Quarterly

SCIENCE MUSEUM OF MINNESOTA

High-Tech Post Production

Building Commissioning

Gamma Knife Installation

Regional Arenas

New Science Museum

ELLERBE BECKET

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In This Issue

Ellerbe Becket's integrated approach to architecture, engineering and construction applies the right knowledge at the right time. An innovator since 1909, the firm works with educational institutions, health care organizations, sports franchises, government entities, corporations and developers.

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COVER PHOTO: This is no "black box." The new Science Museum of Minnesota's entry façade entices visitors with a look inside. (see page 10) Photo by Brian Droege.

Post-Production Playground

Take your Avid Spirit Through their Inferno on a HIPPI with Onyx

HI-WIRE doesn't just treat their clients right, they treat them just right. This brand-new, state-of-the-art, post-production facility makes its name with "startling post … unrelenting service." And it's located in Minneapolis.

Why Minneapolis? "We wanted to create a new center for post-production," explains Marilyn Timmsen-Aden, president. "Minneapolis is easily accessible to both coasts, and there's a vitality here." The business was founded with two goals: Create a cutting-edge production facility that can compete with talent on the East and West Coasts, and give clients an unprecedented level of service.

HI-WIRE's clients spend anywhere from four to 24 hours plus polishing their work in the 11,500-sq.ft. (1,068-sq.m.) facilities. They have two critical requirements: privacy and a high level of involvement in the creative process. HI-WIRE is determined to provide that along with a few choice amenities, whether it's food, concierge services, internet access, a spa visit or a place to exercise.

Photo by Brian Droege

Let's play! In HI-WIRE's edit suites, clients can work side-by-side with creative staff or hang out doing other things while keeping an eye on their project.

There were various challenges for the design team simply because HI-WIRE is a start-up company. "We were involved in brainstorming business strategies and the corporate vision," says Janice Carleen Linster, ASID, IIDA, project manager. "It was our job to create an experience aligned with HI-WIRE's business goals. In a sense, we were involved in inventing HI-WIRE's brand."

HI-WIRE offers real-time video and audio editing and post-production for films, high-definition TV, corporate videos, broadcast, and motion pictures. The design team worked closely with consultants to ensure the facility provides the latest equipment and cutting-edge technologies. This is the first post-production facility in the Midwest that boasts real-time high-definition television editing. High-speed fiber connections move files in and out of editing rooms quickly, making for efficient sessions.

The insistence on customer convenience and service required a relaxed, energetic atmosphere open around the clock. Tucked away on the third floor of prime business and retail property in downtown Minneapolis, HI-WIRE has all the advantages: It's in an accessible, high-energy location, and conveniences and amenities are right next door. Yet there also is a need for a high degree of privacy and isolation of sound within the editing suites.

The facility's public areas and edit suites wrap around each other. "We wanted to separate the editing suites from the noise and distraction of the retail space," explains Shawn Gaither, AIA, interior architect, "yet at the same time we wanted to connect HI-WIRE's public areas with the excitement and energy of it." Winding around the outskirts of the edit suites and offices, the lobby, café and lounge with Internet hookups comfortably define the public aspect of the business. Three restrooms with distinct personalities are just a short jaunt from any edit suite to cater efficiently to the needs of the talent. A quick dash through the gourmet – a thoroughly pleasant trip – takes you to the screening room, complete with a popcorn cart and plush seating.

But HI-WIRE's pride and joy, and reason for existing, are the edit suites, arranged around the facility's inner edges, away from the hustle and bustle of the lounge areas. Every suite is divided into two zones: a raised area where clients can hang out, play video games, do other business, or keep track of their work; and the editing "pit," where the editing crew performs its magic. "Oftentimes clients and creative staff work side-by-side," explains Gaither. Material can be sent to the screening room from any of the editing suites, or from the central computer control room, a carefully engineered, climate-controlled room right at the core of the facility. HI-WIRE also stores video on-site.

Photos by Brian Droege

Magically delicious: Bright colors and fresh-off-the-rack equipment make for a highly charged atmosphere that's all business and pure joy in which to work.

Each of the video suites can accommodate rudimentary audio editing, but there is also a fully equipped audio engineering room with an isolation booth for recording narration and effects. The video suites handle six major editing capabilities: linear, film, high-speed linear, real-time high definition, non-linear and high-end graphics. Consistent with HI-WIRE's philosophy, the equipment list is impressive. Gaither says this fact alone made design work challenging. "The industry is fast-paced, and technology's capabilities are improving exponentially in very short periods of time," he says. "The equipment list kept getting upgrades over the course of design, so we had to design the spaces to be very flexible and adaptable."

In some ways, there were two environments to design: the equipment environment and the physical environment. "Rooms were designed first to suit a certain type of use," explains Linster. "For example, we had to design essentially a room within a room to isolate the audio suite properly."

Humidifying and cooling systems, too, were complex. Adding to this, technology probably will be so much faster, smaller and flatter within three years that the entire space might be redesigned. "Choices made today could affect how the space could be used and developed in the future," says Linster. Consequently, the design team focused on adaptability.

"While it was a challenge not having a resolved, in-place business concept, it was rewarding to participate in the simultaneous development of the business and the environment," says Linster. In designing an experience, the client gave guidance in several areas:

- the type of equipment and how it is used
- how the editor and customer interact
- the variety of ways that a client might use an editing suite, from editing to lounging to con ducting other business

Consoles were custom-designed, and each room can accommodate up to three or four people together. Window treatments had to be both elegant and capable of shutting out the slightest hint of light. Lighting was selected carefully and the décor is "at once highly elegant and comfortable," says Gaither. "We wanted HI-WIRE's clients to feel pampered and enjoy the environment."

