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Partnering Penrose Hospital Surgical Renovation



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Published by
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for Health

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Sometimes innovation is not a new product or a piece of equipment but it is rather a new way of seeing an old problem. By viewing with a new perspective we are able to use existing technology in an entirely different way. This was the case in a recent construction project at Penrose Hospital in Colorado Springs. The Penrose Facility Department was faced with the problem of a severely aging infrastructure for an active surgical suite. The existing hospital campus did not allow for the construction of new facilities. The only practical option was the renovation of the existing OR suite.

This conclusion was brought to the design team to solve. The traditional approach whereby the architect and engineers prepare design drawings for a select list of general contractors to bid was quickly discarded. While this approach might have been yielded a "lower bid cost, it was felt that it did not allow sufficient flexibility and would ultimately lead to a much higher project cost. Bob Fling and David Howard with Penrose understood at the outset that for this project to be successful the contractors and subcontractors had to be equal partners in the development of the design.

This decision to partner paid immediate dividends. The general contractor brought a new perspective to an old problem. Initially great concern was expressed as to how the extensive demolition process could be accomplished in this sterile environment. The design team and owners were viewing demolition in the classic sense. G.E. Johnson suggested that demolition needed to be viewed in an entirely different light. They suggested that we think of it as disassembly not demolition. Disassembly implied a thoughtful and strategic removal of unwanted items. It meant workers in surgical masks carefully removing old piping in much the same way as the surgeons in the OR might remove a malignant tumor.

The development of the disassembly concept was a breakthrough for the design team. It led to a series of design decisions, predicated on new construction techniques centered around the strategic and careful removal of unwanted items.

The design team was off and rolling, and each player now had a vital stake in the success of the project. The result of this partnering can be seen in an extremely successful project. One that seemed at the outset almost impossible to accomplish.

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How do you renovate a surgical suite while it's in full operation? How do you replace the entire medical gas system with surgeries in progress? How do you complete substantial demolition in a sterile environment? How do you install fire sprinklers in a sterile surgical suite? How do you completely gut and renovate a surgical nurse's station that is in use? How do you replace the flooring, ceilings, lighting, mechanical and electrical infrastructure, and finishes in a sterile surgical corridor that must be available for transport of surgery patients, staff, and equipment? How do you meet all the code requirements? How do you upgrade the finishes of the entire suite while in operation? How do you improve the ventilation? How do you do all of these things, to the satisfaction of surgeons, anesthesiologists, nurses, facilities' managers, and building officials while meeting strict schedule and budget parameters, all in an environment that is profitable to the architect and contractor?

Answer: You do it as a team.

The most notable aspect of Penrose Hospital Surgical Suite Renovation was the team approach throughout the entire project. In the words of Penrose's director of construction, Bob Fling, "We made the decision on day one to include GE Johnson Construction Company, Olson Plumbing & Heating, Green Electric, and the Penrose's director of facilities, construction manager, industrial hygienist, nursing supervisor, fire marshall, facilities team leaders, and physicians on the team with RTA Architects and Beaudin Ganze Engineering." The team approach allowed for a successful project that was completed on schedule and under budget while the surgery suite maintained operation. During the 10-month surgery renovation project, 806 more surgeries were completed than during the same period the previous year, a 9 percent increase. The entire team, including the contractor, architect, surgery staff, hospital administrators, and facilities staff approached the project cooperatively. All parties of the design team appreciated the other members' particular needs and demands.

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All team members were involved from the outset of the project. From the beginning of conceptual design, the team incorporated the surgical staff's specific needs, the contractor contributed input relative to constructability, the facilities' personnel monitored maintenance issues, and the architect blended these diverse needs into a functional and aesthetic solution that met all code issues. According to Rene Kehr, RN, the project team was "very interested in the input of staff . . . knowing that certain special needs have to be met by the staff and patients."



[Figure 1](#)

This open flow of information helped develop trust and respect from the beginning of the project. Robbie Villagrana, the plumbing foreman said, "Without the understanding and cooperation from the surgery staff and the maintenance people, getting the project accomplished would have been impossible. Our good working relationship with the hospital people and the other trades is what made it work." This mutual respect encouraged all team members to work toward common goals and a successful project. It allowed for an understanding that the various team members could have slightly different views of a successful project that were not mutually exclusive, and furthermore encouraged all team members to help other team members to achieve their specific goals. It was crucial that this information was passed to the front line workers.

Jack Teff, GEJCC's superintendent, said, "Laborers needed to appreciate the nuances of working in a sterile environment. We taught them to think of disassembly, rather than demolition." Work was performed incrementally to construction activities to cease immediately in the event of a catastrophe that would require unlimited access and movement in the surgical suite.



