

The Center for the Intrepid

10th Anniversary: A Look Back





The Center for the Intrepid, the world's most advanced center for rehabilitation, research, education, and training, opened in 2007. Over the last ten years, the CFI has treated more than a thousand service members who have suffered severe amputations, burns and other wounds in battle. Since it came online, the facility and its incredible staff, patients and their families have contributed to many remarkable advancements in rehabilitation therapy, research, and recovery.

Ten years is a long time, but there are some projects that stand out in our memory. The Center for the Intrepid is one of these projects. It remains one of the most significant projects SmithGroup has had the honor to design. On the 10-year anniversary of its completion, we take a look back how this extraordinary project came into being.

Designing a World-Class Rehabilitation Center for Our Wounded Warriors

by Erin McNamara

At the time the Center for the Intrepid (CFI) was conceived, more than 23,000 troops had been wounded in Iraq and Afghanistan. Of those, more than 10,000 sustained injuries too severe to allow them to return to duty. That number has risen as the combat continues. The most severely injured suffered from double and triple amputations, severe burns, head and body trauma, blindness, deafness, and partial and full paralysis.

In 2005, to meet an urgent and growing need for the care and rehabilitation of the men and women who have sacrificed so much for our nation, an extraordinary team of physicians, researchers, philanthropists, architects, construction workers, and over 600,000 Americans together took on an extraordinary mission: to create, in record time, the world's most technologically advanced physical rehabilitation facility to care for our wounded soldiers.

Just 18 months from its inception—less than half the time it would normally take to design and build a facility of this scope and complexity—The Center for the Intrepid, a world-class, state-of-the-art rehabilitation training and research facility, was dedicated on January 29, 2007.

The new, four-story, 65,000-sf Center for the Intrepid accommodates the most sophisticated amputee rehabilitation technology through the use of advanced prosthetics, computerized and video monitoring for biomechanical studies, virtual reality, robotics, and simulators. The Center also provides specialized spaces for prosthetics fitting and adjustments, consultation and examination rooms, psychology, clinical nutritional services, social work, physical and occupational therapy, gait studies, telemedicine, and research.

In addition to the clinical areas, the design incorporates advanced physical training areas, an indoor pool, running track, climbing wall, gait lanes, uneven terrain and obstacle simulations, and various specialized equipment for advanced strength, balance, agility, and motor skill therapy.

The Center for the Intrepid is designed to provide military patients and veterans with severe extremity injuries, amputations, and burns the best opportunity to regain their pre-injury abilities in a supportive, healing environment. In addition, the Center supports continued innovation and technological advances in military medicine as well as serves as a prototype for similar military and civilian centers of excellence worldwide.

"This is not charity, this is duty."

— Arnold Fisher, Chairman of the Intrepid Fallen Heroes Fund

The prominent site of the CFI, located at the renowned Brooke Army Medical Center, is an appropriate setting for this symbol of military medicine. Deliberately designed as a bold, enduring monument in honor of the sacrifices of our men and women in the armed services, the Center serves as a lasting statement that their service has not been forgotten.

The Mission

The idea for the new facility started with the vision of Colonel Chuck Scoville, US Army (ret.), program manager for the U.S. Army's Amputee Patient Care Program. Advances in battlefield medicine and armor mean that many soldiers, who in previous wars would have died from their wounds, are now surviving—but are returning from war with more horrific injuries. To respond to this need, Scoville envisioned two centers of excellence for amputee and severe trauma rehabilitation at Walter Reed Army Medical Center in Washington, DC, and Brooke Army Medical Center in San Antonio, Texas.

The Walter Reed facility had been planned and designed by SmithGroup when it was put on hold until Congress decided whether or not to close Walter Reed as part of its BRAC (Base Realignment and Closure) process. The Walter Reed facility had already taken nearly two years to get through design when it was put on hold, but the need for new facilities to care for the growing number of amputees was growing ever more urgent.

Then a hero of a different kind stepped up.

The Intrepid Fallen Heroes Fund (IFHF) is a philanthropic fund that was created to provide grants to the families of those who were lost in Iraq and Afghanistan. The Fund had given out over \$14 million to military families when new legislation enacted in May 2005 significantly increased the death benefits necessary to support these families. At that time, the Fund redirected its efforts to support the catastrophically disabled military personnel and their families.

Recognizing that the soldiers' future quality of life, their ability to care for themselves and provide for their families, and their very survival depends on the treatment, rehabilitation and advanced training skills they receive following their injury, the Chairman of the IFHF, Arnold Fisher, called Surgeon General of the Army, Lt. General Kiley, and asked, "How can we help?"

Mr. Fisher learned that the government needed a facility as soon as possible to care for the increasing number of severely wounded soldiers. He knew the government alone couldn't get it done fast enough. He returned to the IFHF board and persuaded them to fund and build a center for advanced rehabilitative care and therapy. The only question asked was how much? Fisher responded, "This is not charity, this is duty," and knew Americans would agree.