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Tour the studios
Acoustic considerations

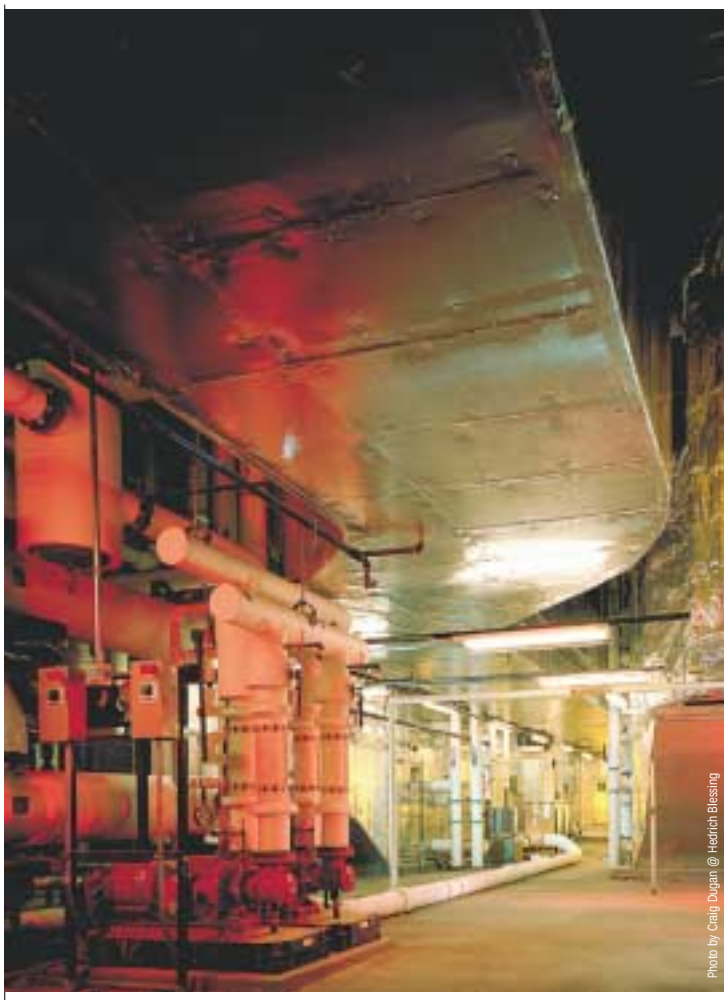
Treats for all: HI-WIRE's concierge services help editing projects go smoothly.

HIGH-END POST: WHERE SPEED AND THE LATEST TECHNIQUES MATTER

- **EDIT 1 Linear suites offer D1, D5, digital beta or digital disk recording.**
- **AUDIO Designed for mixing or creating original music. This room features 16x9 video and ISDN remote recording.**
- **FILM The showcase suite features the Philips Spirit DataCine and is equipped to handle 601 or high definition path throughout. Aaton auto syncing and DaVinci 2K top off this suite's unique capabilities.**
- **INFERNO The Inferno uses an eight-processor SGI Onyx2 to speed through difficult renders quickly. This graphics editing suite is capable of real-time high-definition I/O (or data), with film grain tools and a Mac prep area.**
- **NON-LINEAR AVID OFFLINE Serial digital Avid suites with scalable resolution fit a variety of project requirements. The suites can take input in almost any format and cut short or feature length projects to shuttle drives with storage capacities from eight to 18 gig.**
- **FIRE This suite sets itself apart with real-time high definition, data or 601 I/O. Files move in and out quickly across a high-speed fiber HIPPI network to the Inferno and Spirit suites. Inputting, dirt fixes and titles can be done on a separate edit utility station, greatly speeding up sessions. The service package included with this editing suite includes comforts like massages, meals or the latest video games.**

Getting it Right the First Time

Tony Ramis, PE



Nothing feels better than starting up systems without a hitch. Building commissioning ensures day one is bright and shiny.

Just what is building commissioning? Depending on who you talk to, it's either just making sure everything was installed properly and in working order, or, it's an intensive, time-consuming process of making sure systems work together the way they were designed to, in all situations, as well as training employees on their use and maintenance.

Start-up deficiencies increase the anxiety of occupants, keeping them from realizing the full beneficial use of the building at the time of move-in. As an answer to this phenomenon, in 1989, the "building commissioning" process was developed through the auspices of the American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE). On a fundamental level, a commissioning program will confirm occupant's expectations for building functions.

Designers' and contractors' traditional responsibilities are to monitor and certify that the building has been constructed in accordance with contract documents. Commissioning goes much further, involving implementation of operational policies, procedures, programs, staffing, and training, as well as equipment testing. Every commissioning plan meets specific criteria for the project, its people, and its operations. A "commissioning authority" that includes design professionals, owner's representative and the building operations staff manages the process.

The average person can take up to a year to really know the characteristics of a building, from the way it operates to how the equipment works, and understanding how the schedules of people who use the building affect building systems. In recent years, building commissioning increasingly has been performed. The traditional design and construction process has faced increasing start-up and initial operational problems – a product of the high level of today's total system integration and great strides in technology. Just making sure new equipment works with older models is reason enough to do a commissioning, and oftentimes there's an existing control system that uses a different operating system than the equipment you want to install. With older systems, sometimes it's better just to rely on good old-fashioned electricity, rather than a computerized system, for controls.

Though manufacturers do test equipment rigorously, it's rare to install a building's worth of equipment all from one manufacturer, so even a new building needs to be tested to ensure everything works together as the design theory suggested. While great strides have been made in the past 10 years, there still are no agreed-upon standards for electrical use and power distribution, so it's important to ensure that the design specifications are met with the installation. In some cases, equipment gets hooked up backwards – a simple error easily fixed, yet it can cause a great deal of headache for facility managers once everyone is using a building and not expecting downtime.

Initiating the commissioning process at the beginning of construction yields the best results. However, significant benefits can be achieved by starting at any stage prior to final acceptance of the project.

Including compliance specifications for the contractor with other project documentation not only means the contractor knows what to expect, but also they can help the agent doing the commissioning. Once construction starts, meetings with the contractor determine the exact commissioning process for that project.

Every contractor and manufacturer has their own set of forms and checklists, and the commissioning agency collects them all. For example, in addition to their normal testing process before the start of commissioning, a mechanical contractor will check whether equipment is connected, fans are turning in the correct direction and so forth. None of these things tests the equipment in a real-time use scenario; they simply ensure the physical construction was done properly. Then, for start-up, manufacturers check the equipment to ensure it's running the way in which it was intended. Now, the fun begins.

When the commissioning agency starts its work, it is checking that control sequences happen in the right order, at the proper time and to meet the right conditions (for instance, the emergency control sequence should run only under emergency conditions). Valves are checked to ensure they open and close at the right time, and by the right amount. The agency observes all equipment running in all the conditions it was designed to work in, and measures whether and how well it handles each one. Is a heating or cooling coil throttling back at the right time? Are dampers behaving incorrectly? Are all the various pieces of equipment working together in the proper sequence?

