The George Washington University Hospital
Surgery Expansion Phase 1 Lean Story
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The George Washington University Hospital

The new George Washington University Hospital was opened on August 23, 2002. The hospital had 13 operating rooms and 39 PACU beds, which served as the recovery site for patients requiring anesthesia or conscious sedation. They also serve as patient preparation beds. The hospital also opened with three new interventional radiology suites, two new Cath labs and one relocated Cath lab. The equipment installed at that time was considered current technology, but not the newest technology in the form of flat panel detectors.

The Surgery Expansion Project

The hospital had seen a consistent increase in surgical volume across the last five years. The compounded annual growth rate in operating room hours from 2005 to 2009 was 4.9%. That growth had been driven by academic program recruitment and reduced availability of hospital services elsewhere in the District. In 2005, 9,604 cases were performed in the hospital ORs with annualized 2009 performance expected to reach 10,100 cases.

The increases in surgical volumes had created an associated increase in physician competition for OR time. With newly recruited surgeons in almost every surgical specialty arriving in 2006 and 2007, the hospital was left with only nighttime and weekend hours for surgeons to operate, which is incentive for physicians to seek better operating times in other nearby institutions.

In 2006, the GWU Ambulatory Surgery Center (ASC) at 2120 L Street, NW was opened with three sterile operating rooms and two non-sterile procedure rooms. As a result, a portion of the outpatient/same-day surgical procedures previously performed at the main hospital building were now being performed at the ASC. As expected, the facility had seen a shift in demand for hospital outpatient OR times as hospital outpatient procedures move to the ASC. However, the demand for the inpatient ORs had continued to increase along with the overall demand for surgical services.

The demands on hospital ORs had created downstream challenges for pre-op and recovery space. The 39 PACU beds were utilized for pre-operative preparation as well as post-procedure recovery, including surgery, endoscopy and interventional work. The variety of functions within the PACU create significant challenges for physicians and staff and effectively reduce the available recovery space to roughly 1.2 beds per OR, far from the optimal ratio of 3.0 PACU beds per OR. In addition, the wide range of patient types in the PACU, from moderately sedated cath patients to severely ill ICU patients, created dissatisfaction for patients and families.
GWUH had experienced a growth in surgical procedures. It was essential for GWUH to create additional space to accommodate the surgeons on their medical staff. GWUH had outgrown the existing number of rooms for four reasons:

1. Overall increase in annual surgical procedures;
2. The demand for trauma surgery;
3. The backlog of “add on cases,” and
4. Academic recruitment requirements.

As a result of existing OR capacity issues and anticipated growth in physician demand, it was essential for GW Hospital to create additional space in their surgical services department. The business plan outlined the need for the addition of two operating rooms, expanding surgical suites from 13 to 15 and addition of 13 PACU beds which would continue to serve as post-operative care units and pre/post-operative treatment bays to support the increased surgical volume.

It was estimated that two additional ORs will allow the hospital to perform an average of 1340 additional cases per year. Incremental OR cases were assumed to grow 1.5% between years 1 and 2 and between years 2 and 3. Those assumptions were based on a physician and service line analysis of current and anticipated procedures at GWUH.

The Cath Lab Replacement Project

The increased age of the equipment and old technology continued to put the hospital at a disadvantage in the market. The labs were utilizing an outdated analog imaging chain. The age of the equipment continued to show as they experience technical issues and down-time. In 2009, they expect ten (10) departmental service calls per month, each resulting in a minimum of two (2) hours of downtime. Having such a high number of errors and failures had eroded physician confidence and generated a high level of dissatisfaction with the equipment.

Changes in x-ray technology, to flat panel digital detectors, had made significant improvements in imaging and safety. That translated directly to the quality of the care and case time. Those improvements increase the ability of the physicians to visualize the anatomy, thus decreasing case length, radiation exposure and making measurements more accurate and treatment options more appropriate. The new technology and increased processing speeds would reduce the time between cases, especially for interventional radiology. The biggest expected gain in productivity was the Neuro suite. Demands for 3-D imaging and processing overly tax the equipment, severely impacting the department flow. The requests for 3-D imaging increases every day.
Project Delivery Method

The traditional delivery model for most projects starts with a design team producing construction documents then delivering this to a contractor who prices these documents. This often leads to redesign to fit the budget and potential delays to begin construction. Construction will begin and there are numerous RFI’s to clarify the intent of the design documents or identify how to deal with existing conditions.

The LEAN delivery model was identified as a way to streamline the entire process, reduce wasted time and effort, and provide a superior product to the client. This required that the entire team was brought to the table at the beginning of the project. This also provided the team a means to better predict the cost of the project instead of waiting until CD’s were completed. By establishing target costs up front, the team used a detailed cost estimate to guide the design.

Our Team Structure

Owner – Architect – Consultants – Contractor – Major Subs – User Groups

We started meeting as an entire group. At times, the design team would lead the way and the other team members would provide support and input. The contractor was constantly providing feedback on design items that effect schedule and budget. They also would identify items that would allow for better constructability. At other times the contractor was guiding the team and the design team was a support to allow for innovation to continue into the field.

With the Integrated Project team we learned how to better understand team roles and be able to better incorporate the needs of others into individual decisions. The team had to learn new ways to work together and communicate as these became critical tools in the new delivery method. Communication and collaboration within the entire team was key to success of the project.

In their own words, comments from the team:

“My exposure to the lean processes has significantly changed my opinion of Owner/AE/Sub-Contractor relations. Moving forward, I want to continue learning the processes and perfecting them with my team members.”

Douglas Gray
Project Manager
HITT Contracting
The Project Delivery Team

Key project team members participated in the lean construction training activities and formed the lean construction core leadership group to further lean principles within this project and any upcoming, future work.

Owner,
UHS of Delaware, Inc
367 South Gulph Road
King of Prussia, Pennsylvania 19406

Architect,
HKS, Inc
1919 McKinney Avenue
Dallas, Texas 75201

MEP Engineer
CCRD Partners
3625 North Hall Street, Suite 1300
Dallas, Texas 75219

General Contractor
HITT Contracting, Inc
2900 Fairview Park Drive
Falls Church, Virginia 22042

Electrical Contractor
Power Solutions, LLC
1720 Melford Boulevard
Bowie, Maryland 20715

Mechanical & Plumbing Contractor
Dominion Mechanical Contractors, Inc.
12329 Braddock Road
Fairfax, VA 22030
Program Results

Treatment Areas

2      New Operating Rooms, Brings Hospital Total to 15
19    New Prep/Recovery Beds, Brings Hospital Total to 60
45% Increase in Prep/Recovery Beds

18,000 Renovated Square Foot

Project Costs

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In their own words, comments from the team:

"The project management through lean fundamentals provided great value to GW Hospital by exceeding delivery times and financial performance expectations. Communication with full transparency of actions and coordination to eliminate operational impact assisted with the performance of the Hospital during a large scale construction project."

Kimberly Russo
Chief Operating Officer
The George Washington University Hospital

An Ah-Ha Moment: "I had an ah ha moment related to contingency. We typically include contingency in our budgets to cover risks associated with the design and construction phases of the project. That contingency is usually calculated as a percent (%) of the construction budget and is directly related to the stage of the design (design contingency) or buy-out and progress of the work (construction contingency). On this project, we carried 20% design contingency and 10% construction contingency because that is what the contractor usually carries on a project like this. What I discovered is that we didn’t adjust our design contingency to reflect the collaboration and target value design efforts the project team put forth early in design development. We also did not adjust our construction contingency to reflect the field survey efforts and trade partner pricing collected before construction began. These "lean practices" virtually eliminated the need for contingency because we all worked together to identify and eliminate the risks contingency is usually used for.

I even had another ah ha moment when I realized the contingency we carried was “waste” due to the fact that I asked UHS to commit those dollars to the project then ultimately did not need them. Those dollars could have been used on another project and not tied up in the Surgery Expansion.

On future projects, the team will carefully study the risks and allocate the appropriate line item allowance to cover that risk in lieu of putting a percent (%) contingency on the overall construction cost.

Tim Ott
Challenges & Phasing

Phasing

To minimize the impacts and loss of usable space for the hospital during the construction process, a detailed 4-part phasing plan was developed during the planning/design stages of project development.

A comprehensive phasing presentation [Appendix 4] was a key component in clearly communicating this phasing plan with the user groups and provided a visual description of which areas of the existing facility would be un-available...
during each construction phase and which new rooms would be made available at each turnover.

**System Shutdowns**

A significant challenge conducting renovations in an operating hospital is making system connections to existing utilities that will interrupt service to departments still in operations outside of the renovation area.

To facilitate communications, planning and preparations for the required shut downs and tie-ins, a detailed shut-down plan was developed for each system affected and communicated with a summary Impact Statement [Appendix 5]. Impact statements assisted in the quick exchange of information prior to the shutdown.

Sample Impact Statement:

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**IMPACT STATEMENT**

*Items below to be filled out with as much detail as possible for interruptions to the hospital’s utility systems*

1) **THE WORK:**
   A) Describe what the scope of work is to be performed & why (ultimate purpose/goal of the work)
   Make Tee connections to existing floor medical gas system and install valves for future phasing demo.
   B) Describe how the work will be done (special equipment, hot work, access requirements, etc.), and what hours/days are proposed to be worked to accomplish the task:
   See attached options write up for the 3 potential methods: Smart-Tap, Back-purge, Lokring.
   C) Describe what other options are available to either avoid the work impacting the hospital, or perform it in a different manner:
   See attached options write up.

2) **COMMUNICATE:**
   A) Describe the results of researching what systems &/or areas of the hospital will be affected by this work:
   All 2nd floor zone valves and outlets
   B) Describe the impact will be to those systems/areas:
   Varying degrees of outage depending on method selected. With Smart Tap option critical areas can be maintained.
   C) Describe any temporary measures that can be taken to lessen or avoid the impact to the hospital:
   SmartTap can provide temporary gas hookups to eliminate downtime on some gases. Lokring minimizes shutdown length.
   D) Describe any temporary measures to ensure construction personnel, hospital staff, and public safety
   Signage and cordons off work areas. Memo to staff prior to scheduled outage.
   E) Verify who needs to know the information on this sheet & how it will be communicated:
   GWUH staff affected by the installation. Project team. Provide memorandum or pre-shutdown conference.