The IFHF committed to raising the contributions needed to build the \$50 million Center as quickly as possible. They would also retain the design and construction team and manage the entire process, and then donate the completed facility to the Department of Defense (DOD) and to the nation.

Arnold Fisher knew that he had to circumvent the typical government process and red-tape if he was going to make this happen. Said Fisher, "It had already taken too long when we started." He asked only one thing of the DOD: "give us a site and then get out of our way."

Within a week of that meeting, the DOD had provided a 5-acre site directly adjacent to the Brooke Army Medical Center (BAMC), and the Fund had selected SmithGroup as design architect. SmithGroup quickly assembled a design and consultant team and immediately began work on the project. Within a month, construction manager Skanska USA Building was selected to manage the construction. In record time, a core team had been assembled and was working together to complete a singular mission: get it done right and get it done fast.

THANK YOU
FOR
OUR SERVICE.
BOOTH FAMILY
COLLON FAMILY
KIELY FAMILY

A NATION OWE
OUR GRATITUDE
THE SACRIFICES
MADE IN THE
FOR FREEDOM

Assembling a Unique Team

The first team member that Fisher needed on board was the architect. Chuck Scoville had worked with the national A/E firm SmithGroup to develop the building program and design for the Walter Reed amputee care facility until it had gone on hold. He knew SmithGroup understood the distinct requirements of the facility and its patients and recommended the firm to Fisher. Fisher immediately flew to Washington to meet with SmithGroup, hired them on the spot, and asked them to start work on the project the next day.

"When Mr. Fisher first proposed that the Intrepid Fallen Heroes Fund build a world-leading rehabilitation center for our service members, he remarked that he also wanted it to be a monument to their service," said Scoville. "He then set a specific target date of January 2007 for completion, and it was obvious that it would take a unique team to fulfill his vision. Identifying SmithGroup to partner with us on the project was a pivotal point."

In just 48 hours after that first meeting, SmithGroup principal-in-charge Phil Tobey, medical planner Lora Schwartz, and designer William Hendrix flew to San Antonio with Scoville, Fisher and other leaders of the IFHF to identify the optimal site and meet with leaders of the BAMC amputee program.

"On the initial flight to San Antonio, says Scoville, "Mr. Fisher sat with the architects for the first time, and together they sketched out the building design, having not even seen the land where the building would sit." By the time the plane landed, the team had developed the initial program and concept design that would guide the project for the next 18 months.

In addition to designing the building, SmithGroup would provide medical programming and planning, interior design, lighting design, and landscape architecture. Other specialists were needed, and SmithGroup immediately assembled a team of consultants to round out the team. They chose firms they knew they could work well with, that had the right expertise, that could handle the fast-track schedule, and that, most importantly, would share in their commitment to the mission. They asked Syska Hennessey Group to design the building's engineering systems. Cagley & Associates was named the structural engineer. Civil engineering would be provided by Garcia & Wright Consulting Engineers. Finally, Counsilman Hunsaker was selected as the natatorium consultant.

SmithGroup also knew that the best way to meet the January 2007 completion target, as well as the project budget, was to bring in an experienced construction management team to work alongside the design team from the start of the project. SmithGroup recommended Skanska USA Building, and within four weeks they were on board and a project budget was established.

The IFHF also brought on Plaza Construction Corporation to serve as their owner's representative, with the authority to provide direction in cooperation with SmithGroup and Skanska to permit an expedited approach to issue resolution.

Commitment to the Mission

Every team member understood the mission and the challenge of designing and constructing in just 18 months. During site visits to Walter Reed and Brooke Army Medical Center, team members met with medical staff and patients to better understand the hurdles these wounded soldiers faced during their recovery. It helped motivate and inspire the entire team to keep on track and realize why all the extra hours and grueling schedule was necessary.

"It wasn't just the soldiers' honor and sacrifice that drove us," says Tobey, "but their strength and endurance. Seeing them work so hard, and rise over the course of many months from wheelchair to crutches to running marathons, was just an incredible inspiration to us all. It didn't matter what our personal views of the war were. We couldn't help but rise to the challenge and commit to bringing this facility online as soon as possible."

The aggressive schedule and complex program meant the planning, design and construction teams had to work closely together and completely in parallel. It required absolute trust. There was no formal partnering session; none was needed. But this commitment to each other and to the mission helped the team to work together to respond to the many challenges that would surface during the course of the project.

"I feel that the entire team was extremely open to questions, suggestions, and even constructive criticism," said Col. (ret) Rebecca S. Hooper, who had been appointed Program Manager of the CFI. "The whole thing was done for the injured service members, and everyone pulled together to make that the focus, even if that meant changing course a couple of times."