A basic commissioning process like this may take anywhere from two to three months depending on the complexity and size of the project.

Once the building is in regular use, any changes in equipment, loads, or occupancy should be monitored and documented carefully. Discrepancies between predicted and actual performance, or an analysis of complaints may require re-commissioning a system or area.

Tony Ramis, PE, is an engineering principal in Ellerbe Becket's Washington, D.C. office. He has spent countless hours checking building mechanical systems during the startup phase.

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Sample checklist

PERFORMANCE COMMISSIONING AN HVAC SYSTEM

After HVAC systems have been tested, adjusted and balanced, the contractor can test the controls and calibrate the system. The system is then ready for performance commissioning, which should include a process to permit testing and documenting controls for each device. The commissioning authority performs the following tasks after the contractor has completed his/her contractual obligations.

1. **Verify that the physical installation of components and systems substantially complies with the contract documents.**
2. **Check and adjust actuators from beginning to extent of travel.**
3. **Check all relays and controllers for proper operation.**
4. **Check all system interlocks and safety devices for proper function.**
5. **Verify control systems by comparing actual input/output values to calculated values.**
6. **Perform functional performance testing for all equipment, subsystems and system interfaces using a specific checklist for each.**

Additionally, the commissioning authority performs the tasks listed below prior to final acceptance of the work.

1. **Certify prerequisites for functional performance testing.**
2. **Develop appropriate functional performance checklists for specific pieces of equipment or systems.**
3. **Test equipment and subsystem functional performance.**
4. **Test overall system functional performance.**
5. **Verify and document that all equipment, subsystems and systems meet specified performance requirements.**
6. **Identify functional performance tests that need to be deferred.**
7. **Identify necessary corrective actions required to achieve functional performance.**
8. **Test inter-system functional performance.**
9. **Train operations personnel.**
   - Do a complete overview of all equipment, components and systems with an emphasis on how to use the operations and maintenance manuals
   - Describe the intent of system applications for all modes of operation, including start-up, warm-up, cool-down, occupied and unoccupied modes; include procedures for dealing with abnormal and emergency situations where there is a system response specified

Giving Regional Arenas a Shot

With a package and a plan, building a 10,000-seat arena doesn't have to hurt a bit

Multipurpose arenas can boost city economies. They can help mid-size cities (those with populations of 150,000 to 800,000) recapture entertainment dollars being lost to larger metropolitan areas. Regional-size arenas in these cities generate revenue by tapping the growing popularity of minor league sports, attracting and retaining small businesses and corporations, increasing tourism and revitalizing the urban core.

Sounds like an ideal solution. But many regional arena plans fail to move beyond discussion. Most city staff members have been involved in a building process, but never on the scale required for a major entertainment facility. If you haven't been through it before, it's a complex process.

The Package

To make the building process more convenient, less time consuming and less costly, consider a regional arena package that includes a customizable arena model, a single partner that can guide a city through the necessary steps, and a guaranteed maximum price for the entire project.

Regional arenas may hold up to 10,000 spectators. With a flexible arena model, major elements – including flexibility to accommodate event schedules, seating capacity and exterior "skin design"– are customized to meet each city's specific needs.

Minor elements are standard in the regional arena package. These elements, which are common to arenas regardless of size, include:

- Design flexibility to accommodate an ever-changing mix of events
- Long-span roof structure
- Multiple-event seating configuration to maximize capacity and efficiency
- Event lighting and sound
- Sound control elements to soften and amplify sound as needed
- Flexible HVAC systems that can accommodate ice sheets one day and crowded concerts the next
- Plumbing systems that can withstand above-average surges
- Catering to diverse spectator expectations
- Efficient, accessible loading areas
- Ancillary facilities such as locker rooms, dressing rooms, suites and equipment storage

The ideal arena team is comprehensive and comprises architects, engineers, planners, interior designers and construction personnel, as well as outside consultants such as market researchers, finance companies and public relations firms. The project leader serves as the client's main point of contact, eliminating the burden and confusion of communicating with – and often mediating between – multiple partners.

With an integrated team approach, the standard arena timeline (which typically takes three years just for the first phase: vision to approved financing and land acquisition) is significantly reduced. Additional time is saved in construction when construction personnel provide input early in the design phase; this virtually eliminates change orders and delays.

Actual costs usually come in under the established price because of increased efficiency. Clients have the option to return the savings to city coffers or reinvest them into the arena in the form of higher-quality materials or additional amenities.

Clients who use the model also have more control over where their money is spent. With established budget checkpoints at key stages throughout the project, clients can review costs and direct their money toward areas and functions that are most important to their city.

The Process

There are 12 key elements in building a multipurpose arena, many of which occur simultaneously:

Vision Develop the objectives of the facility and measurable goals that will help determine success.

Community Leadership To help build consensus among stakeholders, a civic facility needs high-level champions from local organizations and agencies.

Market Feasibility Determining the viability of an arena requires a needs analysis, economic impact study, revenue projections, risk factor assessment and an analysis of available finance mechanisms.

Event Planning Today's top-grossing regional arenas boast 125 to 200 event days annually. Event planning should take into consideration local preferences, major tenants, entertainment trends and revenue projections for each type of event.

Operations Options for day-to-day arena management include city-paid staff or a third-party management firm. There are pros and cons of each that must be evaluated for each situation.

MODEL INSPIRATION: THE MARK OF THE QUAD CITIES

An abandoned industrial site along the Mississippi River in Moline, Ill., is now a thriving city center because of the The Mark of the Quad Cities arena. The multipurpose facility has spawned more than US$60 million in nearby development in the seven years since it opened.

***Performance* magazine named The Mark "Arena of the Year" in its attendance class for six consecutive years, and *Agent & Manager Facilities* bestowed its "Prime Site" award on The Mark four times.**

Ellerbe Becket assumed a stewardship role at the request of the client project team, and it soon became apparent that the "single partner" process was a significant improvement over the traditional building process that requires client coordination with multiple contractors.

Photos by Jerry Wilkinson

(above) The Mark – a 12,000-seat indoor arena and conference center – has become one of the top-grossing and most highly awarded regional arenas since opening in 1993. (below) On a once-abandoned industrial site, The Mark has brought life back to the river.

