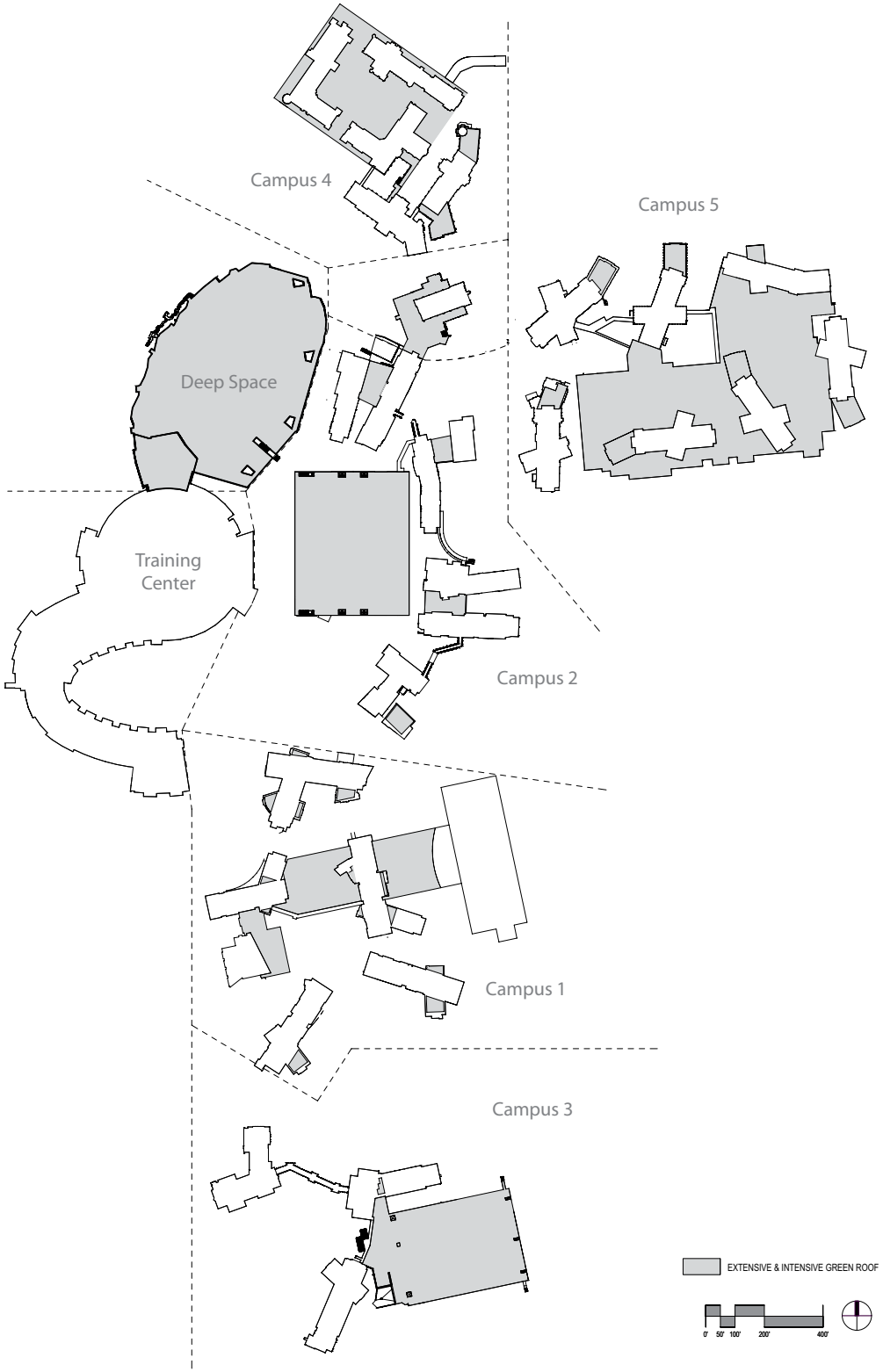
AIA / TAP AWARDS

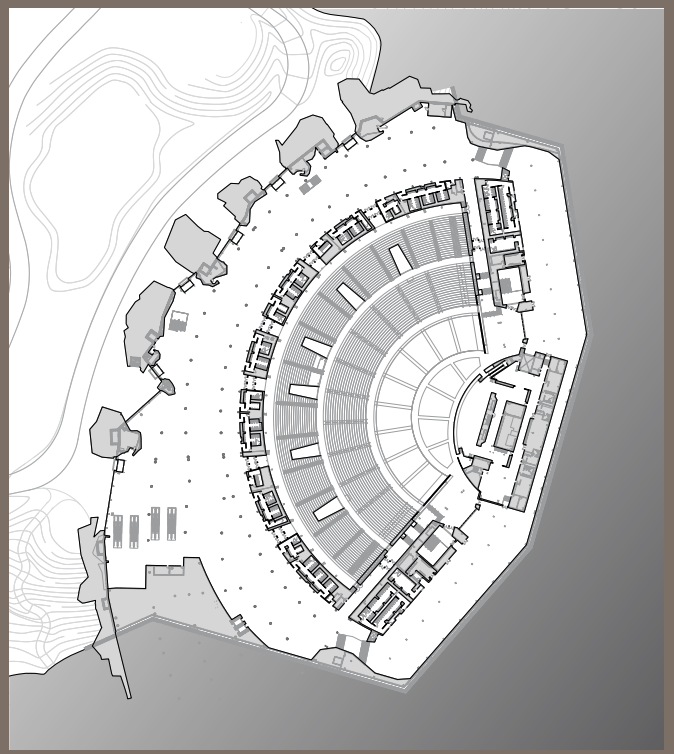
EPIC DEEP SPACE AUDITORIUM



INTRODUCTION

Epic Systems Corporation is a fast growing medical records management company occupying over two million square feet of corporate and conference space on an 811-acre site in Verona, Wisconsin. Deep Space is an 11,400-seat auditorium on Epic's campus built completely underground to preserve the pastoral views of the site and was completed in less than 24 months.