RAWLEY E. CHAMBERS

GEORGE C. BEACH AVE.

ROGER BROOK DRIVE

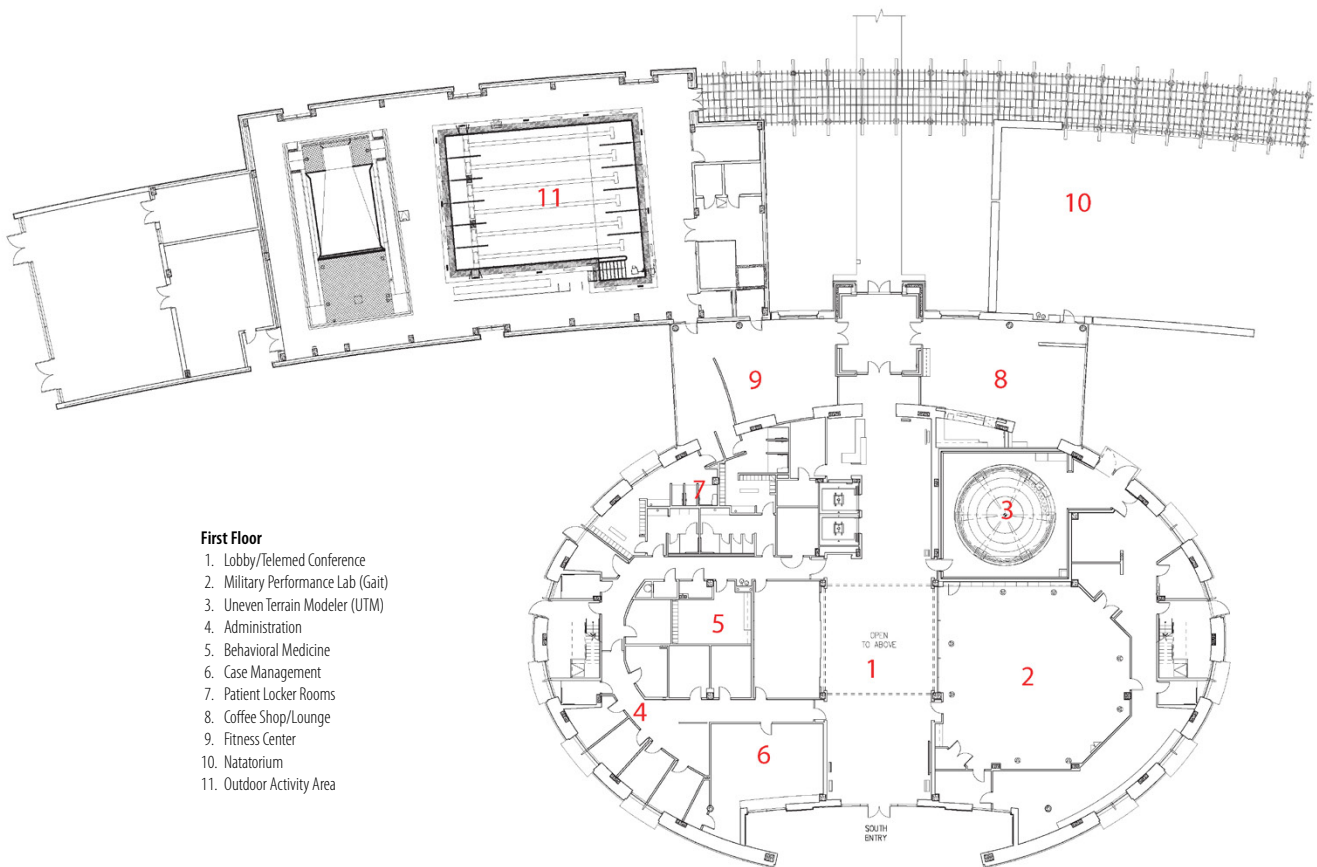
The Building Program

The Center for the Intrepid is distinguished by the number of rehabilitation programs co-located under one roof, enabling a much more comprehensive care approach. Many of the next-generation treatment and rehabilitation environments were conceptualized and designed based on direct input from Chuck Scoville, BAMC specialists in amputee care, and the patients themselves.

Based on the 20,000 sf functional program already developed for the Walter Reed amputee care program, the SmithGroup team felt it would be possible to quickly move into full design and construction documentation. But within a short time, the IFHF decided to increase the functional program by 20 percent. By the time the design team had received input from the clinical staff and patients, the program had doubled. The program

would continue to increase as the IFHF quickly raised more funds than they had initially anticipated—some from very large donors, but it was the small donations of ordinary Americans that helped the IFHF exceed its target. Despite the program increases, the intended completion date remained the same.