Program Cost Determining the overall cost can be difficult when working with numerous partners. Because no one has total control of a typical project, it's unlikely anyone will be willing to guarantee a maximum price, so there's potential to go over budget if disputes arise between partners.

Land Planning Determining the most appropriate potential sites is a serious consideration. Many factors must be assessed: available land, proximity to local population base, transportation issues, urban development desires and environmental impact.

Pro Forma Financial Statements To help secure financing, pro forma financial projections are needed. These also help make a financial case for potential investors (private companies, public agencies or local tax payers).

Financing Options and Approval Government matching funds or other monies may be available, but due to the significant cost of arenas, some public/private arrangements will likely be required, such as sponsorships through suite sales, premium-seat sales, advertising and naming rights.

Public Information and Marketing A public relations plan should be initiated early to help gauge public opinion and, ultimately, gain public support. A related marketing plan should address corporate sponsorship potential, branding guidelines, initial awareness building and ongoing advertising.

Design The arena project team must work closely with the design firm to set building objectives, and clarify visual and functional expectations. Factors that must be considered include the local, architectural context; tenant requirements; microclimate issues such as proper ventilation; seating configurations; acoustics; American with Disabilities Act (ADA) requirements; energy requirements and available energy incentives; traffic flow; and potential expansion requirements.

Construction To avoid costly delays and potential litigation, an integrated design and construction approach should be followed to facilitate clear communication and reduce barriers. This ensures the design takes into account the availability of local labor and materials, construction time related to various design elements and overall constructability.

This is an excerpt of the white paper: "A Solution for Multi-Purpose Arenas in Secondary Markets"

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All about integrated services
Read the full text of the model arena white paper

Well Worth the Weight

Revolutionary medical equipment can involve heavy remodeling and construction efforts

Steve Flaten, AIA · CID · CSI

The Gamma Knife® actually isn't a knife at all. A technologically advanced replacement for the scalpel, the Gamma Knife enables surgeons to precisely intersect a brain target with 201 converging gamma beams. It's more cost efficient than conventional neurosurgery; patients usually go home the same day of this noninvasive radiosurgery. It often eliminates expensive medication and sometimes months of rehabilitation. This treatment can benefit patients with conditions such as brain tumors, abnormal blood vessels and Parkinson's disease, to name just a few.

The Gamma Knife consists of a lightweight head frame, helmet and radiation unit. The medical team – a neurosurgeon, radiation oncologist and radiation physicist – fits the patient into the head frame, then calculates precise coordinates of the abnormality with an MRI or CT scan. On a special couch, the patient moves into the half-dome of the Gamma Knife and is positioned for treatment. The procedure takes 15 to 90 minutes and usually is performed with local anesthesia.

The equipment's tremendous mass and need for radiation protection called for some creative solutions.

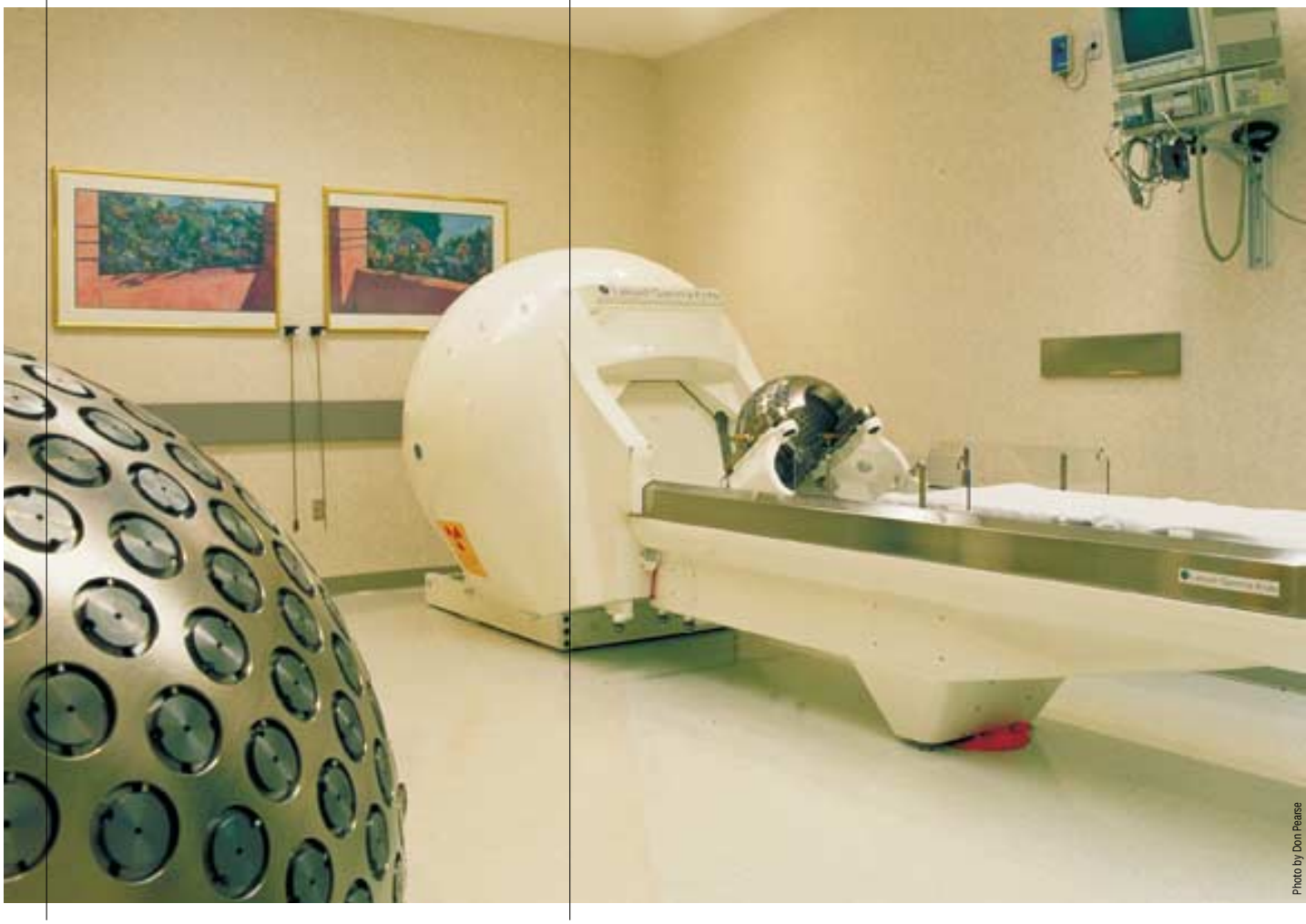


Photo by Don Pease

At the end of 1998 more than 80,000 of these procedures had been performed worldwide. At the time there were only 48 Gamma Knife units in the United States and 112 globally. Now, this innovative technology is gaining more ground.