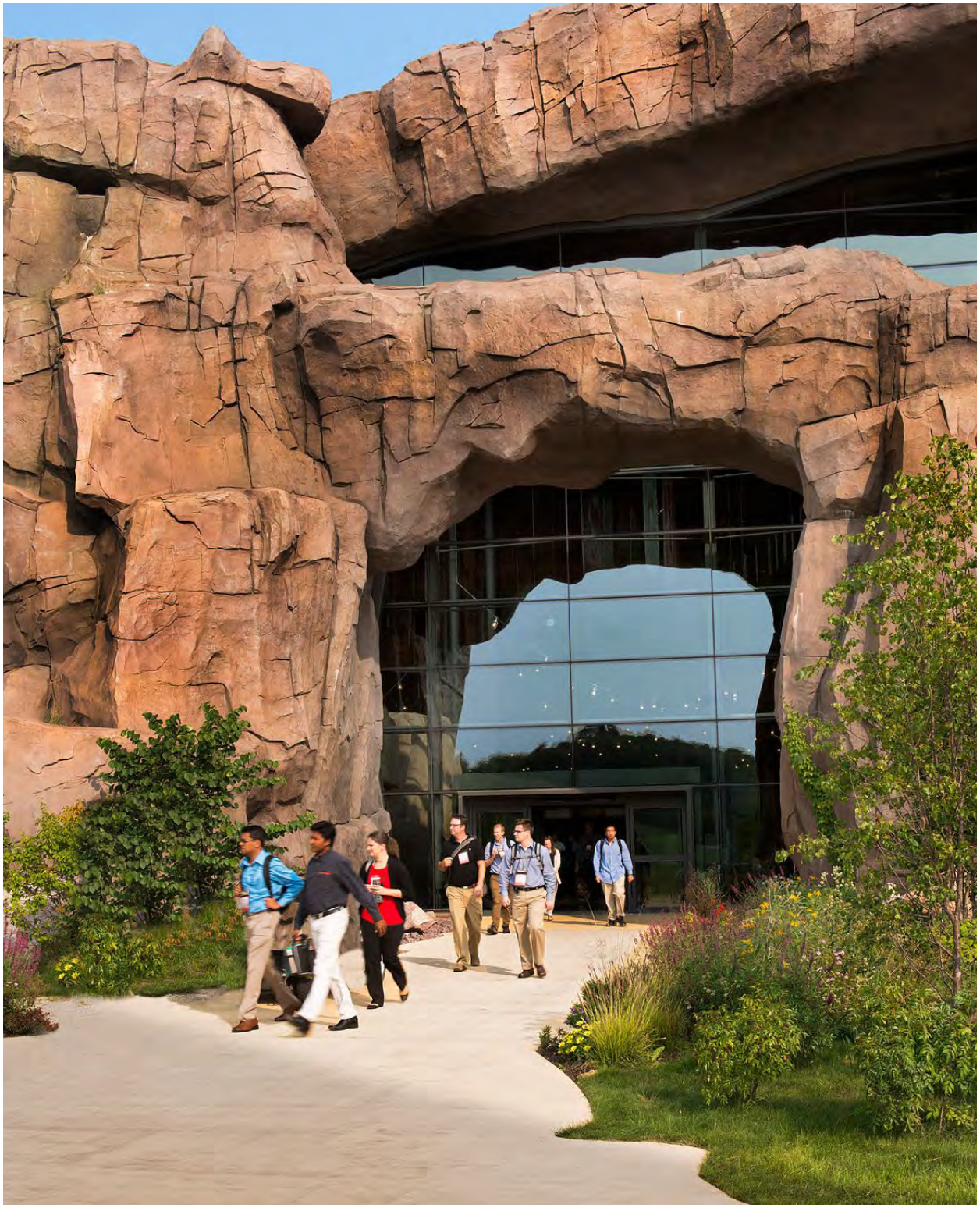
The fan shape of the auditorium is designed to encourage audience interaction and enhance the quality of the large group experience. The space is meant to facilitate the exchange of ideas, where presenters and audience members participate together. The adjacent prefunction space is meant to extend the conversation outside of the auditorium.