3) **CONTINGENCY:**
   A) Discuss what are the weak points or potential failures of the work being performed?
### The Evolution of the Conditions of Satisfaction

#### What are the Conditions of Satisfaction?
The Conditions of Satisfaction is the Statement (statement) authored by the Owner that tells the Project Delivery Team what work a project must pass to be accepted as a success. A project is not a success merely because the team says it is; the final say belongs to the Owner.

#### No Stopping of Work
In order to maintain schedule it is important that there is no unnecessary stopping of work. It would be appropriate to stop work if there is an identifiable error or quality issue that needed to be addressed to avoid future rework. It is also appropriate to step work if the work is causing a patient care issue. Communication between the construction team and the hospital staff about what work is being done is imperative in trying to eliminate stopping work for patient care reasons.

#### No Unscheduled Disruptions
There will be times during a renovation of this nature that the construction will affect how patient care is being given. There may be times where rooms are shut down, medical gases need to be turned off, or paths of travel are altered. It is important to note that these renovations should not affect the QUALITY of care. There should be an effort to avoid any surprise changes of plans with the hospital staff so their focus can be on the quality of care that they are giving, and not on what construction challenges they have during the day.

#### Total Project Transpercncy
Cross communication is important between all parties to ensure that everyone's needs are met. As each participant’s documents evolve, it is important that all eyes can review each other's work to avoid potential errors, change orders, or rework.

#### No RFI’s
Request for Information documents have become the established norm for transmitting questions and answers between the traditional Design Team and the Construction Team. They are also abused, a time waste, and have the ability to become litigious fuel. So how and why do you eliminate RFI’s? You could have the Design Team issue perfect documents, but even with perfect documents you would have to assume that everyone on the Construction Team would understand everything within them and know every decision that went into producing the documents. It is really not about asking questions.

The idea of No RFI’s is to simplify the process of transmitting information. The Construction Team is more involved in the evolution of the design of the building and is part of the decision process; they become more familiar with the documents. The interface between the Project Delivery Team enables them to communicate more freely and save the hard documentation for the issues that require it for pricing or code compliance. This saves the whole team time and eliminates the wasteful RFI process.

#### No Change Orders
Change Order = More Cost.
That statement is obvious, but how do you control it and what contributes to the change orders? Unforeseen conditions, client changes, errors and omissions, rework, are a few of the conditions that lead to change orders.

The goal for the Project Delivery Team is to evaluate the project and try to anticipate issues before they occur through coordination efforts. Communication within the team is imperative to fill any gaps in the documents and ensure that everyone on the team is comfortable with the intended quality of work. Communication with the client and end user is imperative to make sure they understand the end product and are able to make the best decisions possible.

Working as a team the PDT can minimize any issues that do come up during construction to minimize cost and create the best value for the owner.

#### No Rework
There are essentially two reasons for rework.
1. It was not done right the first time because of an error during construction or a misinterpretation of the construction documents.
2. Something has changed to make the original work that was satisfactory, now less than satisfactory (owner or designer changes their mind).

The approach to the no rework goal attacks those reasons. Work needs to be reviewed early by the decision makers to avoid mistakes being spread throughout the job. If possible, and practical, mock-ups of key spaces can give decision makers the ability to review work BEFORE it is even on the job.

Discussions about key design elements need to happen between the team to anticipate any potential of changes due to quality of materials, construction techniques, or lessons learned.

It is almost impossible to anticipate changes due to technology or trends in patient care for healthcare design, but it is possible to collaborate and minimize the affect these unforeseen changes can have on a construction project.
commitment planning

The bottom level in the planning system hierarchy, below lookahead planning, that results in commitments to deliver on which others in the production system can rely because they follow the rule that only sound assignments are to be accepted or made.

Example: On my work plan for next week, I have included providing Cheryl the soils data she needs to evaluate alternative substructure systems for the building. All known constraints have been removed from my task, I understand what’s required and how the information will be used, and I have reserved needed labor and equipment.

conditions of satisfaction (COS)

Directives, often criteria, imposed by the entity initiating a process (usually the owner) that specify how success of the outcome will be gauged.

constraint

Something that stands in the way of a task being executable or sound. Typical constraints on design tasks are inputs from others, clarity of criteria for what is to be produced or provided, approvals or releases, and labor or equipment resources. Typical constraints on construction tasks are the completion of design or prerequisite work; availability of materials, information, and directives. Screening tasks for readiness is assessing the status of their constraints. Removing constraints is making a task ready to be assigned.

Integrated Project Delivery ™ (IPD)

Integrated Project Delivery is a delivery system that seek to align interests, objectives and practices, even in a single business, through a team-based approach. The team primary Team Members would include the Architect, key technical consultants as well as a general contractor and key subcontractors. It creates an organization able to apply the principles and practices of the Lean Project Delivery System. For more information see http://www.leanconstruction.org/lcj/V2_N1/LCJ_05_003.pdf

[IPD is a registered business mark by Lean Construction Institute]

In their own words, comments from the team:

"My Ah-Hah moment came when I understood that we are not just trying to build a better mousetrap, we are trying to build a better WAY to build mousetraps."

Christian Pikel
Dominion Mechanical
**last planner®**

The person or group that makes assignments to direct workers. ‘Squad boss’ and ‘discipline lead’ are common names for last planners in design processes. ‘Superintendent’ (if a job is small) or ‘foreman’ are common names for last planners in construction processes.

**learning**

The process of gaining new knowledge or insights whose implementation may improve product and process development.

**lookahead planning**

The middle level in the planning system hierarchy, below front end planning and above commitment planning, dedicated to controlling the flow of work through the production system.

**lookahead schedule**

The output of lookahead planning, resulting from exploding master schedule activities by means of the activity definition model, screening the resultant tasks before allowing entry into the lookahead window or advancement within the window, and execution of actions needed to make tasks ready for assignment when scheduled. Lookahead schedules may be presented in list form or bar charts.

**PPC**

Percent plan complete; i.e., the number of planned completions divided into the number of actual completions, usually referring to activities on a weekly work plan.

**pulling**

Initiating the delivery of input based on the readiness of the process into which they will enter for transformation into outputs.

Example: Request delivery of prerequisite information at or before the time you will be ready to process that information. Note: what’s different here is that the readiness of the process is known rather than wished. Either the process is ready prior to requesting delivery or plan reliability is sufficiently high that work plans can be used to predict readiness.

**push vs. pull**

A push system schedules the release of work based on demand, while a pull system authorizes the release of work based on system status (from Hopp and Spearman 1996 p. 317)

**weekly work plan**

A list of assignments to be completed within the specified week; typically produced as near as possible to the beginning of the week.
Toyota Way Terms & Definitions Utilized on this Project

*genchi genbutsu* – go and see for yourself to thoroughly understand the problem or situation, learning by trial and error and getting your hands dirty, learning by doing, management by facts (observation and experimentation)

*hansei* – relentless (ruthless) reflection

*hansei-kai* – a reflection meeting

*jidoka* – (1) stop when there is a quality problem, never letting a defect pass into the next station, building in quality as you produce the product, “mistake-proofing” (2) automation with a human touch, machines with human intelligence, freeing people from machines

*JIT* – just in time

*kaizen* – philosophy of continuous improvement, change for the better, working toward the common good

*kanban* – a card, ticket, or sign used to manage pull production, the pull cycle, or just in time

*muda* – waste, non-value-added activities

*mura* – unevenness

*muri* – overburdening people or equipment

In their own words, comments from the team:

"This project has proven to be the most successful project yet that I have worked on while at UHS. The success of this project is a direct result of all the project teams efforts working together toward a common goal - deliver a project that exceeded the customers’ expectations."

Timothy Ott
Asst. Dir. Project Mgmt.
UHS of Delaware, Inc.
Learning & Bringing Lean to the Team

To introduce the project team to the Lean Construction process and Integrated Project Delivery, several of the initial team meetings were conducted with the assistance of Lean Project Consulting to facilitate forming a "Construction Lean Team" and teach new tools such as Last Planner and Impact Statements.

(Full text of Trip Report, Construction Lean Team Proposal and Sample Impact Statements can be found in Appendix 5)

GWU HOSPITAL RENOVATION PROJECT

Project Coach: Steve Knapp

Construction Lean Team

The Team will:

- Learn (deeply and fully) the concepts of lean construction
- Perform studies to determine project needs for improvement
- Develop leadership skills to enable the members to manage and execute Lean projects in the future
- Initiate and execute Kaizen events
- Communicate the lean philosophy to their home group companies.
- Assist GWU Hospital management in identifying and solving problems.
- Execute projects as required
- Work to make this project a “national model” for lean construction in the healthcare industry

The 4 to 6 members will be selected from different groups or companies at the GWU Hospital Project with the support of their current managers or superintendent/foremen. They will serve on the CLT for approximately 6 months (different at first so there is staggering of “terms”).

An Ah-Ha Moment: My first "Ah Ha Moment" on this project occurred when we had a two day work session with Lean Project Consulting, Inc. I have always struggled with how to communicate with clients the inefficiencies that will occur when related work activities are divided up between multiple contractors or design entities. The dice game that LPC presented to us demonstrated how variance can lead to being inefficient and cause schedule delays.

Ray Smith
In addition, the team participated in a learning exercise dubbed "The Dice Game" which strive to explain the variability is the single largest impact to productivity.
At the conclusion of the initial formal training meetings, key project team members formed the 'Lean Management Group' signing a formal Charter.

The GWUH Surgery Project has declared its intention to execute the project utilizing Lean principles. In support of this goal, it is forming a Lean Management Group. The purpose of the Lean Management Group is to bring about the Lean transformation of the GWUH Project by guiding, supporting, and encouraging lean activities, practices, and attitudes.

The Lean Management Group will consist of 3 to 6 project leaders who have been oriented to the Lean approach by participating in various lean training events and who are dedicated to making the GWUH Project Lean transformation a success.