St. Joseph's Hospital's radiation oncology department recently installed the latest model unit for the cost of US$3 million. The cost of remodeling the Marshfield, Wis., hospital space to accommodate the unit was approximately 20 percent of the total cost, due to the complexity of the unit's installation.

A primary challenge was that the Gamma Knife equipment that had to be supported during the radioactive media's installation weighs approximately 104,000 lbs. (47,174 kg). Its tremendous mass sits in an area only eight feet square (.74 sq.m.), which equates to about 1,625 lbs. per sq.ft. (7,934 kg per sq.m.).

The unit's major component is a ball that weighs about 52,000 lbs. (23,587 kg).

How does that compare to other elements in a typical building we may design? A parking ramp, which of course must support the weight of cars, is designed to handle just 50 lbs. per sq.ft. (244 kg per sq.m.). Heavy-loading areas like libraries and a hospital's well-traveled main corridor system commonly are built to handle only twice that weight.

St. Joseph's Hospital's hallway wouldn't support the weight of the Gamma Knife pieces; the unit's major component is a ball that weighs about 52,000 lbs. (23,587 kg). Installation required a large crane to lift the unit into position through an access made in the hospital's outside wall. The Gamma suite's location is important because the radioactive media must be replenished about every seven years. For this purpose, we built the access hatch on the south side of the building in which we can drop the loading machine to renew the sources.

For radiation protection, we had to thicken the room's walls. The walls have about 22 inches (56 cm) of concrete from the floor to the structure above. Because there was only about six inches (15 cm) of concrete in the structure of the floor above, we had to increase the protection. We installed beams below the floor and supported them with the thicker walls, down to the foundations. Steel plate was installed in the ceiling in such a way that the seams overlapped, so no direct beams of radiation could leak through. Each plate was cut to size, lowered through the access area and slid on rails to the end of the room.

For the hospital, the efficiency and benefits of the new technology "outweighed" the complexity of its installation.

Another consideration was to give the space a conventional feeling, rather than looking like a large "radiation bunker." A short wall was placed just inside the door to the treatment room. This wall improves the shielding and allowed us to use a standard door with a slightly higher lead thickness – and still meet radiation protection requirements.

Last but not least, we designed the treatment room for patient comfort. Instead of having overhead lights that shine onto patients' faces, a photo mural that looks like a skylight was installed over the patients' couch. Additional lighting around the room's perimeter gives a subdued light level.

Patients usually lie still in the treatment area for a fair amount of time through preparation and treatment. To ensure they don't become too hot or cold, we installed a thermostat that can be adjusted by the person monitoring the treatment.

To help the patient in the Gamma Knife helmet overcome any feelings of claustrophobia, we used a technique commonly built into MRIs; we placed a special directional eyeball diffuser at the foot of the patient that directs a slight airflow toward the patient's face. Feeling the air movement helps to combat any closed-in feelings.

Steve Flaten, AIA·CID·CSI, principal, manages construction administration for Ellerbe Becket.

www.ellerbebecket.com/ebq
The Gamma Knife at St. Joseph's Hospital
Mayo Health Oasis: gamma knife
Gamma rays in our universe

Destination: Imagination

Did you hear the one about the esteemed cultural center that gambled its future on a new, high-profile facility? Inadequate management made the project unfocused. The facility's design didn't match the organization's purpose. Sponsorships fell through. In the end, the building was pretty – and pretty empty. With no money left and a huge operating deficit, they were forced to close.

Critics called the new building's design artistic and avant-garde, "like a dancer amid the rooftops." The now-defunct organization learned a dancing lesson: You can distract the crowd momentarily with a flashy costume, but the applause stops if you haven't mastered any difficult, technical steps.

People bank on new facilities to improve their organizations' situation and attract who they need: visitors, employees, customers, investors, students. Designing a facility to meet a mission while balancing excitement and functionality requires delicate footwork.

"We have a responsibility to first look inside a client's organization and then do the right thing."

Andy Cers, associate and senior project designer

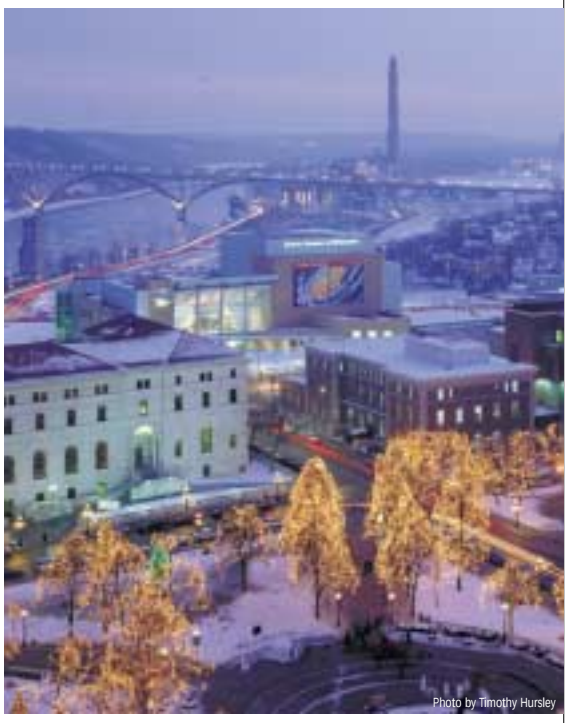
"If a new building doesn't work for visitors, and it isn't operationally or financially viable, it can threaten the survival of even a longstanding institution," says Andy Cers, AIA, associate and senior project designer.

Cers has learned a thing or two about meeting building challenges; he was the design leader of the project team that created the new home for the Science Museum of Minnesota in St. Paul. The new 370,000-sq.ft. (34,373-sq.m.) home for the Science Museum will welcome more visitors per year than most of the regional education and entertainment attractions combined.