ARCHITECT'S STATEMENT

We have held a relationship with the Owner of Epic Systems Corporation for over 20 years. From our first meeting, we knew that our relationship would be unique. As we made ourselves comfortable in the conference room, we asked if our guests needed anything to drink. Their response, assuming a response for coffee, water, or soda, was for a root beer float. This was the first of many situations that challenged our team in a fun and creative way, something that Epic radiates throughout their culture. Working with their team brings out our best level of commitment, service, and collaboration.

Through the course of many projects, we have developed a distinct process for design with this client. We have learned that the best way to approach a meeting, and to have productive results, it to come prepared with not only the traditional architectural graphics, but to complement it with physical models to help illustrate the design intent. This process, including physical models from design to construction, helped enormously throughout the development of the Deep Space Auditorium.



OWNER'S STATEMENT

Time after time this team has been able to design space for us that not only met our unique functional needs but also was extremely creative, comfortable, productive, aesthetically interesting and pleasing and reflects our unique personality. From our experience, we have learned the team personnel takes the time needed to get to know their client and develop a keen understanding of their client's needs and vision. They then translate that vision into extremely functional and creative design solutions.

DESIGN INSPIRATION

How can we design, document, and construct a naturalistic, highly irregular form using technology that is typically used for conventional and orthogonal planes?

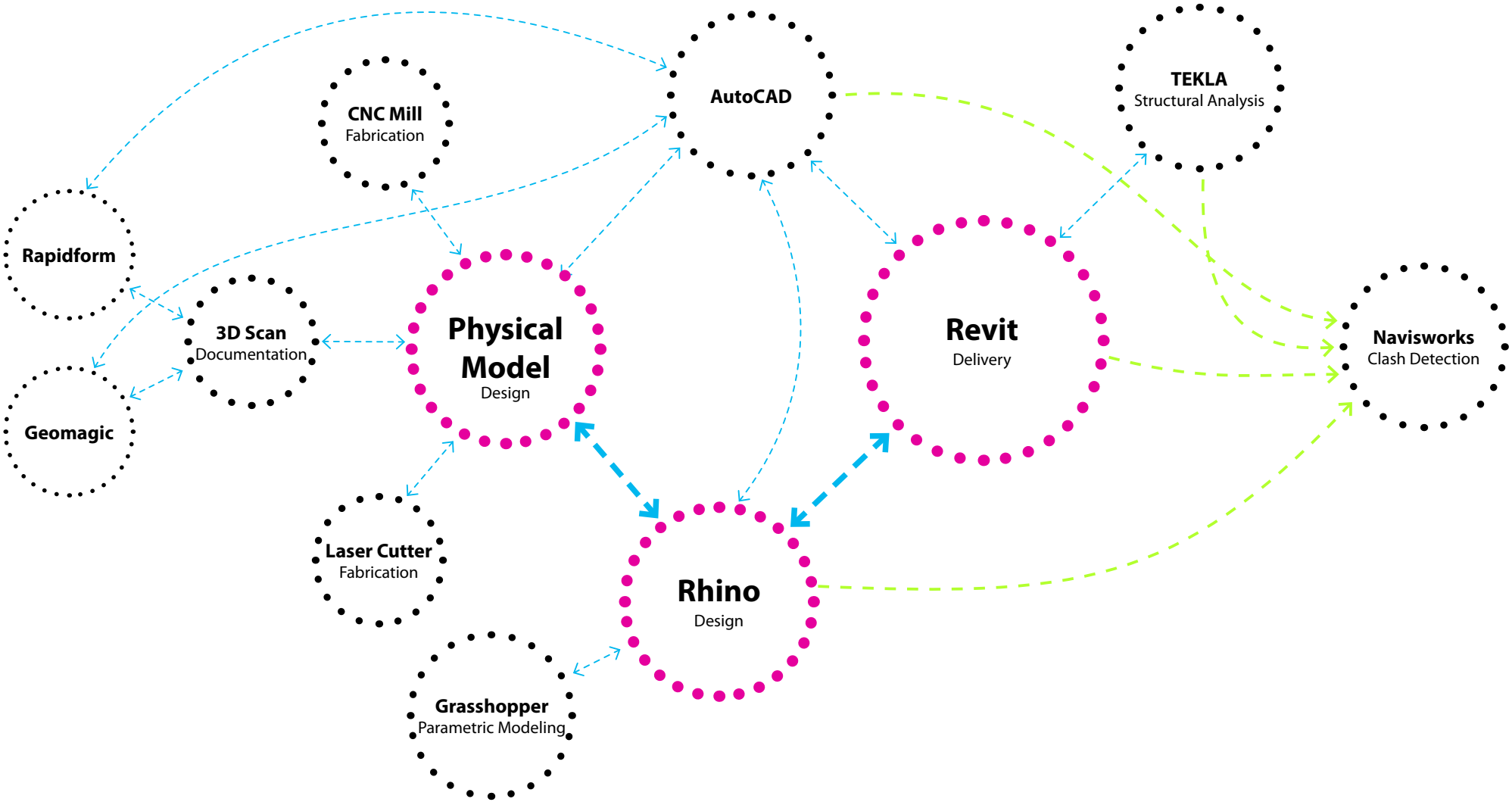
The location of the new auditorium proved the largest design challenge as it needed to fit into the site without blocking the views of the landscape from the newly constructed Learning Center and the other adjacent office buildings. After multiple iterations and design meetings with the client, the final design conveyed the feeling of a cave highlighting that the structure would be depressed into the hillside.

