCH 2	5 days	Fri 5/16/08	Thu 5/22/08
37	Doors & Hardware 3rd Floor Research 2	5 days	Mon 5/26/08	Fri 5/30/08
38	Final Paint 3rd Floor Research 2	5 days	Mon 6/2/08	Fri 6/6/08
19	Install Island/Lab Epoxy Tops 2nd Fl RESEARCH 1	10 days?	Fri 6/6/08	Thu 6/19/08
21	Install Island/Lab Casework 2nd Fl RESEARCH 2	26 days?	Fri 6/6/08	Fri 7/11/08
20	Deck Mounted Fixtures @ Epoxy Tops 2nd Fl RESEARCH 1	5 days?	Fri 6/20/08	Thu 6/26/08
27	CMU Interior/Exterior Walls 3rd Floor	15 days?	Thu 6/26/08	Wed 7/16/08
22	Install Island/Lab Epoxy Tops 2nd Fl RESEARCH 2	10 days?	Mon 7/14/08	Fri 7/25/08
24	Lab Flooring 2nd Floor Research 2	10 days?	Mon 7/21/08	Fri 8/1/08
23	Deck Mounted Fixtures @ Epoxy Tops 2nd Fl RESEARCH 2	5 days	Mon 7/28/08	Fri 8/1/08
25	Doors & Hardware 2nd Floor Research 2	5 days?	Mon 8/4/08	Fri 8/8/08
26	Final Paint 2nd Floor Research 2	5 days?	Mon 8/11/08	Fri 8/15/08
47	Owner MOVE-IN	0 days	Thu 1/29/09	Thu 1/29/09



Project: Summary Schedule of The Sc
Date: Fri 11/21/08

Task	Summary	Rolled Up Progress	Project Summary
Progress	Rolled Up Task	Split	Group By Summary
Milestone	Rolled Up Milestone	External Tasks	Deadline