Mr. Fisher wanted to make sure this facility had everything these soldiers needed to recover from their wounds and go on to lead productive and fulfilling lives—and even return to duty if they desired. Mr. Fisher was also determined to raise enough money to give the team whatever it felt was needed to make the center the most advanced in the world. The design team partnered with BAMC medical staff to reexamine the current amputee care program and to identify medical technologies that had not been available due to either a shortage of funds or lack of research and development.



The team also talked with the patients to learn what types of activities they enjoyed most, and that led to new equipment and programs that would help to motivate them in their recovery. Rock climbing, kayaking, surfing, and basketball are now activities that patients can practice with clinical supervision before attempting it again on their own.

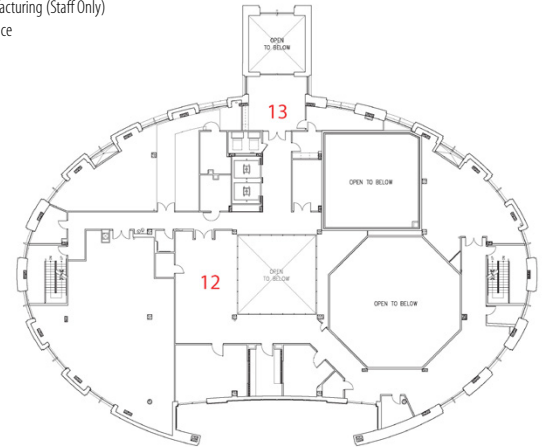
The difficult rehabilitation process for these soldiers can take many, many months. The presence of family members is imperative to the success of their rehabilitation, and the family members were asked what could be done to help support them during this time. This led to the inclusion of more relaxed, social spaces where patients and families could provide one another emotional and spiritual support.

The final program now included prosthetics fabrication, a swimming pool, a wave pool, a coffee/internet lounge, an after-hours fitness area, and larger physical rehabilitation areas in addition to the requirements for clinical administration, occupational therapy, physical rehabilitation, clinical prosthetics, a next-generation gait lab and virtual reality simulators.

The program was verified with Scoville and BAMC staff and modified to also accommodate the outpatient rehabilitation needs of their burn care population and the Department of Veterans Affairs. All of this program had to be placed into a limited, four-story footprint. Says Tobey, "the final facility is fitted together like a Swiss watch."

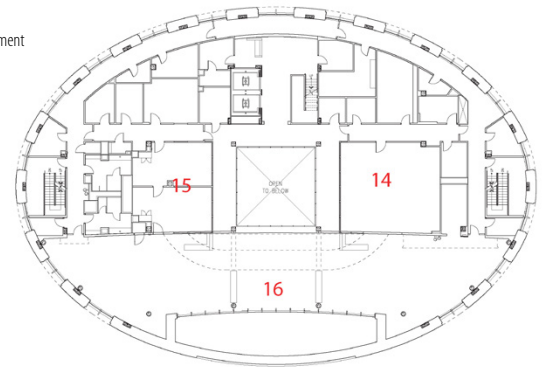
Second Floor

- 12. Prosthetics Manufacturing (Staff Only)
- 13. Training/Conference



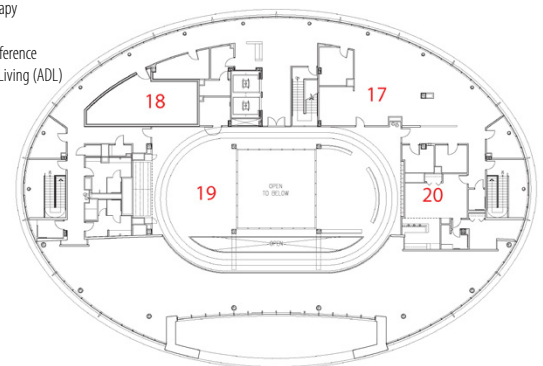
Third Floor

- 14. Physical Therapy
- 15. Prosthetics Department
- 16. Athletic Gym



Fourth Floor

- 17. Occupational Therapy
- 18. Simulation Room
- 19. Athletic Track/Conference
- 20. Activities of Daily Living (ADL)



One of the facility's key areas, the Rehabilitation Training and Exercise Center, is a two-story, light-filled space that symbolically represents the heart of the complex. Spanning the entire front of the building on the two upper floors, the rehabilitation center borrows light from the central atrium and includes a dramatically cantilevered running track; a treadwall and 21-foot climbing tower with auto-belay; custom-designed elevating parallel bars; and other advanced equipment to promote strength, balance, agility and aerobic conditioning. Because of its expansive space and elongated form, multiple rehabilitation activities can be conducted within and adjacent to it, facilitating visibility and interaction for patients, families and caregivers.

"The idea was to make everything open and transparent," says Tobey, "so the patients could learn from and sustain one another when things got really tough."