Wisconsin is known for its unique combination of topography, geology, and exposed rock outcroppings. Although the more literal cave interpretation would have its technical challenges, the overall scale is invisible from the exterior, mitigating the sense of overwhelming size while enhancing the experience of the individual audience members. Viewed from almost any direction, the massive auditorium blends seamlessly with the rural landscape.

The Deep Space auditorium footprint covers 364,113 square feet with 11,400 seats and an additional 3,000 seats in a balcony expansion. It serves as the campus' central auditorium and conference center.

CREATIVE INTEGRATION

The rolling roof forms and cave-inspired massing of the design called for a more organic development of the building structure and façade than conventional BIM documentation would typically allow. Instead, a combination of hand sculpted, CNC, and laser-cut models were developed concurrently with a digital model in Grasshopper and Rhino; programs suited for generation of complex shapes. The final physical model was a large scale clay model that was 3D-scanned in order to produce a digital point cloud which was integrated with the Revit model and became the engine that drove the other technical delivery tools of the project.



Physical → Digital → Physical → Digital → Physical

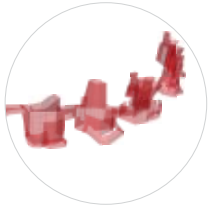
Physical Model
Concept

Rhino
Design

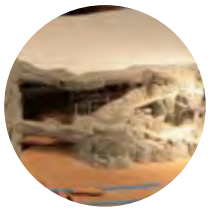
AutoCAD

Laser Cutter

CNC Mill



Physical Model
Large Scale
Clay Model



3D Sacan
Documentation

Revit
Delivery

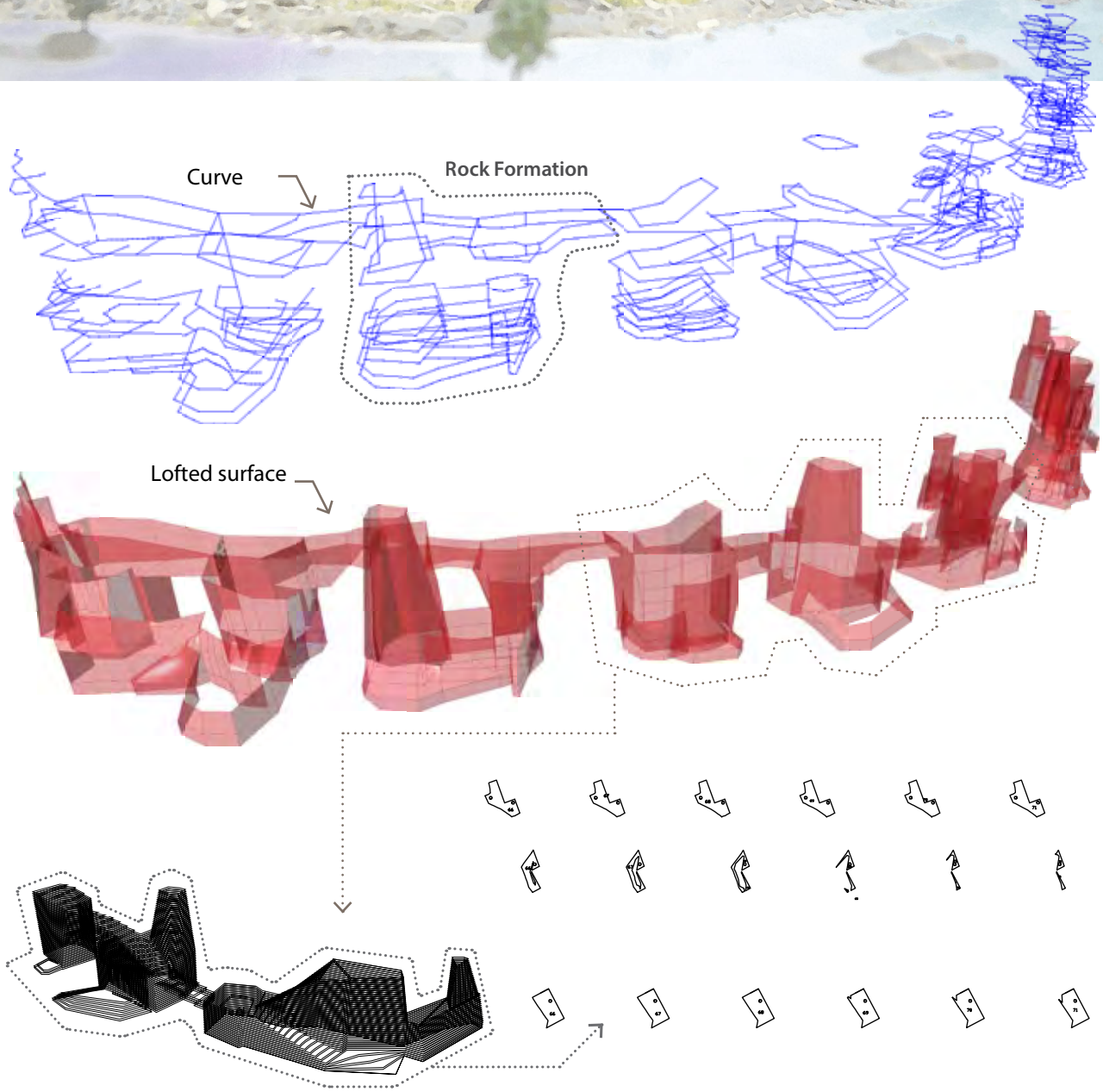
TEKLA
Structural Analysis

Navisworks
Clash Detection

Built Project

BEGINNING THE PROCESS

The first step in the design process began with the creation of a concept model. The architectural team started with clay and a couple of slate shingles. In a matter of days, the design team hand-sculpted a small-scale model (with the building standing roughly 2″ tall). Hand-molding the clay allowed the architects to explore the desired natural cave forms while the slate cladding provided a natural stone texture that resonated with the owner. Green moss was applied over the model's roof and surrounding landscape to complete the concept of the underground anti-building – sunken and covered in earth.

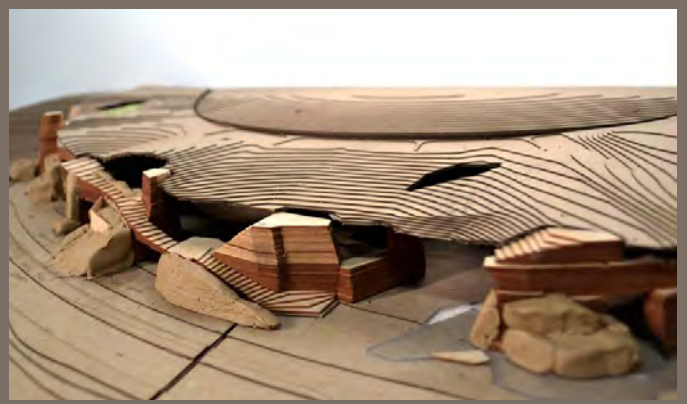


TRANSITION FROM PHYSICAL TO DIGITAL

PART I

The massing of the physical concept model was subdivided into a series of rock formations, before being modeled in Grasshopper. The rock formations were created through a network of curves connected by lofted surfaces. The ability to manipulate these curves allowed the team to immediately see the impact any one adjustment had on the look of the rock surface.

The model was then finalized in Rhino and broken down into stratified layers. These layers were then converted into an AutoCAD file, which was used by the laser cutter to cut the pieces needed to build an armature for the next iteration of the rock wall in the form of a large-scale clay model.