[Figure 2](#)

The mutual trust allowed for flexibility in resolving field conditions. The architect established a rapport that allowed a flexible and efficient method for resolving conflicts between the field conditions and the design details. A more informal approach to altering design to match field conditions was established. Many of the changes were made verbally in the field, after discussion between the RTA and GEJCC staff, with input from the users and facilities personnel. Bob Husband, the Penrose construction manager, facilitated these discussions and kept

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them moving forward. The architect had enough confidence in their overall design, the contractor and the staff to be open to all suggestions. Suggestions from laborers and surgeons alike were given consideration. John Hoelscher, the project architect, said "More important, the staff and physicians were willing partners in the development of alternative solutions that were needed to respond to existing conditions, phasing, and scheduling issues."

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A truly unique atmosphere and relationship were established during the project. Most of the construction personnel and surgical staff were on a first-name basis. Small gestures smoothed the way: the surgical staff regularly brought cookies for the construction personnel, for example, and at the end of the project, the construction personnel returned the kindness with a gift of T-shirts. One of the surgical nurses said after completion of the project, "I really miss all of the guys," referring to the construction personnel. Another nurse said, "These guys had such great patience with us and we developed such great teamwork. We miss them all."



[Figure 3](#)

Communication, a key to the project's success, was addressed in several ways. Weekly meetings were held with all the players. These meetings were primarily for the surgical staff to address their concerns directly to Penrose's construction manager, RTA, and GEJCC. The direct communication that occurred in the field was so successful, however, that midway through the project, these weekly formal meetings became unnecessary and were canceled.



[Figure 4](#)

The project team also established an operations center that was key to information flow. Director of facilities David Howard said, "In the operations center the sole thought was project success. Egos and other concerns were checked at the door."

The team also held weekly construction meetings involving representatives from the various hospital stakeholders, contractor, architect key subcontractors and engineers. At these meetings, issues involving the many parties were discussed. The team established short interval schedules that were distributed weekly to the surgical staff and physicians and published in the hospital newsletter. Any conflicts between the construction and surgery schedules were resolved in advance. According to Phil Harris, the consulting owner's representative, "Since I had been hired to insure that communications were maintained at a high level between the construction team and medical personnel, it was mutually decided that my services were no longer needed when the project was less than 75 percent complete, because of the excellent flow of information and ongoing success of the project."

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The staff's support was key to staying on schedule. From the project's inception, the staff helped to develop the phasing plans and coordinate the heaviest surgery days with the construction schedule. The construction personnel stayed flexible to avoid or minimize inevitable conflicts. The surgical staff facilitated the construction activities that were performed in their proximity by remaining empathetic to the construction personnel's professional needs.

The considerable work during the design phase was also crucial to meeting the schedule. The architect and engineers alike performed extensive field investigations and interviews with the stakeholders. This intimacy with existing conditions and requirements greatly reduced interruptions and surprises. GEJCC's project manager, Fred Wolfe, stated, "The flexibility and openness of the team promoted an approach that allowed for quick resolution of the unavoidable surprises and kept the project on track." In addition, Penrose's Construction Management staff was always available with input based on a unique understanding of both the construction considerations and the hospital's concerns.

The team had to meet many measures of success. First was Penrose Hospital's strategic plan, major elements of which were to obtain a fully modernized surgical facility without incurring the cost of building a new facility; to keep the facility on the main hospital campus; and to meet all code and staff requirements. It became apparent that the only way to successfully meet these criteria was to renovate the existing suite. Consideration of two main cost elements contributed to this decision: the cost of a new facility, including the added construction costs for a new building and the cost of obtaining the real estate; and the potential loss of revenue if the number of surgeries was to be reduced during the renovation. By successfully renovating the existing suite, the added cost of a new facility was not incurred. The revenue generated by surgeries in the existing suite was actually was increased.

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Design Innovations to Serve the Community

Meeting the community's needs was integral to Penrose Hospital's strategic plan. The hospital administration gave top priority to determining these needs and how to support them. Donna Bertram, the hospital's senior vice president, met regularly with community leaders to develop a community needs assessment that provided a backdrop for the needed program. The assessment revealed the special significance of maintaining the surgical services in the city's core; providing uninterrupted trauma services during construction; and focusing the economic benefits of the project on local firms.

The surgery renovation project was extremely successful in meeting all of these needs. The hospital maintained their full surgical services—not one trauma patient was diverted because of the construction activities. The project's economic benefit was channeled almost exclusively to local firms, tradespeople, and subcontractors.

Design that would enhance surgical staff productivity was critical to the success of the project. The first step was to improve the storage systems within the operating rooms and adjacent corridors. The design team combined effective space-planning techniques with input from staff to determine the most efficient storage scheme. Clutter was eliminated through the use of built-in cabinets and equipment alcoves. The effect was not only practical, but also much more aesthetically pleasing.