Often museums look to new facilities to increase their capacity to serve the public. Most established institutions, like the 93-year-old Science Museum, have aging facilities that are an assemblage of buildings acquired over the years, inadequate in space and function. A new building can provide answers to the multiple challenges a growing institution faces.

"Because a new building gives you the opportunity for a fresh start, why look to existing models of what a museum should be?" asks Cers. "Wouldn't it be much better to create a new model based on the vision of the institution?"

Cers says that by first understanding the complexities of the Science Museum and its long-term vision, the team could create a new building with a strategically focused design.



With its picture-perfect urban fit, the Science Museum of Minnesota is a riverfront development catalyst and a community-supported cultural amenity like no other.

From the glass front with downtown views to the stairways and terraces that descend to the river, the museum's design is all about creating connections.

Photo by Brian Drege

Realizing the Vision

In the 1990s the Science Museum's programs and popularity had grown far beyond the capacity of the old facility. Museum leaders and staff started thinking about doubling its space and capabilities.

"From the beginning of the process, we thought about our purpose and how the function of a new building would serve our vision," says Dr. James L. Peterson, museum president. "No one drew a line before they understood all the different layers of the building and how it would all function. This is why the new building works exceptionally well."

Their vision was to enhance the Science Museum's regional and global reputation as a leader in science education. Essential to this mission: a building that was a dynamic, compelling visitor attraction that would allow the museum to be accessible to and actively engaged with diverse communities. Staff started the process by defining who they were, who they wanted to be, and whom they served.

"We had a bold attitude going into the design process," says Paul Martin, director of exhibit development. "We knew what we needed. We wanted to work with an architect who would acknowledge us as experts on our business and visitors."

Architects certainly know how to create nice spaces and put buildings together, says Cers, and may have ideas about what museums should be. "But we don't live and breathe museums. We aren't in contact with a million visitors a year," says Cers. "How could we possibly know the business of the museum better than the museum folks?"

Figuring out who it's for

Before they put pencils to paper, designers and museum staff formed five "issue teams" to set goals, investigate issues and develop project design criteria. Early on they spent time developing an understanding of the many types of visitors, their needs and expectations, the museum's diverse programs and activities, and the practical considerations of housing all of these activities in one building. Later the issue teams spent time developing and testing various design strategies and critiquing early design proposals.

A fundamental step was finding the ideal way everything – visitors, information, staff, trash and the valuable collections – should flow through the new facility. In a collections-based museum, overlapping trash and collections paths could cause a disastrous contamination of science research work.

Cers sums up the design perspective: "Our mission was to make the museum's mission the primary focus of the building. And their mission is to serve visitors in the best way possible."

Visitors always were the primary concern. Peterson says, "Early on we said this building has to work first and foremost for the visitors who use it."

No one wanted another predictable museum: a tangle of hallways with closed-in rooms. Usually visitors don't know what's at a corridor's end until they get there. If it's something in which they're not interested, they have to backtrack through already-seen exhibits. This can put obstacles in the way of learning and make a museum visit frustrating.

The Science Museum wanted the building's design to support two core goals: provide an engaging and stimulating educational experience, and make the visit welcoming and convenient. "Basically," explains Martin, "we always need to balance learning and fun."

So the design team took out most of the walls. More than a third of the new building is glass, providing dramatic views of the river and city. Exhibit spaces surround a light-filled atrium, allowing visitors to see all of their choices laid out naturally in front of them. Visitors can loop through every space without ever treading the same path twice. "It was very deliberately designed so people could be led by their own curiosity and not be limited by the architecture," says Cers.

Incorporating key elements

A Science Museum survey uncovered three museum elements that visitors highly value: 1) things they can't see anywhere else; 2) learning by doing; and 3) relevance to visitors' lives.

Architects let the museum easily incorporate these visitor values with a flexible environment. The space accommodates an amazing variety of interactive, innovative exhibits and will handle a wide range of yet-to-be-imagined programs.

"The Science Museum's reputation used to be for great traveling exhibits," says Martin. "At one point we had the best work we've ever done at everybody else's museum around the country, while the exhibits in our place hadn't changed in ages. We tried to look at this new building differently, as not permanent. All of the exhibit space can come and go fairly easily. What should be flexible, is."

And what should be permanent, is, too – like the 10,000 sq.ft. (929 sq.m.) of restrooms in the new building, plus a plethora of elevators in all the right places. There's public space everywhere, including cafés, terraces and staircases that wind

TWICE AS NICE

THE MISSION: enhancing reputation as leader; showing visitors what they've never seen
A SOLUTION: creating North America's first dual-screen Omnitheater

"The client wanted the flexibility of having both a large, flat screen and a domed screen in the same space," explains Dan Thurmes, project architect. "With a two-screen system, the nine-story-diameter domed screen must rotate forward in front of the audience for use, and then rotate back to a place above and behind the audience while the flat screen is in use."

The domed screen needed to rotate back far enough to not block the vision of patrons in the back row of the stadium-type seating while they were watching the nine-story wide, seven-story-tall flat screen. In full forward position, the domed screen comes within three feet of the floor.

The theater's design and structural support had to consider the correct range of dome motion, the theater's fifth floor location, the dome's size and a massive counterweight system. Projection point design criteria set the first row of seats about 10 feet (3.05 meters) above the floor.

"The challenge," says Thurmes, "was in designing exits, accessibility, seating for over 400 people and theater support spaces all within the boundaries of a 27-meter (88.6-foot) diameter dome, while it was either in the forward or back position."

The design solution required most of the support spaces to be split between two floors beneath the seating. Designers created routes for entering and exiting the theater (including accessibility for people with disabilities) low and behind the seating area. The exit and accessibility seating was placed in the middle of the seating area, on the sixth floor.

The flat screen (far left) and domed screen co-exist in a theater with a volume larger than all six tanks in Sea World, Orlando, Fla., that house Shamu - the star orca.

Photos by Timothy Hursley

The building works "not as a picture in a magazine, but as a place full of people and motion," says Don Pohlman, director of the collections exhibit hall. Wide open, light-filled spaces handle the crowds beautifully. Daily museum attendance is up from previous years.

At the heart of the design: a bright, open atrium showing visitors every exciting experience and exploration that awaits them.

Photo by Timothy Hursley

down to the Mississippi River. By placing the new museum in a compact site on the downtown's edge, it's helping reestablish the city's connection to the long-inaccessible riverfront.