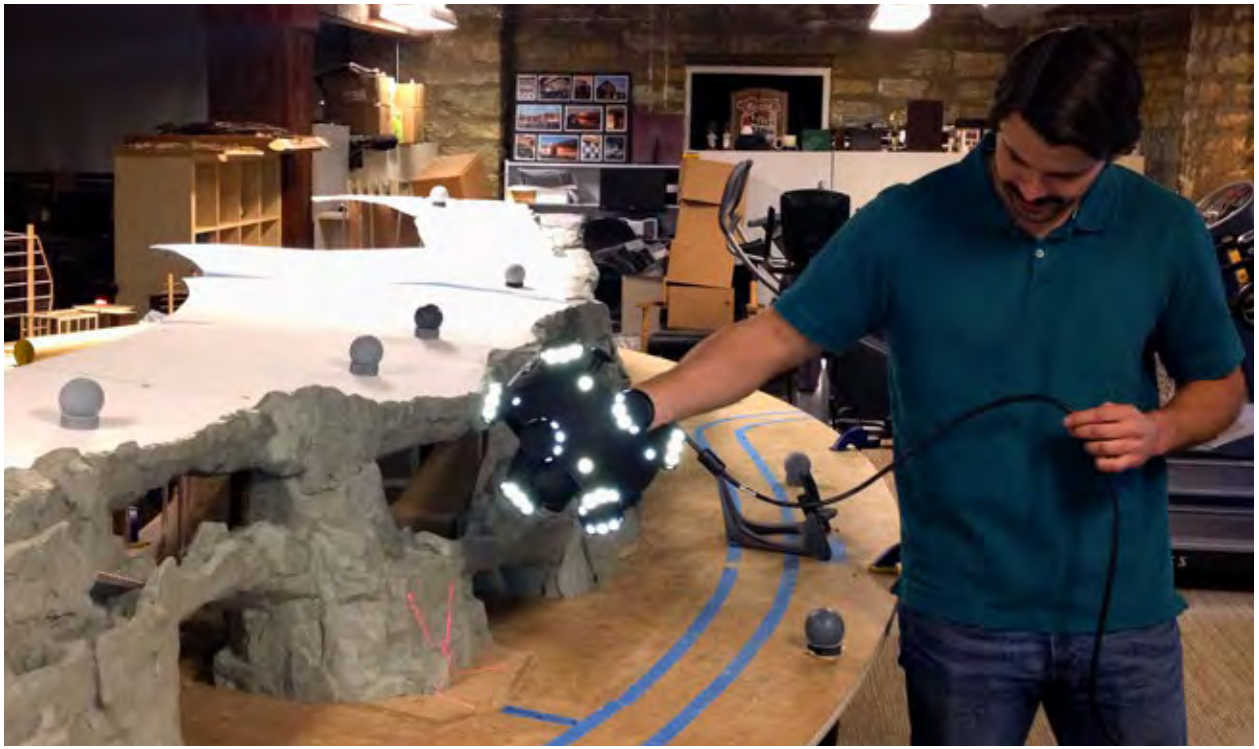


CREATING A LARGE SCALE MODEL

A very high level of detail for the rock surfaces was necessary in the development of this model since it would be the reference for creating the digital model. The design team worked with a local sculptor to understand the vision and carve intricate rock formations out of clay. The model was created at a large scale (1/4″ = 1′-0″) to allow for the highly detailed sculpting process and to minimize the loss of information during the enlargement process.

Additional study models were created to coordinate the structural concrete core with the exterior rockwork surface, making sure only the glass panels of the custom steel curtain wall system were visible in the cave-like openings.

In addition to the benefit the model had in the design development and construction documentation phases, it was also helpful in discussing the constructability of the project. The general contractor and themed rockwork contractor frequently reviewed the progress of the model with the architect and discussed the construction process and sequencing. The model helped with integration of companion systems such as the custom steel curtain wall, integral stairs in the rock formations, and structural support.



TRANSITION FROM PHYSICAL TO DIGITAL

PART II

When the desired effect had been achieved, the 18 foot long clay model was translated back into digital form via a 3D-scanner. Throughout the design development process, the massing and textures had become even more detailed. The scanning process, with accuracy to one millimeter, was critical in maintaining the essence of the design as the next physical iteration would be the full scale building – a 48x enlargement.

Rapidform Software was used to align and mesh together the data resulting in a point cloud which could then be linked back to the Revit model. Coordination could continue with other building enclosure components such as the roof and enclosure wall structures and the complex custom-steel curtain wall.