The Lean Management Group (LMG) will meet on at least a monthly basis. The roles and responsibilities of each Lean Management Group member will include:

- Build personal expertise in Lean principles, methods, and behaviors through individual and group study.
- Exhibit new behaviors and commitment to Lean principles and methods.
- Drive Lean transformation throughout the GWUH Project and within the organizations supporting it.
- Establish regular measurement of the Lean transformation.

This group will:

- Implement the Last Planner® System (LPS) on the project
- Identify and conduct initial kaizen events.
- Foster continuous improvement by encouraging small changes at all levels.
- Provide training to selected personnel in additional Lean techniques.
- Monitor progress of the project using LPS or other techniques.
- Develop a “Lean story” of the GWUH transformation both for internal use and to explain to customers and suppliers how the project organization manages its work.
- Insure that other leaders within the participating organizations are actively supporting the transformation.

We commit to these roles, responsibilities, and actions on ___________, 20__

Tim Ott __________________________ Ray Smith ______________________
Sarah Kuchera ______________ Doug Gray __________________
Christian Pikel ______________ Glenn Phillips ______________

The Lean Management Group meets regularly to discuss progress and improvements on implementing lean principles throughout the construction efforts at GWUH.
A typical Lean Management Group Agenda

Review of Conditions of Satisfaction:
  Are we on track to meet these goals? If not, what action do we need to take to get us back on track?
  How many calls have we had into the Call-In/Help line?
  **Get copy of the call log**

Status of Last Planner Training:
  Are we seeing a benefit from its use? What has our Percent Planned Complete (PPC) been?

Lean Saving Pool:
  What are we doing to find ways to further contribute to the pool?

LMG and Future Meetings:
  Review of LLG Charter
  Set future goals

Lean Story – A3
Kaizen Board
First Look Walk-thru with Staff
Matrix schedule
Exit Sign issue
Plus Delta’s for OAC

In their own words, comments from the team:

“As an HKS Construction services project manager, you must concentrate and maintain four aspects that lead to a successful project: relationships, quality, schedule, and cost. Individually they are just as important as they are together. The GWUH OR Expansion project team worked diligently to maintain these four aspects, which in turn produced a successful project for everybody. I personally would like to thank everybody for all their hard work.”

Ray Smith
Associate Principal
HKS, Inc.
Pull Planning and Work Registers

One of the key tools implemented through the lean process is developing the 'Pull Plan' and 'Work Register' through the last planner system.

The pull plan develops project task commitments by working backwards from the target end date. By pulling activities and needs (and their durations) from the end date, tasks are planned based on the 'last responsible date' of completion.

Tasks developed on the pull plan are transferred to the work register which provides a method of tracking and updating team members on task completion progress and identifying constraints which need to be cleared. On the surgery project, work register check-ins - 15 minute conference calls to update team members - occurred either weekly or bi-weekly depending on level of activity.
### Last Planner System

From design pull planning and work registers, into the construction phases of the project, the project team implemented the 'Last Planner' system with weekly production look ahead planning meetings and specifically the look back reviews of actual production vs planned - Part Planned Complete (PPC)

For examples of the Last Planner and PPC from this project, please reference Appendix.
Innovations

Pre-Design Ductwork/Existing Conditions Walkthrough (All-Hands)

As a part of the pre-design review, the MEP engineer identified that the schematic architectural layout for the new OR’s was immediately adjacent to a large existing HVAC shaft. The existing ductwork design was modified during construction and the as-built documents were not available so it was not clear what the specific obstructions were in the immediate area. The team decided to go and see the existing conditions prior to additional design continuing.

Once at the location, there were large ducts that served the entire southern half of the floor passed immediately over the planned area for one of the OR’s. The ductwork spanned over half of the new OR planned space. The contractor went and measured the precise location of the ducts and this was overlaid onto the proposed design.

Once this was identified in the design concept it allowed the design team to have conversations with the end users so they could clearly understand the constraints from the existing conditions. The entire team and the user identified that there was limited space for support of the overhead equipment booms. The equipment planner provided options for alternate technology that required less ceiling space. The location of the OR table and other critical equipment was located in the room so there would not be interference in the field during construction.

By working as a team, there were no required shut downs to relocate the duct; the equipment that was designed to be in the room was properly installed in the room with no compromise; there were no change orders affiliated with the final solution and all parties were please with the outcome.

Head Wall Mock-Up

Instead of reviewing headwall devices with end users on traditional 2-D CAD Plans or Elevation drawings, the design team used an available space in the hospital to create a quickly adjustable mock-up of a patient bed headwall. Using velcro strips and dummy headwall devices, this allowed the users to experience the location and quantities of devices first hand, and most importantly provide input and make adjustments.
User groups viewing and adjusting placement of head wall devices.

Final headwall layout was then incorporated into the design documents.
Punch List Process

At the start of the project the Collaborative Project Delivery Team (CPD) developed a "No Punch List" process as one of the "Conditions of Satisfaction". The goal of the "No Punch List" was not to sacrifice quality, or prevent the design team from reviewing the work, but to increase the quality of work as well as reduce the risk of rework. The CPD collaborated on a weekly basis and discussed work that would be occurring over the next few weeks. During these collaboration sessions, questions were answered and problems were resolved prior to work beginning. The CPD also established quality standards that were accepted by all team members prior to work activities beginning. Mock Ups, above ceiling check lists, below ceiling check lists, and the Last Planner system were some of the instruments used to control quality and limit rework.

Through commitment from the CPD and the process that was implemented, the CPD achieved their goal of a "No Punch List" project. The inspection for Substantial Completion at the end of each phase was completed in less than one hour with no deficiencies issued to HITT Contracting, Inc.

Matrix Schedule

An innovative scheduling and communications tool developed and utilized on this project is the area 'Matrix' schedule which breaks down the project or phase area by rooms (or other small segment) and identifies detailed tasks that will occur in that location on various dates. This works together with the field pull planning and 'last planner' as well as providing a concise way of communicating with hospital staff.

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<td>N/A</td>
</tr>
<tr>
<td>02042 SOILED UTILITY</td>
<td>N/A</td>
<td>16-Feb</td>
<td>N/A</td>
<td>N/A</td>
<td>18-Feb</td>
<td>17-Feb</td>
<td>15-Feb</td>
<td>N/A</td>
</tr>
<tr>
<td>02061 CORRIDOR</td>
<td>N/A</td>
<td>16-Mar</td>
<td>N/A</td>
<td>N/A</td>
<td>18-Feb</td>
<td>17-Feb</td>
<td>15-Feb</td>
<td>N/A</td>
</tr>
<tr>
<td>02099 CORRIDOR</td>
<td>N/A</td>
<td>16-Mar</td>
<td>N/A</td>
<td>N/A</td>
<td>18-Feb</td>
<td>17-Feb</td>
<td>15-Feb</td>
<td>N/A</td>
</tr>
<tr>
<td>02132 HSKP</td>
<td>N/A</td>
<td>16-Mar</td>
<td>N/A</td>
<td>N/A</td>
<td>18-Feb</td>
<td>17-Feb</td>
<td>15-Feb</td>
<td>N/A</td>
</tr>
</tbody>
</table>
LOKRING Medical Gas Fittings

To help minimize the impacts and downtime caused by trying in new medical gas branches and making modifications to the existing system, a new type of gas fitting was utilized which eliminates the need for brazing and nitrogen purge.

The crimp on fitting without requiring a purge allows for a pre-fabricated Tee/Valve assembly to be installed onto an existing pipe in minutes and re-certification of the gas system can be accomplished locally, since no purge gases are introduced into the system.

LOKRING crimp fit coupling installed on copper tubing
Operating Room - Ceiling Gas Outlet Pre-fabrication

For a congested operating room ceiling with many medical gasses going to ceiling outlets with retractable hose drops, coordination can be a challenge.

One innovative solution to free some of the coordination issues on this project was to prefabricate the outlet array into a framed/drywalled ceiling panel, with pipe connections pre-piped away from the congested area. This allows the whole assembly to be set into place with above ceiling piping being completed in more open work areas.

In their own words, comments from the team:

"What we have learned is a better method of coordination, communication and integration between the trade partners, HIT Contracting, the Owner, End User and Architects/Engineers."

Richard Caruso
Superintendent
HIT Contracting
GEORGE WASHINGTON UNIVERSITY HOSPITAL- OR RENOVATION

TASK TITLE: DESIGN DEVELOPMENT RETROSPECTIVE

RESPONSIBLE PARTY: BERNAITA BEIKMANN DATE: SEPTEMBER 14, 2009

OR DESIGN:
- OR Design in good location to minimize disruption during construction and is a good location for function and flow.
- Was able to share Sub Sterile with OR #1, allowing new OR to be larger size.
- Restrictions on Ceiling Heights in OR's determined equipment and layout possibilities in OR #16.
- Sterile was included in first round of DD for the OR's so equipment could be reviewed and chosen at that time.

PACU/RECOVERY:
- PACU and Recovery spaces are separated by existing Clean/Soiled/Office support spaces, breaking recovery up.
- Restrictions on Isolation Exhaust and quantity of ductwork in overhead restricted the location of the Isolation Rooms.
- Was able to provide a shared toilet room between Isolation Rooms.
- Support spaces are centrally located. Multiple meds areas are located to cut down on staff travel distance.
- End central nurse station looks too much at walls and not at patients.
- Eliminated locker area waste and captured it in recovery bays that are useful.
- Headwalls designed to all have PACU set up to increase flexibility.
- Recovery is using a decentralized nurse model that meets corporate intent for keeping nurses close to patients.
- Reducing size of Nurse Station allowed us to add more Recovery Bays.
- There was a communication disconnect between Staff/ Administration/ Corporate/ IT staff on the method of documentation for the staff.
- PACU Mock-up went well and was well received by staff.
- There were issues with multiple pricing documents for Data/ELric and different meetings were held to determine the different documents with different people.
**OVERALL SPACE/EFFICIENCY:**

Overall the staff is extremely pleased with the outcome of the Expansion Project. Additional OR's and PACU beds have provided for improved throughput and increased surgery volumes.