The state-of-the-art Gait Laboratory is directly visible from the main lobby through full-height glass walls. The Lab is fitted with 24 motion capture cameras, mounted on a custom-designed automated truss, which use infrared light to analyze human motion, with particular emphasis on amputee gait. Force plates in the floor, parallel bars and treadmills measure ground reaction forces in three directions to determine the torque that muscles or prosthetic components produce. Electromyography (EMG) is used to assess the electrical activity that is given off during muscular contraction, detecting both the timing and intensity of muscular contractions.

Adjacent to the Gait Lab is the Computer Assisted Rehabilitation Environment (CAREN). The CAREN is a 21-foot diameter simulator dome with a 300-degree screen upon which a variety of 'virtual realities' are displayed. The system immerses the patients in a fully reactive virtual and physical environment, using sensors placed on the body, high-speed infrared cameras, and a moving platform that reacts to the patients' movements. It encourages patients to use atrophied muscles and relearn skills necessary in the real world, from walking on different terrains to riding a horse.

SmithGroup addressed the other unique programmatic requirements of the project by integrating them in highly visible ways throughout the facility. The Prosthetics fitting and manufacturing facility, located on the second and third floors, is fully integrated into the Center and can be viewed from the atrium. Here, prosthetists and technicians utilize a team approach to provide state-of-the-art, on-site fabrication, using computer-assisted technology for design, milling, production and continuous fitting and adjustment of prosthetic devices, including unique specialty limbs for sports and other activities. It is the first time prosthetics manufacturing has been integrated into the clinical setting.





The overall quality of the design and the space is extraordinary.

In the adjacent natatorium, there is a six-lane pool for pre-running activities, kayaking, water basketball and volleyball, and swimming. Also located in the natatorium is the Flowrider®, a unique indoor wave pool with simulated surfing used to improve balance, coordination, strength, motivation and confidence.

Rounding out the facility is a variety of comprehensive support spaces to help patients and their families maximize their potential for recovery, including social services, case management, and behavioral medicine.

An Activities of Daily Living Apartment (ADL)—a full residential simulation with kitchen, bedroom and bathroom—and Vehicle Training Simulator provides patients a real-world environment in which to practice everyday skills. Many patients

desire to return to active duty and a state-of-the-art Firearms Training Simulator (FATS) allows patients to practice and qualify with military- standard weapons systems.

With input from patients and staff, SmithGroup also designed lounges with internet access as well as outdoor recreation areas—including a basketball court with a custom-designed cushioned surface—to give patients and family members a place to relax between treatments as well as provide emotional and spiritual support to one another.

“The overall quality of the design and the space is extraordinary,” says Col. Hooper. “It doesn’t have a healthcare feeling... patients and staff will be treated to working in an environment that is beautiful and functional.”





The Building Design

Determined to build not simply a state-of-the-art facility, Mr. Fisher was intent on constructing a monument to American heroes. Fisher originally had conceived of a building that was circular in plan, similar to the Jefferson Memorial in Washington, DC. After several studies, SmithGroup determined that an elliptical rather than a circular plan would accommodate the complex functions more efficiently but still present a monumental quality.

Designed to achieve a feeling of permanence, the building's unique, four-story elliptical shape is clad in rose-colored granite and solidly rests on a black granite base. The granite façade is penetrated by vertical, three-story high glazed openings that provide a sense of transparency and abundant light into the interior. A single, horizontal glass band wraps the entire ellipse at

the fourth floor, allowing the roof to 'float.' Most of the patient activities are intentionally placed along the outer edge of the building, and the generous use of glass provides patients, who often spend the entire day in rehabilitation, views to the outside and plenty of natural daylight.

Punching throughout the Center's stepped metal roof is a central, glass-enclosed atrium that floods the core of the building and adjacent treatment spaces with natural light. This key feature is the focal point for the activities on all floors and serves as the central wayfinding element of the facility. The ground floor entrance court penetrates completely through the building, offering access to major functional areas from all sides. Designed for flexibility, this space can be quickly converted to educational and conference as well as ceremonial use.





The SmithGroup team sought a balance throughout the facility by designing spaces that would simultaneously support the critical mission of rehabilitation, provide supportive areas for patients and families, and facilitate ongoing research. A ‘village concept’ organizes the Center around a common courtyard—shared by two Fisher Houses that were also being constructed on the five-acre site. The Fisher Houses, a residence for patients and family members, are symmetrically located on axis with the north entry of the Center, the focal point of the site on axis with the main entry to the Brooke Army Medical Center.

SmithGroup’s vision to warmly welcome families and patients to the center was made possible through the design of granite pavers that line the paths to the Center and the Houses, engraved with thousands of donor names, expressions of gratitude, and prayers. A long arc of wall and landscape forms the backdrop to the main facility, containing a series of indoor and outdoor rooms, including the natatorium, healing garden, outdoor activity area, outdoor uneven terrain course, and cypress bosque.