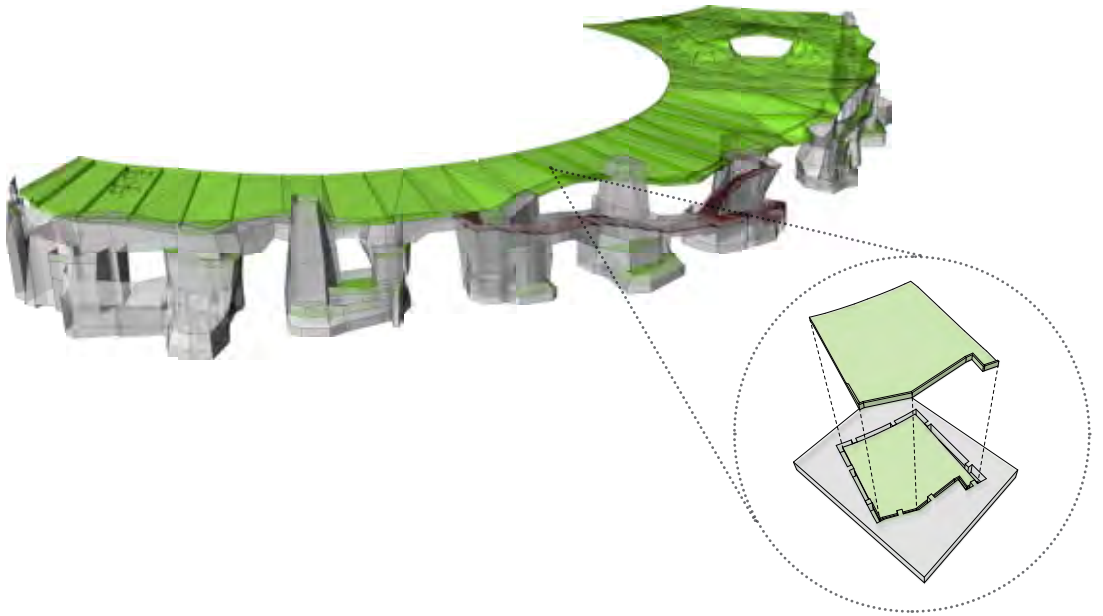
THE ROOF

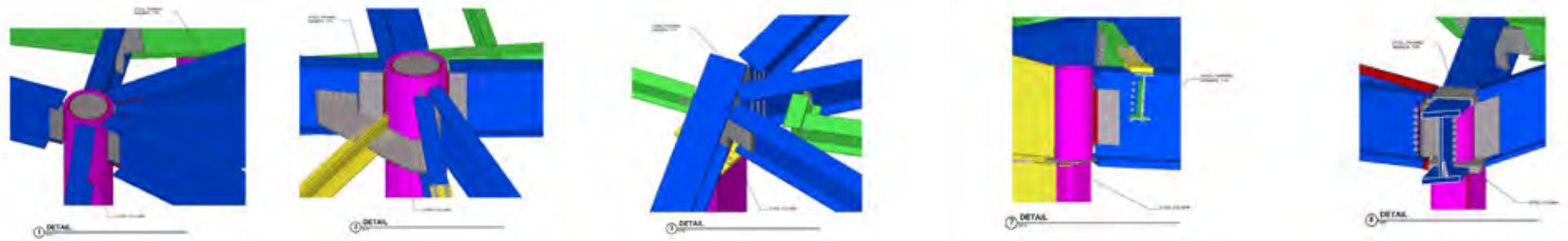
The Design

The roof was designed with a similar process as the west wall. The structure is predominantly underground and is covered with native grasses. The green roof covers over 8 acres and provides visual and physical connections to the surrounding Wisconsin landscape. During design, a physical model fabricated with the CNC mill was created to work hand-in-hand with the Rhino and Revit models.

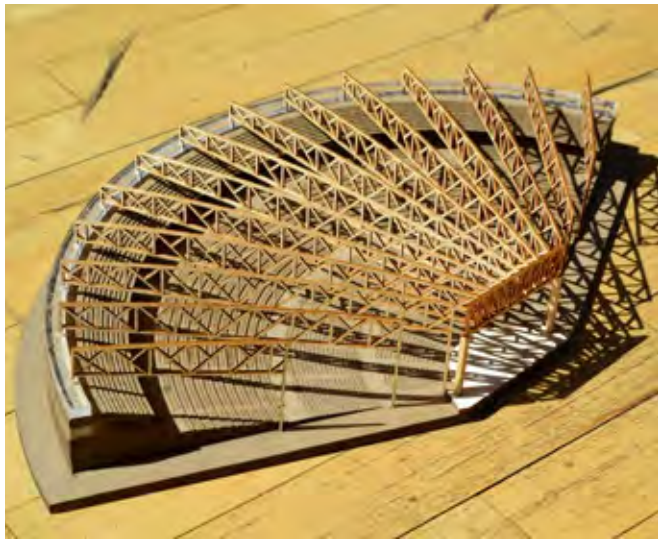
The Engineering

Due to the long spans and heavy green roof loads, a fully detailed TEKLA model was also used for the structural engineering. This platform also allowed the engineers to circumvent the normal shop drawing detailing process usually performed by the steel fabricators. This process, along with a sequenced document delivery system and the engineers integrated assistance to the contractor in developing the most efficient erection processes, which saved an estimated 12 to 18 months on the project schedule.