The 2 new OR's are very spacious and technology is great.

Direct visual of PACU patients from the Central Station is restricted due to partitions and isolation Rooms seem remote.

Central Station is great place for physicians to meet and discussed patient care – very spacious.

Additional patient toilet is needed in Pre/Post OP area.

Patient flow through the department has greatly improved.

Physicians and staff are extremely satisfied with new Endo Suite.

**EQUIPMENT:**

The equipment planned process needs to be simplified so users can better understand.

The state-of-the-art technology in the OR's a physician satisfied specific to elevators and vascular systems.

**TECHNOLOGY:**

 Plenty of computers and other IS equipment.

Bedside chart and wall mounted doc stations working very well.

Additional wall phones needed in patient bays.

Excellent support from IS dept.

A camera system in the OR's would help in room turn-over.

**BUDGET/NEEDS:**

All needs were identified and accommodated on the project.

No equipment items were overlooked or not provide.

**STORAGE/CASEWORK:**

Need additional shelf spaces for pumps in PACU.

**FINISHES:**

Cabinets and countertop are very nice.

Color palette used if very pleasing to patients and staff.

Waiting room furniture very nice.

Finishes appear consistent throughout the floor and matches well with existing areas.

**DESIGN PROCESS:**

Design team worked very well with Users and accepted feedback.

Tremendous amount of information sharing throughout the process.

Notes from meetings results could have been helpful for those who didn't attend meetings.

End product matched what was expected and functioned as planned.

**CONSTRUCTION PROCESS:**

No unscheduled disruptions – everything was planned very well.

Site was always safe and no ICRA or ISM issues.

Regular project meetings kept everyone informed.

Only had one instance where doctor complained about noise and a 5 Why was promptly conducted.

**KAIZEN:**

Central Station should be situated such that all patients can be visually monitored by physicians.

Provide adequate patient toilets to reduce patient wall times.

Mock up a holding area in OP area to verify adequate space for desired functions.

Identify technological opportunities to improve efficiency such as OR cameras and wall phone placement.

Establish meeting minute format that fulfills User expectations.

Consider all equipment needs during mock up to avoid inadequate space or storage functions.

From Noise 5 Why:

- Regularly notify and update Drs on phasing and scheduling
- Proactively relocate Drs Sleep Room away from noisy activities
- Regularly mock up demo noise at each phase
- Tell right person, right time, right duration and right noise level
- Solicit regular feedback from Drs throughout the project

**COST ANALYSIS:**

<table>
<thead>
<tr>
<th>Cost Category</th>
<th>Cost (USD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>FF&amp;E</td>
<td>$3,925,000</td>
</tr>
<tr>
<td>Construction</td>
<td>$4,365,000</td>
</tr>
<tr>
<td>Soft Costs</td>
<td>$880,000</td>
</tr>
<tr>
<td>Total</td>
<td>$8,170,000</td>
</tr>
</tbody>
</table>

**Square Footage:**

- Renovated: 18,000 SF
- Cost/SF: $455 (5245/SF, construction only)
INITIAL PROBLEM PERCEPTION:
Coordination of humidifier start-up, impacts of problems during start-up on turn-over.

CLARIFICATION OF THE PROBLEM:
We have been coordinating humidifier start-up (three parties: Dominion Mechanical, Dri-Steem Rep and Siemens) during the 'testing' week of the space – the week prior to turn-over when air is on to the system. Any problems encountered during start-up cause a last minute re-scheduling of start-up personnel and run into turn-over schedule.

POINT OF CAUSE:
Waiting until we have airflow on to test the whole humidification system – Steam generator and dispersion to room air/room humidistat.

RECOMMENDATION:
Separate the start-up/testing of the Dri-Steem generators (Controlled by Dri-Steem Panel) and control of the room humidity (Siemens).

KAIZEN:
Pull the testing of the various parts of the Dri-Steem system (Generator, steam valve, fill and drain operations) back earlier in the schedule (~ 1 month prior to turnover) using a temporary 'call for humidity' signal from Siemens, and prove the unit to the point of making steam vapor (not connected to ductwork). Once the space is finished and clean to the point of turning on air, test and calibrate the actual call for humidity from the permanent humidistat installed in the space. This will allow more time for shakeout/correction of any issues with the main operating parts and only leaves the controls tuning for the final testing.
LEAN LEADERSHIP GROUP – The George Washington University Hospital

TASK TITLE: 1st Medical Gas Main Tie-Ins/Shutdown for New Valves

RESPONSIBLE PARTY: Christian Pikel DATE: March 28, 2011

INITIAL PROBLEM PERCEPTION:
Adding new medical gas valves to existing 2nd floor main would require an extensive shutdown or expensive 'smart tap' operations.

CLARIFICATION OF THE PROBLEM:
Traditional methods of medical gas fitting/valve installation require introduction of purge gases into the system which requires extensive re-certification before the system can be placed back in operation. An alternative 'Smart Tap' procedure requires a specialty subcontractor and adds significant cost to the installation.

POINT OF CAUSE:
This is a typical challenge on existing/in operation medical gas system where no 'future' valves are available in the location of work.

RECOMMENDATION:
Lokring brand mechanical crimp fittings allow for the installation of Tees and valves without brazing and without purge gases. A shutdown is still required, but the length of shutdown and recertification is significantly reduced. Installation of the fittings only requires a tool rental and training, no specialty contractor is needed.

KAIZEN:
Use of Lokring fittings for medical gas tie-ins during shutdown activities.
## LEAN LEADERSHIP GROUP – The George Washington University Hospital

**TASK TITLE:** Inspections Hansei  
**RESPONSIBLE PARTY:** DOUG GRAY  
**DATE:** March 2, 2010

<table>
<thead>
<tr>
<th>INITIAL PROBLEM PERCEPTION:</th>
</tr>
</thead>
<tbody>
<tr>
<td>3rd party delayed</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CLARIFICATION OF THE PROBLEM:</th>
</tr>
</thead>
<tbody>
<tr>
<td>With current AHJ lead time for inspections there was a need for 3rd party inspections - to date the 3rd party firm has not helped with expediting AHJ blessing of 3rd part procedures.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>POINT OF CAUSE:</th>
</tr>
</thead>
<tbody>
<tr>
<td>In depth conversations did not occur months prior to inspection due date regarding HITT Contracting expectations other than due dates, this should have been followed up daily until 3rd party reviewer grasped concept and verified that all paper work was in the hands of AHJ.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>RECOMMENDATION:</th>
</tr>
</thead>
<tbody>
<tr>
<td>HITT team including subcontractors should pre-plan and contribute with push pull operations with 3rd party inspection team.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>KAIZEN:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Include 3rd party inspection team on pre-planning coordination meetings.</td>
</tr>
</tbody>
</table>
**BEFORE IMPROVEMENT** (Problem) | **AFTER IMPROVEMENT** (Solution)
--- | ---
It is critically important for designers (architect and equipment & furniture) to make sure that whatever equipment is placed in areas in a set location there are sufficient utilities (power, data, voice, water, etc). Realize wall mounted computers were not in the original scope of work, but team needs to discuss. | “Lean” process will allow for a more collaborative approach & lessen this issue.

| OR # 15 was reportedly going to have a desk to house the two (2) computers required. Turns out the “desk” provided by Steris also houses control screen/station for Steris system. Therefore only one (1) desktop fit on the “desk”. | In the future, speaking clearly & defining needs should avoid this issue in the future.

| Biomed items are apparently outstanding including wall mounting monitors and the central monitor at the new nursing station. | It is imperative that customer’s expectations are discussed in a language that everyone understands. “Cabling” does not include medical device / proprietary cabling.

**EFFECT:**

Essentially, it is imperative that all team members work & speak with each other. This will allow the team to provide our customer with a quality work product using minimal funds and time.

Overall a successful project; hope you agree. Would like to try to make sure in the design phases that location of items by the customer include the necessary data, voice and power needed. IT’s involvement should serve as a double check.
LEAN LEADERSHIP GROUP – The George Washington University Hospital

TASK TITLE: COORDINATION OF WORK NEAR HOSPITAL OPERATIONS  Hansei

RESPONSIBLE PARTY: MELISSA REED  DATE: June 29, 2010

<table>
<thead>
<tr>
<th>INITIAL PROBLEM PERCEPTION:</th>
</tr>
</thead>
<tbody>
<tr>
<td>HOW COORDINATION OF WORK NEAR ON-GOING HOSPITAL OPERATIONS SHOULD BE HANDLED.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CLARIFICATION OF THE PROBLEM:</th>
</tr>
</thead>
<tbody>
<tr>
<td>COMMUNICATION WITH HOSPITAL STAFF AND MAKE SURE THAT DETAILED DRAWINGS AND CLAIRFICATIONS ARE PROVIDED AND REVIEWED WITH ALL PARTIES BEFORE ANY WORK COMMENCES.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>POINT OF CAUSE:</th>
</tr>
</thead>
<tbody>
<tr>
<td>QUALITY CONTROL AND SUPERVISION OF ALL INFECTIOUS CONTROL AND TO ENSURE ALL AREAS ARE SECURE. (genchi genbutsu – see for yourself, get your hands dirty)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>RECOMMENDATION:</th>
</tr>
</thead>
<tbody>
<tr>
<td>HITT SUPERVISION AND HOSPITAL PERSONELL TALK ABOUT AND REITERATE THE IMPORTANCE OF INFECTIOUS CONTROL AND TO INSURE THAT IT IS MONITORED REGULARLY. (sensei - teacher)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>KAIZEN:</th>
</tr>
</thead>
<tbody>
<tr>
<td>HOLD DISCUSSION WALK THRU’S, MEETINGS AND PROVIDE DETAILED DRAWINGS TO GET THE HOSPITAL STAFF AND SUBCONTRACTORS INVOLVED IN SELECTION OF WERE THE INFECTIOUS CONTROL WALLS, EGGRESS AND HEPA FILTERS WILL BE PLACED TO PROVIDE A SAFE ENVIRONMENT FOR HOSPITAL PATIENTS AND STAFF. (jidoka – mistake-proofing)</td>
</tr>
</tbody>
</table>
**LEAN LEADERSHIP GROUP – The George Washington University Hospital**