First-of-Its-Kind Technology

Planning spaces to accommodate technology and equipment that was still in research and development was just one of the many challenges that faced the team.

“Working with the sheer number of equipment designers and vendors required a truly unified team effort,” said Scoville.

Based on the performance criteria from the BAMC’s gait engineers, SmithGroup partnered with LA Propoint of California to develop the truss assembly and operating system for the Gait Lab’s motion capture system. LA Propoint’s experience with light rigging assemblies commonly used for concert stages or movie sets prepared them to develop the first motorized camera assembly in the world for gait motion capture.

The unique activities incorporated into the Gait Lab, including a 50’ running lane; terrain paths with gravel and foam; a 1.5-ton inclining, dual-belted treadmill; and an inclining parallel bar, created operational challenges for the gait engineers. Manually adjusting each camera between the five activities would have limited the number of patients seen each day and limited the activities a patient could attempt in one appointment.

The truss assembly was developed to mechanically move the infrared cameras into five different preset locations, some moving as much as 15 feet in less than 10 seconds. The system comprises two triangular trusses held by eight truss columns on isolation pads. The truss assembly includes 24 fixed and motorized camera mounts, the software, controls, linear Motion Rails, the human operator interface console, installation and training.

Members of the team visited the Chaim Sheba Rehabilitation Hospital in Tel Aviv to see one of only a few CAREN systems that were in use at the time. The team also traveled to Amsterdam to meet with Motek and the manufacturers for the motion base and the platform.

Motek, the Amsterdam-based developer for the CAREN system, had begun conceptualizing a larger version for the Center for the Intrepid that included a 300-degree, self-supporting domed projection screen and a 4-meter diameter motion platform with an embedded treadmill that would better immerse a patient into the virtual reality scenario than a front projection screen.

Doctors attribute this system's success in motivating patients to its "cool video game" factor, which helps to rebuild a patient's confidence to self-balance, cut rehabilitation times dramatically and get the soldiers walking again in record time.

The team needed to quickly understand the unique design and construction requirements for the larger, more advanced CAREN system, which had not yet been built. Issues such as isolated floor slabs, acoustical treatments, lighting conditions, and electrical loads had to be studied and resolved.

Multiple concrete pours were required by subcontractor Baker Concrete to accommodate the expansion joints that would separate the CAREN from the rest of the building, needed because of the required inertia of the motion platform, which had to be shielded from the vibration of a nearby rail line. Since many of the soldiers suffer from post-traumatic stress disorder (PTSD), it was also important to acoustically separate the CAREN, as well as the firearms simulator, from the rest of the building to avoid sudden loud sounds.



Achieving the Impossible

The seemingly impossible schedule was achieved because of the vision—and passion—for the project that was effectively communicated to all project team members. The difference in this project is that this vision and passion was also effectively communicated to the subcontractors, the suppliers, and each and every trade worker who participated in the project.

It took more than 1,000 subcontractor personnel and 325,000 man hours to construct this facility. Each individual was critical to its success, and every hour worked counted.

The schedule required intense coordination between SmithGroup, Skanska and Plaza Construction (owner's rep) throughout the entire process. Ground broke in November 2005, five months after the project began design. By February 2006, 16 early packages were out for bid.

"In order to meet this aggressive schedule, the process was not a series of discrete events," explains Bill Kline, SmithGroupJJR's project manager. "Rather it was an overlapping cascade of elements happening simultaneously. Construction procurement began 90 days after the start of design, and the team was still designing and value engineering 120 days before completion."

During the construction, key members of the design team were on site for four days every other week. During the final six months of construction, Kline and Skanska's Project Executive Dean Poillucci spoke on an almost daily basis to review outstanding issues, resolve problems and identify next steps.

"Pride of authorship with regards to the design documents took a back seat to speed of execution and material delivery," says Poillucci. "Not many A/Es in the industry would have been able to demonstrate this level of flexibility and accommodate the construction schedule needs."

This level of flexibility and accommodation was evident in every team member. Ideas to enhance the design, save on costs, and speed up the schedule came from every quarter. When challenges arose, everyone worked together to come up with innovative solutions and keep the project moving forward.

"It was the presence of the wounded warriors that served as the visible reminder of the significance of this project and bonded the disparate groups into a single team," said Col. Scoville.

Skanska's thorough pre-construction planning and integrated scheduling techniques immediately led the team to three major conclusions. The design deliverables would have to accommodate many phased deliverables. Because of the tight schedule, there was time to design only once—the team had to forgo any significant redesign or major constructability issues revolving around value engineering and budget. Skanska's constant and early involvement in the design review and coordination process permitted valuable input from the construction team to prevent time costly redesign from occurring. Finally, the upfront input from critical subcontractors was essential during design development to prevent subsequent changes.