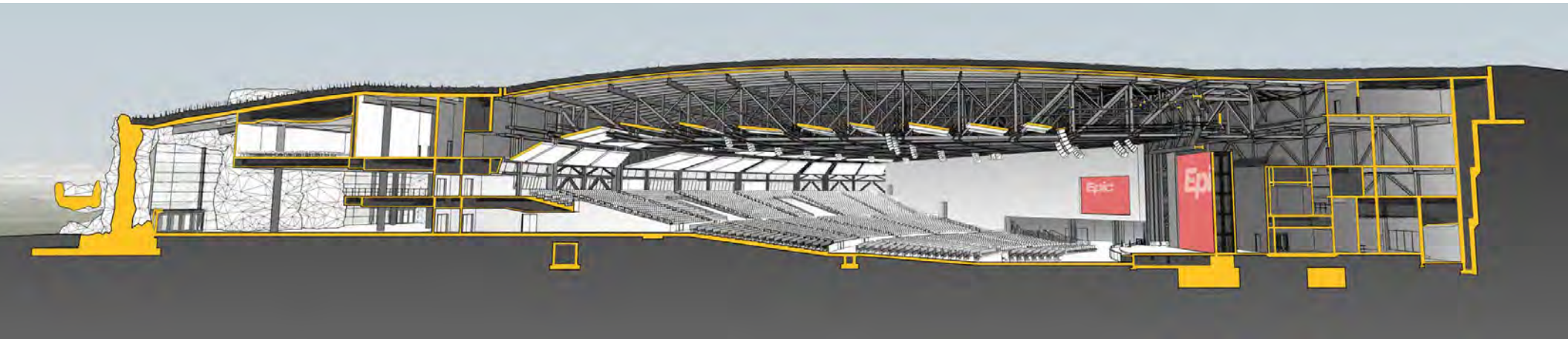




Structural connections in TEKLA