**TASK TITLE:** Angio Lab Power Issue  
**RESPONSIBLE PARTY:** Power Solutions  
**DATE:** December 13, 2010

<table>
<thead>
<tr>
<th>INITIAL PROBLEM PERCEPTION:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Out of Phase feeders between the main feeders and the UPS feeders causing Lab not to Sync</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CLARIFICATION OF THE PROBLEM:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Survey and confirm the perception was correct.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>POINT OF CAUSE:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Field Survey was conducted to coordinate the existing conditions with the new construction requirement for the space adding a new UPS.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>RECOMMENDATION:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Check rework of wiring for work that was already completed with Philips and GW Hospital prior to commencement of new work.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>KAIZEN:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Discussions and field surveys between HITT Contracting, GW Hospital, Philips and Power Solutions determined that the initial installation did not work with the existing phasing with the new UPS equipment.</td>
</tr>
</tbody>
</table>
LEAN LEADERSHIP GROUP – The George Washington University Hospital

**TASK TITLE:** OR #16 Duct Modifications

**RESPONSIBLE PARTY:** Dominion Mechanical

**DATE:** November 30, 2010

<table>
<thead>
<tr>
<th>INITIAL PROBLEM PERCEPTION:</th>
</tr>
</thead>
<tbody>
<tr>
<td>A main duct line would interfere with the new air devices designed for OR#16.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CLARIFICATION OF THE PROBLEM:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Modifications to the existing 50x26 ductwork is necessary to allow room to fit the new air devices in OR #16. The duct modification will require a shutdown of the system for 8 hours to demo existing duct and replace with new.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>POINT OF CAUSE:</th>
</tr>
</thead>
<tbody>
<tr>
<td>This section of Phase 4 ceilings could not be accessed prior to start of work; a survey of the area could not be conducted.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>RECOMMENDATION:</th>
</tr>
</thead>
<tbody>
<tr>
<td>To re-work these sections of ductwork so that they coordinate with the new design and won’t interfere with the new Air Devices.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>KAIZEN:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Through the 'go and look' with Dominion Mechanical, CMC Sheet Metal, HITT Contracting, Inc., CCRD and HKS, the work was coordinated with GWUH and has been completed. If areas with potential existing conditions are inaccessible during the design phase, indicate area as required for future coordination when the space is accessible. Build design verification and coordination activities into the schedule for when a genchi genbutsu is possible and do not detail/fabricate until it is complete.</td>
</tr>
</tbody>
</table>
LEAN LEADERSHIP GROUP – The George Washington University Hospital

TASK TITLE: OR #15 Humidifier Relocation

RESPONSIBLE PARTY: Dominion Mechanical

DATE: November 30, 2010

INITIAL PROBLEM PERCEPTION:
After gaining access to the Phase 4 ceiling space, it was discovered that the existing humidifier H2-0 was not installed per the existing conditions.

CLARIFICATION OF THE PROBLEM:
Its as-built location would have concealed it in the new OR#15 ceiling which would have required an access panel for access and would have been a maintenance issue with entering the OR to service the unit.

POINT OF CAUSE:
A field survey was conducted to coordinate the existing condition with the new construction requirements of the space.

RECOMMENDATION:
Relocate the humidifier into the corridor ceiling next to the new OR15 humidifier location.

KAIZEN:
The shut-down/relocation of the humidifier was coordinated with GWUH to minimize impacts to the OR.
Genchi genbutsu - go and see every existing component before design is complete. If areas are inaccessible at particular phases, plan for design completion when areas are accessible in later phases.
INITIAL PROBLEM PERCEPTION:
Water leaked from a drainage pipe into the MRI control room during a fixture startup causing damage to a monitor, modem and control tower and ceiling tiles.

CLARIFICATION OF THE PROBLEM:
A fixture was started/water flushed with an incomplete joint below the floor. We did not realize there was a problem until it was reported to engineering and engineering reported to us.

POINT OF CAUSE:
No one was downstairs visually inspecting the piping during start-up. It occurred during the day and room is not accessible during the day.

The 1st floor work was fragmented – one night to run piping from fixture location to vicinity of tie-in point, weeks later, different crew made tie-in.

Possible reversal of normal sequence – typically drop carrier and piping through floor, then run piping from fixture connection to point of system connection.

RECOMMENDATION/RESOLUTION:
Ceiling tile replacement was completed by field personnel.
GE was called by hospital to repair/replace damaged equipment. Bill forthcoming.

KAIZEN:
Underslab work needs to be consolidated/coordinated in time blocks for nights/off-hours so that piping can be installed from point of penetration to point of connection in a continuous sequence (can be multiple nights, but should not be broken up over time).

Pipe ‘wetting’ or fixture startup must be a minimum 2 person operation with means of communication. One person is visually inspecting the pipe run underneath as the other is working above. For long runs with many fittings an air pressure test should be performed up to the final connection to existing system. A visual inspection of the final joints be made in the same fashion above.

When working or testing above occupied areas, any equipment or property below that can be relocated should be. Any equipment that cannot be relocated needs to be covered with plastic sheeting and/or additional protection against water until testing is complete.
**LEAN LEADERSHIP GROUP – The George Washington University Hospital**

**TASK TITLE:** Phase III into Phase IV Work  
**RESPONSIBLE PARTY:** HITT  
**DATE:** September 21, 2010

<table>
<thead>
<tr>
<th>INITIAL PROBLEM PERCEPTION:</th>
<th>How to design phasing plans which will not impact the end user and the importance of understanding the phasing plan.</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>CLARIFICATION OF THE PROBLEM:</th>
<th>Phase 4 work was possible during construction of Phase 3 and 100% reflective of collaboration by HITT Contracting with the end users showing order of magnitude renovation was encompassing; with illustrated drawings indicating the placement of IC walls and keeping commitments made regarding start and completion dates.</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>POINT OF CAUSE:</th>
<th>Placement of infectious walls prior to starting the phase work would impact the flow of patients.</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>RECOMMENDATION:</th>
<th>HITT Contracting conducted meetings with End Users and Client to discuss the breakup of the phases.</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>KAIZEN:</th>
<th>Communication between HITT Contracting and the End User was accomplished.</th>
</tr>
</thead>
</table>
**INITIAL PROBLEM PERCEPTION:**
Drywall cutting and put-back at existing headwall conditions Phase 3.

**CLARIFICATION OF THE PROBLEM:**
Minimize drywall Demolition for Med Gas outlet installation to prevent un-necessary patching and finishing.

**POINT OF CAUSE:**
The existing headwall configuration could not be arranged to accommodate additional outlets to match the new headwalls.

**RECOMMENDATION:**
Dominion recommended they prefab outlet and piping so that they may be placed through small holes that are cut the same size as outlets which will then tie into Med Gas mains above ceiling.

**KAIZEN:**
Coordination between mechanical and gypsum tradesmen in the field to devise a plan with a piping solution as a time savings.
TASK TITLE: Running Electrical Branch Circuit Homeruns thru existing Spaces

RESPONSIBLE PARTY: HITT/Power Solutions

DATE: August 20, 2010

INITIAL PROBLEM PERCEPTION:
How to get electrical branch circuit homeruns thru existing spaces without interruption to Hospital staff or Patients.

CLARIFICATION OF THE PROBLEM:
Phase 3 is 3 months later than phase 1 as is the same problem with Phases 2 &4. Conduits need to be pulled thru phases 1 & 2 to get to Phases 3 & 4.

POINT OF CAUSE:
Healthcare renovation work always entails working within a live environment – therefore every opportunity to construct scheduled scope must be performed during the time trades are in the un-occupied area.

RECOMMENDATION:
All conduits for phase 3 & 4 need to be hooked up as compact as possible and brought thru phases 1 & 2 as they are constructed as not to be intrusive to hospital patients and staff after phases 1 & 2 are turned over.

KAIZEN:
Planning thru HITT and Power Solutions enabled all work to be done without interruption to the Hospital Staff or patients and without impact project schedule.
LEAN LEADERSHIP GROUP – The George Washington University Hospital

TASK TITLE: PHASE I, EXHAUST DUCTWORK

RESPONSIBLE PARTY: CMC SHEET METAL

DATE: 2/24/10

INITIAL PROBLEM PERCEPTION: As Built drawings did not match existing conditions, which affected the design documents for the new work.

CLARIFICATION OF THE PROBLEM: Main Exhaust ductwork size was different than what was shown on the As Built drawings. Also, the routing of piping and conduits was not shown on As-Builts. Both of these made the routing for the new duct different than anticipated.

POINT OF CAUSE: Inaccurate As-Builts documents from previous contractor, affected design documents for current project.

RECOMMENDATION: CMC proposed a new solution based on a field survey and coordination and presented the solution to the engineer for approval. Approved solution attached.