"We wanted to improve science education for our visitors. The city, the mayor and the community wanted to redevelop the riverfront. Those two purposes converged in this new building," explains Peterson.

Keeping it going for the next century

Most visitors don't notice the building's structural and engineering elements. But the complexity is all around them, from the climate control systems that protect the 1.7 million artifacts in the collections vault, to structural elements that support weighty dinosaurs in the paleontology hall.

What visitors do experience are special places and services that keep them coming back, like a children's education center with a separate entrance and driveway for school buses. Visitors use the computer centers, lecture halls and rentable banquet spaces. They marvel at North America's only dual-screen theater with a rotating dome (see "Twice as Nice"). They create tornadoes in a tube and hear real-time seismic activity on the other side of the world, translated electronically into xylophone symphonies.

The old museum had 5,000 sq.ft. (465 sq.m.) for traveling exhibits. The new design upped that to 12,000 sq.ft. (1,115 sq.m.) for maximum flexibility and capacity. The old building physically separated disciplines such as biology and geology. Now, mingling disciplines and exhibits encourage scientists to learn from each other, and visitors learn without boundaries.

Just like other companies and organizations, the Science Museum's business is ever-changing. New facilities have to anticipate new developments. As example, Martin explains that "learning by doing" is new to museums within the last 20 or 30 years. Early interaction techniques involved just pushing a button or turning a crank near an exhibit. In this new building, children construct working electrical circuitry. Visitors don white coats and scrape cells from inside their mouths to examine them in a cellular biology lab.

What's the future of science education and museums? Standing in the atrium of the new Science Museum, Martin gestures with both arms and says, "We're living it."

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Fast facts
Top 10 design features
Explore the museum

ROOM TO BREATHE

THE MISSION: creating best visitor environment plus 24-7 labs and collections systems
A SOLUTION: managing temperature, humidity and indoor air quality

A museum that isn't a "black box" challenges mechanical engineers. For the new Science Museum of Minnesota, engineers worked closely with museum staff and architects to form solutions. One major task was to develop criteria for temperature and humidity ranges that would satisfy science and conservation departments.

Rex Rundquist, PE, associate and senior mechanical engineering project leader, says, "We had to protect the valuable exhibits and irreplaceable collections. We had to consider the desired flexibility for the exhibits and anticipate requirements for traveling exhibits. And we had to fit within a reasonable operational budget."

Achieving constant temperature and humidity levels was challenging, considering what needed to be supported and balanced:

- **Glass in the exhibit areas, with potentially damaging UV rays and heat from solar gain**
- **Large, open spaces to draw people into paid exhibits**
- **Movement of large volume of people in and out of building**
- **Changing exhibits**
- **Various functions with different operating hours/design criteria (i.e., labs, water exhibits, classrooms, offices, restaurants)**
- **Construction, maintenance, operating costs**

Rundquist says indoor air quality was a major concern. "The quality of air going into the building was questionable," he explains, "with the location near busy streets with car, bus and truck traffic, river traffic and a coal-burning district energy plant next door."

Engineers carefully planned locations of the outside air intakes and the exhaust air discharges (for lab exhaust, kitchen exhaust, etc.). They installed gas phase filtration on two air handling units, with seven more units designed to accommodate gas phase filtration in the future.

Market Segment News

Health Care Organizations

Samsung Medical Center Seoul, Korea
- New project: 1,138,498-sq.ft. (105,769-sq.m.) addition to existing Samsung Medical Center
- 972 beds (60 ICU), outpatient services, pharmacy, operating rooms, clinical labs
- Medical school, research facility and parking
- Planning, architecture and engineering through design development
- In association with Samoo Architects and Engineers
- Concept design presentation: June 2000

Metropolitan Hospital Grand Rapids, Mich.
- New project: study for 450,000-sq.ft. (41,805-sq.m.) potential replacement hospital
- Programming, planning, architecture, interiors, landscape architecture, engineering and cost estimating
- In association with McMannis Associates and The Innova Group

Mayo Clinic Jacksonville, Davis Building Phase III
Jacksonville, Fla.
- Two-story, 120,000-sq.ft. (11,148-sq.m.) addition forms base for significant future vertical growth
- New patient drop-off, registration, information services, education center
- Clinical departments: venipuncture, internal medicine, orthopedics, ophthalmology, infectious diseases
- Planning, architecture, interiors, landscape, engineering, construction administration
- Opened: early 2000

Florida Children's Hospital Orlando, Fla.
- Interior renovation of 23,000 sq.ft. (2,137 sq.m.): pediatrics, pediatric intensive care and peds hematology/oncology units
- In association with Hunton Brady Pryor, Maso of Orlando
- Opened: March 2000

Government Entities

Fort Detrick Primary Care Clinic Fort Detrick, Md.
- 25,000-sq.ft. (2,323-sq.m.) primary care clinic for U.S. Army Corps of Engineers
- Medical and dental outpatient examination, treatment, administration and diagnostic areas
- Construction administration, interior design, master planning
- Dedicated: February 18, 2000

Corporations

Target Corporation Brooklyn Park, Minn.
- New project: Target Technology Center
- Two-story building with 45,000 sq.ft. (4,180 sq.m.) of raised floor space, 95,000 sq.ft. (8,826 sq.m.) total space and secured service court
- Tier 3+ level of redundancy in mechanical, electrical, building systems
- Full architecture and engineering
- Completion: 2001

Computer Associates Bloomington, Minn.; Memphis, Tenn.; St. Louis, Mo.
- New projects: three office spaces (17,365 sq.ft./1,613 sq.m. to 25,020 sq.ft./2,324 sq.m.) for growing business operations
- Each project includes office space and Virtual Enterprise Center with training rooms, auditorium and display space
- Interior design
- In association with Computer Associates' design team

State Farm Mutual Automobile Insurance Company
Columbus, Ohio
- New project: Ohio Operations Center
- Four-story office building, including campus-style master site plan for two future phases
- 150,000 sq.ft. (13,935 sq.m.), with outdoor stormwater pond planted with wetland vegetation
- Full design services
- Completion: 2001

Metris Companies Minnetonka, Minn.
- New project: 305,000-sq.ft. (28,335 sq.m.) headquarters facility
- Full-service cafeteria, daycare center, fitness center, convenience store and flexible meeting areas
- Interior design
- Occupied: September 2000