[Figure 5](#)

The design made more effective use of the physician changing area and expanded and improved the physician's shower facilities. The design totally revamped the nurse's station. The renovated station made for more effective use of the space. The nurses' input resulted in a more efficient filing system, better organized work areas, and greater communication.

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Staff efficiency was also greatly improved by modifying the layout of the operating rooms. The rooms were increased in size, with improved lighting, emergency power, ventilation, and new finishes. Lighting throughout the suite was improved with fixtures that are easier for the surgical teams to operate. An added benefit was standardization of the lighting hardware throughout the suite. Green Electric installed indirect lighting in the corridors. This had a substantial benefit to the staff and patients alike, making for much more pleasant ambient light and the elimination of the hypnotic effect that repetitive, direct overhead lighting has on patients.

The existing interior finishes in the surgery suite were cold and institutional (the entire suite was an unattractive hospital green). The corridor walls were severely damaged and in need of repair. The entire atmosphere was depressing. The new finishes blended lively colors that brightened and opened the space. Practical touches such as IPC wainscot and corner guards provided throughout insured that the spaces would remain attractive and cheerful for a long time.



[Figure 6](#)

The staff gave input on equipment layout, lighting, finish selection, and overall concepts for the renovated suite. Concurrently, RTA solicited input from the contractor regarding constructability. This allowed for a design that minimized the impact of construction on the staff and helped keep the budget within the project's fiscal constraints.

Utilizing input from all its members, the team was able to bring continuity to the suite's finishes and provide for a cleaner and more soothing environment. This improvement in aesthetics is important in an environment that is stressful to staff and patients alike. The design team selected materials for their durability, pleasing appearance, and ease of maintenance. The existing tile flooring, for example, was replaced with a seamless vinyl product that, in addition to being aesthetically pleasing, is easier to maintain. The design also streamlined the decontamination area to require less space and improve the efficiency of the decontamination process.

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Energy Conservation and Environmental Awareness

Another design consideration undertaken by the project team was energy efficiency. First, the entire heating/ventilation/cooling system was rebalanced to bring existing air handling units to their optimum operating levels. In addition, the controls were all upgraded to direct digital controls (DDC), which, as David Howard said, "will insure the most efficient use of our infrastructure [and] all but eliminate complaints from the staff and physicians on room temperatures."

Reworking the entire domestic hot water loop increased efficiency. The installation of electronic ballasts and T-8 bulbs throughout the suite will also significantly reduce the electricity consumption over time.

Environmental awareness was the last design imperative. The environmental considerations in a surgical suite are considerable. A key need was to convert the entire suite to one 100 percent outside air. The increase in outside air will provide substantial benefit to the patients and staff. The project team also designed and installed a new laminar flow air distribution system in the operating rooms to bathe the patient and the surgical team in fresh air from supply vents in the ceiling. The air is vented through return grilles near the floor and released outside the building. This system provides for a healthier and more comfortable environment.

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"Disassembly" and Construction

The team developed many innovative construction techniques that allowed surgical procedures to continue in the midst of the construction. The surgery staff took 2 out of 12 operating rooms out of service at a time to allow for renovation. Cutting through the exterior walls allowed freedom of movement for the construction personnel and the needed materials. The mechanical contractor, Olson Plumbing and Heating, was able to develop an airlock, which kept the construction area negative-pressure relative to the rest of the surgical suite. This allowed for greater freedom of activity in these areas, as opposed to work that had to be completed in the sterile areas.

In areas such as the corridor, where negative pressure could not be achieved, all construction personnel were required to wear surgical gowns, footwear and headgear. GEJCC developed a mobile chamber that tapped into the in-house vacuum system and allowed for "disassembly" in the corridor by allowing a laborer to work in a small confined area of negative pressure. The chamber had one open side that was sealed against the area that required "disassembly."

A portable plastic temporary ceiling was developed for use in areas that required the structure to be exposed when construction was not ongoing in the immediate area. This allowed the use of the areas by the staff, maintained a sterile environment, and helped increase lighting in the construction area.

In addition, Penrose Hospital's infection control and industrial hygienist monitored air quality and infection rates in the vicinity of the construction. They determined there were no cases of infection attributable to the construction.

The Penrose Surgery Suite Renovation project met or exceeded all of the measures of success, resulting in a state-of-the-art facility, completed on time and under budget without reducing the number of patients served. The project was also profitable for the contractors, architect, and engineers. P. Terrence O'Rourke, M.D., described the project's success as the result of "close collaboration between the operating and construction personnel. All the surgeons who utilized the operating rooms during the renovation had nothing but compliments regarding the planning and implementation of the renovation project."

Bob Fling said it best: "Every time a problem came up the group would step forward and say 'This is our problem and we will solve it together.' No more can be asked of any group." 🐼

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This article originally appeared in *The Academy Journal*, published by the AIA Academy of Architecture for Healthcare (volume 1, part 1 – October 1998).