KAIZEN: genchi genbutsu was done by HITT/HKS/CCRD/DOMINION/CMC to develop a solution without having to write an RFI which may have impacted the progress of the project. Resolution duration was 2 hours.
Final A3 OAC Report
### PROJECT COST

<table>
<thead>
<tr>
<th>Phase 1</th>
<th>Phase 1 &amp; 1B</th>
<th>Phase 2</th>
<th>Phase 3</th>
<th>Total</th>
<th>Target Costs</th>
<th>Conditions</th>
<th>Over</th>
<th>Subtotal</th>
<th>Fee</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>CATH LABS</td>
<td>CATH LABS</td>
<td>CATH LABS</td>
<td>CATH LABS</td>
<td>CATH LABS</td>
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<td>CATH LABS</td>
<td>CATH LABS</td>
<td>CATH LABS</td>
<td>CATH LABS</td>
</tr>
<tr>
<td>31-Jan-11</td>
<td>31-Jan-11</td>
<td>14-Dec-10</td>
<td>48</td>
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<td>222,120</td>
<td>0</td>
<td>30,791</td>
<td>800,575</td>
<td>0</td>
<td>800,575</td>
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</tbody>
</table>

### PORTAL TO ACTION

<table>
<thead>
<tr>
<th>Opportunity to Accelerate Overall or Expansion Schedule</th>
<th>Days gained to date</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current schedule will be updated to reflect this change</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

### SCHEDULE MILESTONES

<table>
<thead>
<tr>
<th>Expected</th>
<th>Actual</th>
<th>Type</th>
<th>Name</th>
<th>Dates</th>
<th>Target Date</th>
<th>Forecast Date</th>
<th>Variance + or -</th>
<th>Total</th>
<th>Less Fee</th>
</tr>
</thead>
<tbody>
<tr>
<td>23-Mar-11</td>
<td>23-Mar-11</td>
<td>19-Mar-11</td>
<td>Cath Lab 2 DOH Inspection</td>
<td>10-Jun-10</td>
<td>10-Jun-10</td>
<td>10-Jun-10</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

### QUALITY GOALS

<table>
<thead>
<tr>
<th>Goal</th>
<th>Current</th>
<th>Target</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Unscheduled Disruptions</td>
<td>Some minor complaints, no major issues</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre-Installation Meeting</td>
<td>Yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mock-Ups as Required</td>
<td>Yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No-Rework</td>
<td>Yes</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### SAFETY

<table>
<thead>
<tr>
<th>Delay Days</th>
<th>Safety</th>
<th>Work Days</th>
<th>Incidents</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>5</td>
<td>0</td>
</tr>
</tbody>
</table>

### OPPORTUNITIES TO ACCELERATE OR EXPANSION SCHEDULE

<table>
<thead>
<tr>
<th>Opportunity Potential days gained</th>
<th>Days gained to date</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preparing Full TAB Reports</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Receiving Design in Office</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Receiving Full TAB Reports</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Receiving Subject Installation</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

### PROJECT PHOTOS

#### OR Phase IV

#### OR Phase V

### PROJECT PHOTOS

#### OR Phase IV

#### OR Phase V
Final Last Planner and PPC
## WEEKLY WORK PLAN

**Area:** 2nd Floor  
**Subcontractor:** Listed Below  
**Shift:** Day  
**Last Planner:** HITT  

<table>
<thead>
<tr>
<th>ACTIVITIES</th>
<th>COMPLETED</th>
</tr>
</thead>
<tbody>
<tr>
<td>8 February 8, 2010</td>
<td></td>
</tr>
</tbody>
</table>

### MASTER SCHEDULE ACTIVITY ID

<table>
<thead>
<tr>
<th>Activity Description</th>
<th>Responsible Individual</th>
<th>Start Date</th>
<th>Done?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Branch circuits and In-wall, Patients bathroom to Endo 1</td>
<td>Electrical Contractor</td>
<td>08-Feb-10</td>
<td>X X</td>
</tr>
<tr>
<td>Fire Alarm Rough In Soil Utility and staff lounge</td>
<td>Electrical Contractor</td>
<td></td>
<td>X X X X</td>
</tr>
<tr>
<td>Framing Soil Utility and Staff Lounge</td>
<td>Drywall Contractor</td>
<td></td>
<td>X X X</td>
</tr>
<tr>
<td>Returns and Supplies in Endo 1, 2 &amp; 3 finished</td>
<td>Mechanical Contractor</td>
<td></td>
<td>X X X X X</td>
</tr>
<tr>
<td>Framing Mop Sink area, computer room, staff lounge, utility and Recovery rooms 12-16</td>
<td>Drywall Contractor</td>
<td></td>
<td>X X X X X</td>
</tr>
<tr>
<td>Core Drilling and Piping on 1st floor Endo area complete</td>
<td>Mechanical Contractor</td>
<td></td>
<td>X X X</td>
</tr>
<tr>
<td>Core Drilling and piping Utility and Staff Lounge</td>
<td>Mechanical Contractor</td>
<td></td>
<td>X X</td>
</tr>
<tr>
<td>Med Gas in Ceiling from Zone Valve box in Corridor to Endo 2</td>
<td>Mechanical Contractor</td>
<td></td>
<td>X X X X X</td>
</tr>
<tr>
<td>Sketch Duct work for utility staff lounge</td>
<td>Mechanical Contractor</td>
<td></td>
<td>X X</td>
</tr>
<tr>
<td>Workable Backlog (What work can I do w/o affecting other trades if above plan breaks down?)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Catwalk</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### CATEGORIES OF PLAN FAILURE

<table>
<thead>
<tr>
<th>Activity ID</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Activity ID</td>
<td>Category</td>
</tr>
</tbody>
</table>

### LEARNING

<table>
<thead>
<tr>
<th>Category</th>
<th>Reason for Plan Failure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safe - Defined - Sound - Proper Sequence - Right Size - Able to Learn</td>
<td></td>
</tr>
</tbody>
</table>

| START DATE | 08-Feb-10 |
THE GEORGE WASHINGTON UNIVERSITY HOSPITAL OR RENOVATION

PLAN PERCENT COMPLETE

GWU-OR PHASE 1

0 % 1 0 %
2 0 % 3 0 %
4 0 % 5 0 %
6 0 % 7 0 %
8 0 % 9 0 %
1 0 0 %

PROJECT VARIANCE CONTROL
PHASING PLAN – EXISTING PLAN

EXISTING ROOM COUNT
5 EXISTING ENDOSCOPY ROOMS
18 EXISTING PACU BAYS
16 EXISTING PRE-OP/POST-OP BAYS
8 EXISTING RECOVERY CHAIRS
4 EXISTING INPATIENT BAYS FOR OVERFLOW
46 TOTAL PRE-OP/POST-OP AREAS

PHASE OVERVIEW
PHASE 1: 46 TOTAL PRE-OP/POST-OP AREAS
PHASE 1B: 55 TOTAL PRE-OP/POST-OP AREAS
PHASE 2: 55 TOTAL PRE-OP/POST-OP AREAS
PHASE 2B: 58 TOTAL PRE-OP/POST-OP AREAS
PHASE 3: 42 TOTAL PRE-OP/POST-OP AREAS
PHASE 4: 51 TOTAL PRE-OP/POST-OP AREAS
FINAL COMPLETION: 60 TOTAL PRE-OP/POST-OP AREAS
PHASING PLAN – PHASE 1

LEVEL TWO.

ROOM COUNT
3 EXISTING ENDOSCOPY ROOMS
18 EXISTING PACU BAYS
16 EXISTING PRE-OP/POST-OP BAYS
8 EXISTING RECOVERY CHAIRS
4 EXISTING INPATIENT BAYS FOR OVERFLOW
46 TOTAL PRE-OP/POST-OP AREAS

PHASE 1
FIRST FLOOR WAITING ROOM IS CLOSED.
EXISTING OFFICE AREA IS CLOSED.
INSTALL TEMPORARY PARTITIONS FOR CONSTRUCTION.
CLOSE 2 SOUTH ENDOSCOPY ROOMS.
RELOCATE STORM DRAIN/12" PIPE IN COMPUTER ROOM.
NEED ACCESS IN LEVEL ONE FOR PIPE RELOCATION.
RELOCATE SANITARY VENT
ATTEMPT MOST OF MEDICAL GAS ABOVE CEILING WORK IN PHASE 1.
ADD ADDITIONAL OXYGEN LINE TO PICK UP ADDED OXYGEN.
PHASING PLAN – PHASE 1

LEVEL ONE.

PHASE 1
RELOCATE STORM DRAIN/ 12" PIPE IN COMPUTER ROOM.
NEED ACCESS IN LEVEL ONE FOR PIPE RELOCATION.
RELOCATE SANITARY VENT
ATTEMPT MOST OF MEDICAL GAS ABOVE CEILING WORK IN PHASE 1.
ADD ADDITIONAL OXYGEN LINE TO PICK UP ADDED OXYGEN.
PHASING PLAN – PHASE 1B

LEVEL TWO.

ROOM COUNT
2 EXISTING ENDOSCOPY ROOMS
3 NEW ENDOSCOPY ROOMS
18 EXISTING PACU BAYS
16 EXISTING PRE-OP/POST-OP BAYS
9 NEW PRE-OP/POST-OP BAYS
8 EXISTING RECOVERY CHAIRS
4 EXISTING INPATIENT BAYS FOR OVERFLOW
55 TOTAL PRE-OP/POST-OP AREAS

PHASE 1B
CLOSE THIRD ENDOSCOPY ROOM TO FINISH OUT ROOMS IN NEW ENDOSCOPY SPACE.
PHASING PLAN – PHASE 2

LEVEL TWO.

ROOM COUNT
3 NEW ENDOSCOPY ROOMS
18 EXISTING PACU BAYS
16 EXISTING PRE-OP/POST-OP BAYS
9 NEW PRE-OP/POST-OP BAYS
8 EXISTING RECOVERY CHAIRS
4 EXISTING INPATIENT BAYS FOR OVERFLOW
55 TOTAL PRE-OP/POST-OP AREAS

PHASE 2
OPEN NEW ENDOSCOPY AREA.
ENCLOSE 2 RECOVERY BAYS WITHIN ENDOSCOPY SUITE TEMPORARILY TO MAINTAIN EXITING
CLOSE EXISTING ENDOSCOPY AREA
OPEN NEW RECOVERY BAYS
PHASING PLAN – PHASE 2B

LEVEL TWO.