Developers

Embassy Suites Airport Hotel Caracas, Venezuela
- New project: Simon Bolivar International Airport Hotel
- 150-room, four-star hotel catering to business travelers; suite-size rooms and conference center
- Architecture
- In association with Embassy Suites Hotels

El Nabeque Sharm El Sheik, Egypt
- New project: four-star development with 200-room resort hotel and100 chalets
- Beach-front amenities, outdoor recreational facilities, swimming pools, tennis courts
- Architecture through schematic design

Baron's Court Sports and Leisure Resort
Alexandria, Egypt
- New project: social club with recreational amenities; health club with tennis, basketball, squash, soccer, football and Olympic-size pool
- 3,000-seat arena for sporting events
- Architecture

U.S. Bancorp Minneapolis, Minn.
- U.S. Bancorp Center: 1,013,300 sq.ft. (94,136 sq.m.) office tower with 30 stories and penthouse, three levels of below-grade parking
- Up to 42,000 sq.ft./3,902 sq.m. floor plates for ample team space and flexibility
- Retail space on first two floors
- Architecture, interior design and civil engineering
- Trading floors opened: May 2000

SPORTS FRANCHISES

Charlotte Arena Charlotte, N.C.
- New project: multipurpose arena for professional and amateur sports; national sporting, musical, cultural, family events
- Up to 750,000 sq.ft. (69,675 sq.m.); four concourses; 65 to 70 suites; party suites and co-op suites; 3,000 club seats; 19,400 seats for NBA Charlotte Hornets basketball
- Conceptual planning and programming

Lambeau Field Green Bay, Wis.
- New project: renovation/expansion of NFL Green Bay Packers' stadium
- New Titletown: year-round destination with Packers Hall of Fame, pro shop, fan amenities
- 71,000 seats; 167 suites; 3,000 indoor club seats; 3,200 outdoor seats; "tailgate" terraces
- Prime consultant, architecture, structural/MEP engineering and graphics
- Completion: August 2003

Washington State Football/Soccer Stadium and Exhibition Center Seattle, Wash.
- Seattle Kingdome imploded in March 2000 to clear site
- New stadium: 67,000 seats; 7,000 club seats; 71 upper-level suites; 12 field-level endzone suites
- First football stadium to connect with exhibition center (325,000 sq.ft./30,193 sq.m.)
- Architecture, electrical engineering, mechanical engineering
- Completion: 2002

EDUCATIONAL INSTITUTIONS

University of Maryland, Eastern Shore
Princess Anne, Md.
- New project: Social Studies, Education and Health Sciences (SSEHS) Building
- 114,000 sq.ft. (10,591 sq.m.) with classrooms, teaching labs, community outreach physical therapy and rehabilitation clinic
- Architecture and M/E/P engineering
- In association with Zigler/Snead LLP, Restl Designers, Inc. and SST Planners
- Completion: 2003

St. Catherine's School Richmond, Va.
- New project: athletic /recreation complex
- 11,000-sq.ft. (1,022-sq.m.) fieldhouse; 9,000-sq.ft. (836-sq.m.) gymnasium with basketball court; eight-lane pool; weight and fitness center; wellness/training center
- Architecture, structural engineering, planning, landscape
- Completion: December 2002

California State University, Humboldt Campus
Arcata, Calif.
- New project: addition/renovation of University Center
- 6,800 sq.ft. (632 sq.m.) of new space and 8,900 sq.ft. (827 sq.m.) of existing space
- New offices, dining areas and support spaces for performing arts events
- Architecture
- Completion: 2002

Texas Christian University Fort Worth, Texas
- New project: Tucker Engineering and Technology Center
- Inexpensively reconfigured space to accommodate changes in teaching and research
- Mediated classrooms, research and computer labs, conference and seminar space
- Architectural and interior design, electrical/mechanical engineering
- In association with Hahnfeld Associates
- Completion: December 2001

College of St. Catherine St. Paul/Minneapolis, Minn.
- Campus master space plan/framework for campus growth and development
- New focus and energy to residential campus life with new academic village and expanded student center
- Redefinition of building use to support growth and communication among departments
- Completion: spring 2000

ERRORS & OMISSIONS

Volume 2, Number 4

Clarification: Regarding "Restoring Success" on page 8, the exceptional expansion and renovation of Yale University's Payne Whitney Gymnasium was the result of a winning combination – a collaboration of Ellerbe Becket, Cesar Pelli & Associates and Flack + Kurtz. As Babe Ruth once said, "The way a team plays as a whole determines its success."

Modification: After the *Quarterly* went to press, the description of The Center for Health Improvement in Hays, Kan., changed (page 21). It will be a 80,000-sq.ft. (7,432-sq.m.) wellness center, complete in 2001.

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Honors and presentations

Quarterly

Wizards of High Tech

Saitama Super Arena moves Tokyo fans

An arena? A stadium? No, wait, it's a concert venue! In about 20 minutes, the Saitama Super Arena near Tokyo converts from an intimate concert venue to a full-fledged stadium. A high-tech concept called Moving Block, developed in an international design competition, moves 9,200 seats – along with restrooms, concessions and hallways – a distance of 231 ft. (70 m.) to convert the arena to a stadium and back again.

Movable partitions – the largest of their type in the world – allow the 15,000-ton (13,610-tonne) structure to host 36,500 people for a football game; 27,000 for an exhibition; or 5,000 for a recital. Sound quality is imperative in such a structure, and the arena's sound-shielding design ensures that noise does not leak outside. Even the seats are made from sound-absorbing materials.

"A facility with the functional diversity and flexibility of a Swiss Army Knife offers a wide range of features and combinations," says principal Gordon Wood. "By using the latest technology and design concepts, Japan has a facility unlike any in the world."

The design team was led by Nikken Sekkei Ltd, the representatives of MAS*2000 Design Team, in association with Ellerbe Becket and Flack+Kurtz Consulting Engineers. A special joint venture entity consisting of Taisei Construction, Mitsubishi Heavy Industries and UDK provided design support and construction.

A gleaming silver, futuristic exterior complements Saitama's technological marvels.

When the 20-minute conversion begins, an automatic, flexible utility regulation system starts up as the 64 base bogeys, or trucks, travel their steel rails. Electric cables wind up and release from their reels. Plumbing and air-conditioning supplies cut and reconnect.

Ellerbe Becket

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