The first major decision facing the project team was whether to proceed with a structural steel design or CIP concrete. The initial schedule prepared for the project showed erection of steel was to begin in April or May of 2006. However, an early decision to proceed with CIP Concrete rather than steel allowed completion of the structure on March 31, 2006. The facility geometry, vibration sensitive equipment, progressive collapse design, anti-terror/force protection requirements, and the ability to begin construction immediately supported the decision for CIP concrete. This approach also accommodated changes in the design of the medical equipment program.

Skanska then set out to identify the leading local and regional subcontracting firms that had the leadership, design assist capability, and craft resources to construct this project. In August 2005, only two months into the project, Skanska met one-on-one with four to six firms each for site work; CIP concrete; stone masons; glass and glazing; swimming pools; roofers; mechanical/plumbing and electrical. The purpose of these meetings was to review the construction requirements, gather input on means, methods and schedule, and understand material and labor availability. Skanska also explored alternate contracting methods to permit the early critical path contractors to begin work prior to completing IFC (Issue for Construction) packages.

Skanska was in the process of updating the schedule and finalizing the project budget based on subcontractor input when Hurricane Katrina hit the Louisiana coast. The entire project team had to quickly understand the impact that Hurricane Katrina placed on the local San Antonio labor market, availability of materials and equipment, and price escalation.

Starting in November, daily meetings were held in Skanska's field office with the subcontractor superintendents and foremen to review open work items, schedules, information needs, manpower, overtime needs, and other issues needed to maintain the focus and project urgency.

There were many examples of the team coming together to meet the challenges of the project. Skanska had requested that each subcontractor provide cost- and time-saving suggestions with their bids. Baker suggested that close to \$1 million could be saved, along with several weeks on the schedule, if the roof of the natatorium could be redesigned. This redesign simplified the configuration, reducing the quantity of concrete, the amount of reinforcing, and the number of pours required and reducing the MEP installation costs as well. SmithGroup agreed to change the design. The ductwork in the natatorium, which had been designed to be concealed, was left exposed in this scheme, and the redesign was completed after close coordination with the mechanical contractor, Brandt Engineering, Syska and Hennessy, and SmithGroup.

DGB Glass was engaged to complete the exterior glazing package, and Glenn Baker of DGB Glass postponed his retirement to personally supervise the project. Designed to coordinate with the stone coursing, the glazing maintains a 19" module that governs the proportions of all design elements on the exterior of the building. SmithGroupJJR's designers and DGB developed alternative details to provide the needed sun shading devices, maintaining the design intent, reducing the cost, and simplifying fabrication and installation. DGB coordinated operable panels required for the passive atrium emergency ventilation system, provided specialty stainless steel panels, and offered numerous value-added suggestions to improve the project's constructability.

DGB worked with SmithGroup to omit the planned laylight and modify the interior glazing system of the dramatic four-story atrium, and coordinate the decorative frit pattern—evocative of the stripes in the U.S. flag. Plaza Construction was also able to assist in the improvement of the fritted glass delivery dates by four weeks. Since much of the interior work associated with the lobby finishes was dependent upon the delivery and installation of the central atrium, this improved delivery time permitted the balance of the lobby finishes to be accelerated.

The beautiful red Carnelian stone was an essential element to the monumental design intent. The first sketches called for 4" split-face granite, with very deep 3" reveals to emphasize the strength and solidity of the building. A mock-up was constructed by Cold Spring Granite; however, after the initial estimates were complete, it became clear that the budget and schedule would not support this unique expression.

After several trips to quarries and fabrication facilities, SmithGroup, working with Cold Spring Granites' Duane Kreuger, selected a Diamond 100 finish, which enhances the red tones of the stone, provides a rustic rough texture, and exposes the mica flecks to the Texas sun, enlivening the beveled surfaces of the elliptical shape. The stone began quarrying and fabrication prior to the completion of construction documents.

SmithGroup, working with a design assist subcontractor, had detailed the exterior stone with single-piece, stainless steel, split-tail anchors. Ultimately, a different contractor, Intrepid Stone, was selected and they designed, engineered, and constructed a granite face utilizing a two-piece anchorage system. Substantial savings were found in using the combination of the larger stones and a two-piece anchorage system.

Construction Begins

Construction of the foundation system, drilled caissons, began on November 23, 2005. Due to the fast-track nature of the project, IFC slab, final reinforcing steel and sleeve/blockout drawings were issued approximately one week prior to each of the five structural slab pours for the project. This required unprecedented coordination between Cagley and Associates (structural engineer, SmithGroup (architect), Syska Hennessy (MEP engineer), Skanska (CM), and Baker Concrete (CIP concrete subcontractor) throughout the construction of the structure.