ROOM COUNT
3 NEW ENDOSCOPY ROOMS
18 EXISTING PACU BAYS
14 EXISTING PRE-OP/POST-OP BAYS
14 NEW PRE-OP/POST-OP BAYS
8 EXISTING RECOVERY CHAIRS
4 EXISTING INPATIENT BAYS FOR OVERFLOW
58 TOTAL PRE-OP/POST-OP AREAS

PHASE 2B
INSTALL TEMPORARY WALLS AND DOORS FOR CONSTRUCTION TO PROVIDE AN ENTRANCE INTO THE PACU AREA.
**Room Count**

- 3 New Endoscopy Rooms
- 18 Existing PACU Bays
- 14 New Pre-Op/Post-Op Bay
- 6 Existing Recovery Chairs - Relocated
- 4 Existing Inpatient Bays for Overflow
- 42 Total Pre-Op/Post-Op Areas

**Phase 2**

- Open Reception Area
- Close Existing Pre-Op/Post-Op Area
- Add New Entrance/Exit to PACU
- Open New Cath Recovery Bays
- Open New Waiting Areas

**Level Two**
PHASING PLAN – PHASE 4

ROOM COUNT
3 NEW ENDOSCOPY ROOMS
39 NEW PRE-OP/POST-OP BAYS
8 EXISTING RECOVERY CHAIRS - RELOCATED
4 EXISTING INPATIENT BAYS FOR OVERFLOW
51 TOTAL PRE-OP/POST-OP AREAS

PHASE 2
CLOSE PACU
REMOVE TEMPORARY PARTITIONS IN PRE-OP/ POST-OP AREA
ADD REMAINING BAYS IN PRE-OP/ POST-OP AREAS
Impact Statements
### IMPACT STATEMENT

Items below to be filled out with as much detail as possible for interruptions to the hospital's utility systems

<table>
<thead>
<tr>
<th>1) THE WORK:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>A) Describe what the scope of work is to be performed &amp; why (ultimate purpose/goal of the work)</td>
<td></td>
</tr>
<tr>
<td>Make Tee connections to existing floor medical gas system and install valves for future phasing demo.</td>
<td></td>
</tr>
<tr>
<td>B) Describe how the work will be done (special equipment, hot work, access requirements, etc.), and what hours/days are proposed to be worked to accomplish the task:</td>
<td></td>
</tr>
<tr>
<td>See attached options write up for the 3 potential methods: Smart-Tap, Back-purge, Lokring.</td>
<td></td>
</tr>
<tr>
<td>C) Describe what other options are available to either avoid the work impacting the hospital, or perform it in a different manner:</td>
<td></td>
</tr>
<tr>
<td>See attached options write up.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2) COMMUNICATE:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>A) Describe the results of researching what systems &amp;/or areas of the hospital will be affected by this work:</td>
<td></td>
</tr>
<tr>
<td>All 2nd floor zone valves and outlets</td>
<td></td>
</tr>
<tr>
<td>B) Describe the impact will be to those systems/areas:</td>
<td></td>
</tr>
<tr>
<td>Varying degrees of outage depending on method selected. With Smart Tap option critical areas can be maintained.</td>
<td></td>
</tr>
<tr>
<td>C) Describe any temporary measures that can be taken to lessen or avoid the impact to the hospital:</td>
<td></td>
</tr>
<tr>
<td>SmartTap can provide temporary gas hookups to eliminate downtime on some gases. Lokring minimizes shutdown length.</td>
<td></td>
</tr>
<tr>
<td>D) Describe any temporary measures to ensure construction personnel, hospital staff, and public safety</td>
<td></td>
</tr>
<tr>
<td>Signage and cordon off work areas. Memo to staff prior to scheduled outage.</td>
<td></td>
</tr>
<tr>
<td>E) Verify who needs to know the information on this sheet &amp; how it will be communicated:</td>
<td></td>
</tr>
<tr>
<td>GWUH staff affected by the installation. Project team. Provide memorandum or pre-shutdown conference.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>3) CONTINGENCY:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>A) Discuss what are the weak points or potential failures of the work being performed?</td>
<td></td>
</tr>
<tr>
<td>Depending on method chosen, if installation complication are encountered, missing shutdown or completion window.</td>
<td></td>
</tr>
<tr>
<td>B) Discuss what are the weak points or potential failures of the existing systems affected by the work?</td>
<td></td>
</tr>
<tr>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>C) Discuss what are the weak points or potential failures of the temporary measures in place during the work?</td>
<td></td>
</tr>
<tr>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>D) What contingency plans are feasible to have in place based on the above items.</td>
<td></td>
</tr>
<tr>
<td>Staged shutdown/work areas. Abort remaining installation and re-schedule uncompleted gases if necessary (Most feasible with Lokring option).</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>4) TRIAL</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>A) When feasible, coordinate a trial outage/disruption to simulate the work in order to verify assumptions/information on existing operations &amp; resulting impact on the hospital.</td>
<td></td>
</tr>
<tr>
<td>(1) Items to be coordinated for the trial:</td>
<td></td>
</tr>
<tr>
<td>N/A - For Lokring option, factory certification of Dominion Personnel will be conducted prior to work. This could be scheduled to occur at the facility.</td>
<td></td>
</tr>
<tr>
<td>(2) Results of the trial:</td>
<td></td>
</tr>
<tr>
<td>N/A</td>
<td></td>
</tr>
</tbody>
</table>

Date to **START** the above work: January 2010 - Day to be confirmed

Date to **COMPLETE** the above work: Same day

**AGREED TO BY:**

System Design/Construction Representative: __________________________

Hospital Representative: __________________________

Construction Manager Representative: __________________________

Trade(s) Performing Work Representative: __________________________

Trade(s) Performing Work Representative: __________________________

Trade(s) Performing Work Representative: __________________________
# Project GWUH 2nd Floor South Renovation

## Subject
Steam and HHW Shut-down Plan

## Date
11/29/2009

## By
Dominion Mechanical

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Responsibility</th>
<th>Duration (Hrs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Isolate LPS/LPS and HS/R Service to Second Floor at Valves outside of Housekeeping 21070</td>
<td>GWUH Facilities w/assistance from DMC</td>
<td>0.5</td>
</tr>
<tr>
<td>1.a</td>
<td>Blowdown steam and drain HS/R and LPR at Equipment (Humidifiers &amp; VAVs)</td>
<td>GWUH Facilities w/assistance from DMC</td>
<td>1</td>
</tr>
<tr>
<td>1.B</td>
<td>Post Hotwork Permits, Remove Ceiling Tiles in Work Areas, Set protective plastic/sheeting as required/defined by facilities</td>
<td>DMC</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>Install Isolation Valves on 1-1/4&quot; LPS and 1&quot; LPR branch line for Phase 2 Demo</td>
<td>DMC - Steam Crew 1</td>
<td>1.5</td>
</tr>
<tr>
<td>3</td>
<td>Install 1&quot; LPS T-O-L, Nipple, Valve and 3/4&quot; T-O-L, Nipple, Valve (3 each) for Phase 1 Humidifiers</td>
<td>DMC - Steam Crew 1</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>Install 1&quot; Isolation Ball valves before 3/4&quot; reducer for Phase 1 demo/VAV new install</td>
<td>DMC - Copper Crew</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>Install Reducing Tee and 3/4&quot; Valves for Phase 4 VAVs</td>
<td>DMC - Copper Crew</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>Install/Replace 3/4&quot; Isolation Valves for Phase 4 VAVs</td>
<td>DMC Copper Crew</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>Reducing Tee and 3/4&quot; Valves for Future VAVs - 2 Locations</td>
<td>DMC Copper Crew</td>
<td>1.5</td>
</tr>
<tr>
<td>8</td>
<td>Replace Isolation Valves for Future demo</td>
<td>DMC Copper Crew</td>
<td>1</td>
</tr>
<tr>
<td>9</td>
<td>Reducing Tee and 1&quot; Valves HS/R for future VAVs</td>
<td>DMC Copper Crew</td>
<td>1</td>
</tr>
<tr>
<td>10</td>
<td>1-1/4&quot; LPS, 1&quot; LPR T-O-L, Nipple Valve for Future Humid</td>
<td>DMC Steam Crew 1</td>
<td>2</td>
</tr>
<tr>
<td>11</td>
<td>1&quot; TOL, Nipple and Valve LPS/R for Future Humid</td>
<td>DMC Steam Crew 2</td>
<td>2</td>
</tr>
<tr>
<td>12</td>
<td>1&quot; TOL, Nipple and Valve LPS/R for Future Humid</td>
<td>DMC Steam Crew 2</td>
<td>2</td>
</tr>
<tr>
<td>13</td>
<td>Test LPS/R, HS/R new joints - procedure TBD</td>
<td>DMC</td>
<td>1</td>
</tr>
<tr>
<td>13.a</td>
<td>Fire Watch</td>
<td>DMC</td>
<td>1</td>
</tr>
<tr>
<td>14</td>
<td>Fill HS/R system and open floor isolation valves #1 to put back in service</td>
<td>GWUH Facilities w/assistance from DMC</td>
<td>1</td>
</tr>
<tr>
<td>15</td>
<td>Warmup LPS/R system and blowdown at Equipment Traps</td>
<td>GWUH Facilities w/assistance from DMC</td>
<td>1</td>
</tr>
<tr>
<td>16</td>
<td>Replace ceiling tiles, remove protective plastic/sheeting, cleanup</td>
<td>DMC</td>
<td>1</td>
</tr>
</tbody>
</table>

| Shutdown Duration | 9 |
| Planned Shutdown Date | TBD/Jan, 2010 |
Accolades
Mr. Hitt,

I wanted to take a moment to pass along our appreciation for the professional and compassionate way Mr. Caruso supported GWUH’s Intensive Care Unit last Friday as we dealt with a difficult family situation. A patient had died in the ICU and approximately 30 grieving family members arrived at the hospital. Culturally this family grieved by sobbing, screaming and prostrating themselves on the floor. We needed some place adjacent to the ICU to put some of the family members to decrease the tension and anxiety for other patients in the ICU. Within minutes of a request for assistance, Mr. Caruso emptied a room being used for storage by the construction team and prepared it so we could use it for this family. This allowed them to grieve together as they need to do but also allowed the ICU to maintain a much more controlled environment.

We have appreciated working with Mr. Caruso throughout the project. The support shown to the hospital staff and this patient’s family through this time was exceptional.

Sincerely,

Barbara Jacobs

Barbara S. Jacobs, MSN, RN, CCRN, CENP
Director, Critical Care
George Washington University Hospital
900 23rd Street, NW
Washington, DC 20037
202-715-4736
barbara.jacobs@gwu-hospital.com

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Hi Mr. Hitt,

The entire construction project for the operating room has been top notch. The team for the project have consistently been professional, available and ensured everyone that worked for them did the same. Comments from the physicians and nursing staff have all been very favorable, finding it hard to believe we have completed such a major renovation without interruption, and often not even realizing anyone was on the other side of the barrier wall. Richard Caruso, the superintendent, did an excellent job communicating with the six sigma construction task group, communicated at other strategic intervals seeking input from the major stakeholders, and kept us apprised of progress for the duration. Doug Gray, the project manager, was invaluable to the project. He worked closely with everyone, again keeping us all well informed and allowing for input at appropriate times. Melissa Reed and Nick Raico have been invaluable as well. Their team work, willingness to work with us, and excellent communication has made the entire project a very positive experience.