The structure proceeded at a rapid pace when, on March 2, 2006, the project team was faced with a major challenge. As Baker Concrete was placing concrete for the fourth floor, the fourth-floor ring beam formwork collapsed at the northwest quadrant of the building. At the time of the formwork collapse, the project team was forecasting to complete the structure of the main building one week ahead of its already aggressive schedule.

The formwork collapsed at approximately 4:45 am. Skanska immediately mobilized its safety professionals to quickly assess the situation and determine that all workers were safe. Key mem-



A large, bright physical therapy gym with various exercise machines and people working out. In the background, a man in a military uniform is assisting another man with a leg brace on a machine. In the center, a man in a blue shirt is working with a red exercise ball. To the right, a man is seated on a machine, and another man is standing nearby. In the foreground, a man is holding a blue ball, and another man is standing with his back to the camera. On the floor, there are blue mats, a red cylindrical object, and some equipment. Large windows on the right side provide a view of the outdoors.

Mission Accomplished.

"This facility is not just about the service members that are here. It's about the ones that are coming through the door, the ones that have yet to be wounded. And they can rest assured knowing that the facilities are here. They're available to them, and they will be taken care of to the best of any country's standards. This is state of the world." — Marine Cpl. Aaron Mankin, undergoing treatment for a head injury^{††}.

bers of the project team, including senior members of Skanska, Cagley, Plaza Construction, and Baker Concrete joined the site project team later that morning to determine the root cause, evaluate the stability of the structure, and develop a plan to demolish, remediate, and complete construction on time.

Once the structure was determined to be stable, the project team immediately began demolition of the affected fourth-floor slab. Construction crews worked nearly 24 hours a day to demolish the concrete that was placed, install a revised shoring/form work system with reinforcing steel, and repour the fourth-floor slab. Every member of the project team rallied to provide all of the support and oversight required to ensure that the demolition work was completed safely and securely. Despite this incident, the structure was still completed on schedule.

"This was the defining moment for the project," said Poillucci. "After Baker Concrete stepped up to complete the structure on schedule following the formwork collapse, other trades followed that heroic action and stepped up to the plate. Baker Concrete helped set up the project for its success."

Skanska launched 'Operation Final Push' in mid-July, 2006, with an off-site conference for all subcontractors and suppliers to address any challenges in the final six months of completion. Skanska introduced "Critical Path Overtime" to the project, which allowed overtime monies to be spent on the activities and areas that had a positive impact on the critical path of the project, or on areas of the project that would permit the next trade to complete work at an earlier opportunity. The total overtime spent on the project was less than 1 percent of the total project cost. When compared to the cost of additional time for a more traditional schedule, the cost premium to achieve the project schedule approached zero.

By mid-August 2006, Skanska had met with all subcontractor personnel, vendors and suppliers to ensure their complete understanding of the mission of the project, the schedule for completion, the challenges that the project team faced, and how each worker on the project could help.

A follow-up meeting to 'Operation Final Push' was held in mid-September to kick-off the start of final finishes, removal of the exterior scaffolding system, waterproofing, granite, glass and

glazing and roofing, the availability of conditioned spaces in the building to support finishes, and the start of the installation of the CAREN medical equipment. Each worker received a CD containing videos of the CAREN system, both computer-generated and actual shop testing footage. The installation of the CAREN system began one week later, and there was a marked increase in everyone's morale and productivity in the field.

Mission Accomplished

On January 29, 2007, The Center for the Intrepid, a world-class, advanced rehabilitation training facility, opened—on time and on budget—at the Brooke Army Medical Center in San Antonio, Texas, with a moving dedication attended by more than 3,000 from a grateful nation.

This exceptional project was successful because of the ability to communicate the importance of the facility to each woman and man who participated in the project and to transfer the passion of Chuck Scoville, the dedicated staff at BAMC, and Arnold Fisher and the staff of the Intrepid Fallen Heroes Fund to each and every designer, subcontractor, supplier and tradesman.

But there were others on the team. The Center for the Intrepid is the result of over 600,000 Americans who donated the money to make this Center possible, and each of them shares in the team's successful completion of what is now the world's most advanced physical rehabilitation facility in military medicine. But the most important members of this team were the soldiers—the severely wounded service men and women whose selfless sacrifices entitle them to the best rehabilitative care we can give them.

The entire project team knew what they were designing and constructing, why it was so important, when it had to be completed, and what they needed to do as a team to get it done. This commitment and dedication was observed every single day of the project.

"Our team's goal was to design the world's premier rehabilitation facility to honor the courage and sacrifices of our military," says Tobey. "We believe we have met the challenge. Each and every one of us is honored to have had a role in this".

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Citations

^{††} Anderson Cooper 360, The Toughest Battle: Healing Heroes. (2007, January 29). Retrieved from <http://www.cnn.com/Transcripts/0701/29/acd.01.html>

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