Thank you from all of us for an excellent opportunity.

I would be more than happy to be a reference for you if needed.

Thank you most sincerely,

Elizabeth White, RN
The George Washington University Hospital
Director Perioperative Services
Office: 202-715-4536
elizabeth.white@gwu-hospital.com
Russell Hitt  
President, Hitt Contracting, Inc.  
2900 Fairview Park Drive  
Falls Church, VA 22042

June 4, 2010  

Dear Mr. Hitt,

I am the Director of Surgical Services at the George Washington University Hospital and wanted to write a brief note to compliment Mr. Richard Caruso for doing such an outstanding job at our hospital with the renovation. The entire time the work has been in progress, it has been seamless to us. We have had excellent communication and have been kept well informed of work that is scheduled, any changes and future plans. We have worked collaboratively to plan egress, which is a challenge in critical areas as the ICU, PACU, Cath Lab, Interventional Radiology and OR with our high acuity patient population. We have been able to review the plans and have walk throughs of the areas during the construction phases. Mr. Caruso has been a true professional and has ensured a high professional standard for the entire staff working under him.

The entire group involved on the hospital side has unanimously concurred on the exceptional experience we have had to date with all aspects of the construction and the collaboration between all areas. Needless to say, it has been a tremendously positive experience for us, and we have had minimal interruption or awareness the work is on-going. I wanted to thank you and Mr. Caruso for making this such a pleasant experience, and we love the end product!

Sincerely,

Elizabeth White, RN  
Director, Surgical Services

Cc: Dr. Michael Berrigan  
Chair, Anesthesia
GWUH Surgery Phase 1
Noise 5 Why

Problem Statement

Why?

Why?

Why?

Why?

Why?

Why?

Action Plan

Drs are awaken by noise
  - Don't wake Drs

Can't sleep with noise
  - Surgery get disrupted
  - Don't disrupt Surgery

Didn't know Drs were sleeping
  - Find out when

Dr wasn't inform
  - Inform Dr

Dr is a light sleeper
  - Different than what was told

Not feeling well
  - Dr sleeping too close to noise
  - Move Dr away from noise

Not the right person was informed
  - Tell the right person

Doctors are angry about noise
  - Patient complain to Drs about noise
  - More anesthesiain

Don't make noise

Drs don't like the noise
  - Can't think

New Dr didn't know what to expect
  - Dr didn't participate in "mock noise" exercise

Level of noise increased
  - Noise location moved

Level of noise increased
  - Don't make noise

Drs don't like the noise
  - Can’t think

New Dr didn't know what to expect
  - Dr didn't participate in "mock noise" exercise

Level of noise increased
  - Noise location moved

Regularly notify and update Drs
  - Proactively relocate Drs Sleep Room
  - Regularly mock up demo noise at each phase
  - Tell the right person, the right time, right duration and right noise level
  - Solicit regular feedback from Drs

Don't make noise
2 December 2009

Observations and Recommendations

Intro to Lean and Last Planner System – the team participated in their normal team meeting followed by an LPC presentation on lean construction and the Last Planner System. This included a pull planning session leading to “demolition”. Numerous activities were identified as required to get to “demolition” and team members committed to add these to the construction schedule or the work register as appropriate.

ConsensusDocs 300 Tri-party agreement – the project is being executed under a CSD 300 agreement. Several issues need to be resolved to take full advantage of the benefits offered by this form of contracting. See below for some issues and recommendations:

- The Management Group is defined as a representative from the Owner, Designer (architect) and Contractor. 4.1 states that other members of the Collaborative Project Delivery Team may be added to the Management Group if desired. The reasonable candidates would be CCRD and the electrical and mechanical subs. I recommend that the Management Group remain at 3 with the others as members of the CPD Team for the immediate future – consider expanding the Management Group at a later date.

- The Collaborative Project Delivery Team seems to be functioning well with weekly meetings, etc. John Draper (LPC) is beginning to coach them in the application of the Last Planner System. With the use of LPS, there should be Constraint Logs available (to supplement the Work Record currently being maintained by the “designer”) and Weekly Work Plans and an associated Plan Percent Complete calculation. Have the Trade Contractors (at least the MEP guys) been provided with and asked to sign “joining agreements”? I recommend that they are, especially if they are not added to the Management Group.

- Budgets – Article 8 defines in some detail a number of budgets, all leading up to a Project Target Cost Estimate (8.3). As part of this definition Target Value Pricing (8.1.5) is included. This is intended (with its “on-going” pricing) to provide current cost information to the Management Group so they can execute their responsibilities to complete the project as the best “that the budget will allow”. The Management Group must assure that the necessary estimating is occurring and being reported on an appropriate basis.

- CSD 300 requires an “incentive program” to have certain characteristics (11.3). The Management Group must define the basis for an incentive program in the very near future. Note that 11.4 defines the savings as those achieved from the
PTCE (similar to a typical GMP cost) and those will not include savings achieved by the up-front work performed by the Trade Contractors in their early collaboration with the designers. The Management Group should determine the actual basis for the incentive program in the near future. (I will provide some further ideas under separate cover shortly)

**Lean Implementation** – the Management Group is charged with “managing” the project - a significant task in itself and in addition the Management Group members are not at the project on a day to day basis. Thus, if the Management Group wishes to encourage continuous improvements and further implementation of lean techniques on the project – the formation of a “construction lean team” might be in order. See the attachment for proposed qualifications and roles.

**Activities**

Wed – Meet the team, intro to lean and LPS, pull phase planning to get to demolition, discussion of issues (social)

**Attachments:**

Construction Lean Team Proposal
Construction Lean Team

The Team will:

- Learn (deeply and fully) the concepts of lean construction
- Perform studies to determine project needs for improvement
- Develop leadership skills to enable the members to manage and execute Lean projects in the future
- Initiate and execute Kaizen events
- Communicate the lean philosophy to their home group companies.
- Assist GWU Hospital management in identifying and solving problems.
- Execute projects as required
- Work to make this project a “national model” for lean construction in the healthcare industry

The 4 to 6 members will be selected from different groups or companies at the GWU Hospital Project with the support of their current managers or superintendent/foremen. They will serve on the CLT for approximately 6 months (different at first so there is staggering of “terms”).

Some qualifications – willing to learn, background knowledge of construction operations, seen as a leader within their parent organizations and have the full support of their corporate managers.

The CLT will be managed by Doug Gray (until someone else emerges as “the leader”). They will typically meet once per week for education and communication and will be available up to full time for short periods when executing projects or participating in team activities.

Some example activities for the team:

- Identify new team goals – zero punch list, improved schedule performance, breakthrough construction techniques
- Analyze the procurement, supply, fabrication and on-site storage of components – develop improvement plans
- Kaizen events on various operations – installation of fixtures, connections to headwall, etc.
- 5S activity on different sections of project – labeling components, organizing tool boxes, etc.
- Development of standardized work processes
- Collaborative approach to schedule improvements – by batch, planning group and overall.
• Identifying and recording improvements for future use – encouraging broad participation in QnE Kaizen or simple improvements.
• Value stream mapping of operations
• Organize storage and supply of bulk materials
• More improvement or use of prefabrication activities
• Training of additional staff in “lean leadership”

I see the formation of a CLT as a significant step in moving “lean” forward on this project and for the participating companies. It should have the wholehearted support of the Management Group and company leadership. They should be willing to tell members that this will lead to promotions, expanded responsibilities and future benefits within their companies.

This effort will, in fact, provide the members with a better understanding of lean than they could get in any other way and should make GWU Hospital Project a national model of lean construction success.
The GWUH Surgery Project has declared its intention to execute the project utilizing Lean principles. In support of this goal, it is forming a Lean Management Group. The purpose of the Lean Management Group is to bring about the Lean transformation of the GWUH Project by guiding, supporting, and encouraging lean activities, practices, and attitudes.

The Lean Management Group will consist of 3 to 6 project leaders who have been oriented to the Lean approach by participating in various lean training events and who are dedicated to making the GWUH Project Lean transformation a success.

The Lean Management Group (LMG) will meet on at least a monthly basis. The roles and responsibilities of each Lean Management Group member will include:

- Build personal expertise in Lean principles, methods, and behaviors through individual and group study.
- Exhibit new behaviors and commitment to Lean principles and methods.
- Drive Lean transformation throughout the GWUH Project and within the organizations supporting it.
- Establish regular measurement of the Lean transformation.

This group will:

- Implement the Last Planner® System (LPS) on the project
- Identify and conduct initial kaizen events.
- Foster continuous improvement by encouraging small changes at all levels.
- Provide training to selected personnel in additional Lean techniques.
- Monitor progress of the project using LPS or other techniques.
- Develop a “Lean story” of the GWUH transformation both for internal use and to explain to customers and suppliers how the project organization manages its work.
- Insure that other leaders within the participating organizations are actively supporting the transformation.

We commit to these roles, responsibilities, and actions on ____________, 20___

Tim Ott__________________ Ray Smith__________________
Sarah Kuchera__________________ Doug Gray__________________
Christian Pikel__________________ Glenn Phillips__________________
Lean Management Group  
Meeting Agenda – March 10, 2010

1:00pm – 2:00pm

Review of Conditions of Satisfaction:  
Are we on track to meet these goals? If not, what action do we need to take to get us back on track?  
How many calls have we had into the Call-In/Help line?

Status of Last Planner Training:  
Are we seeing a benefit from its use? What has our Percent Planned Complete (PPC) been?

Lean Saving Pool:  
What are we doing to find ways to further contribute to the pool?

LMG and Future Meetings:  
Review of LLG Charter  
Set future goals

Plus Delta