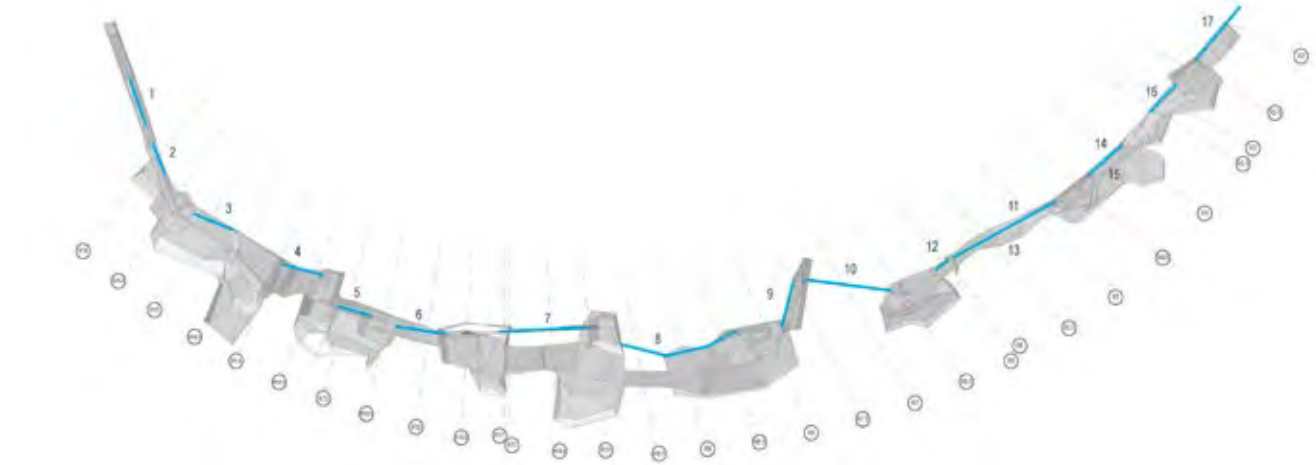


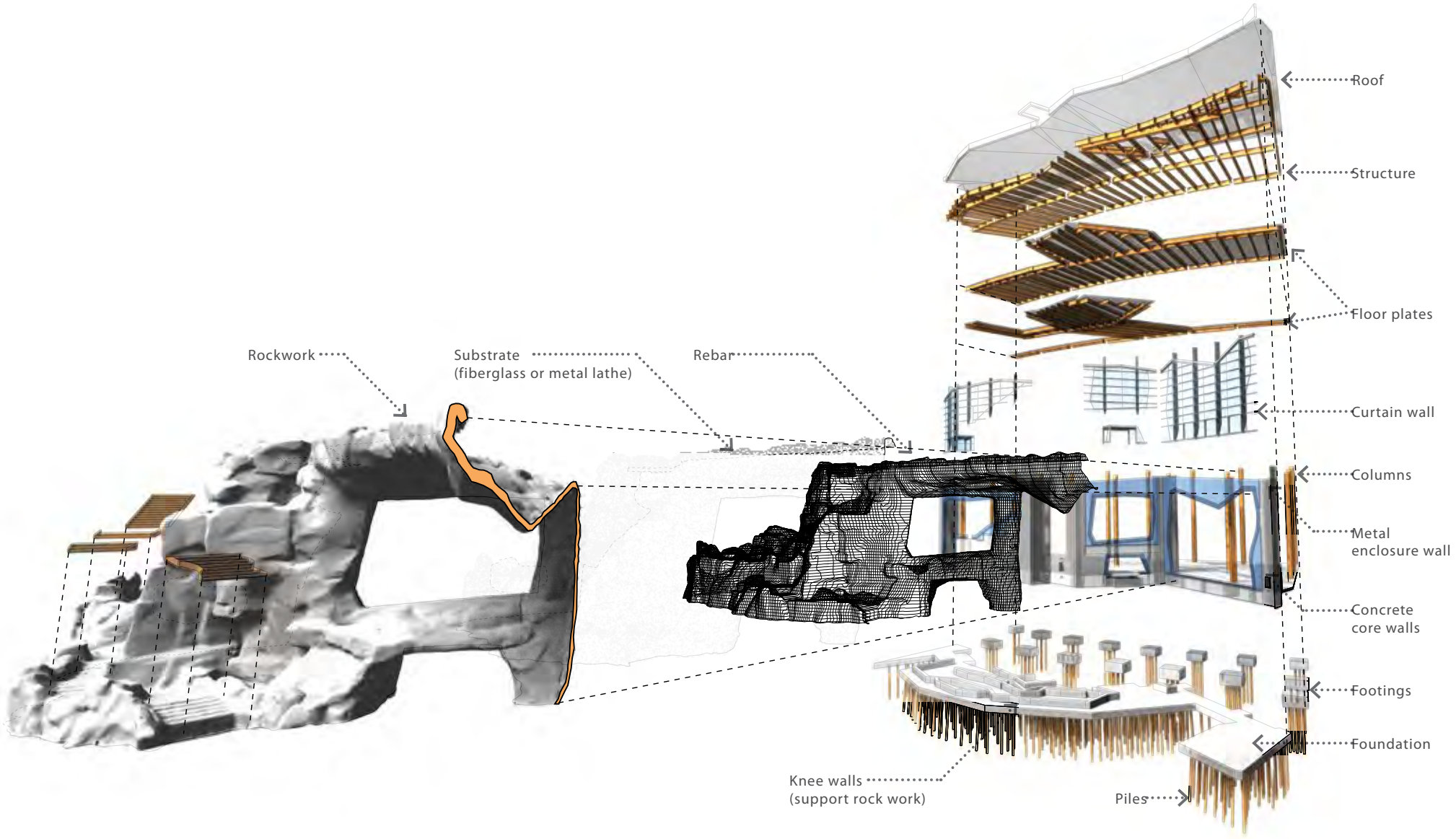
Steel fabrication

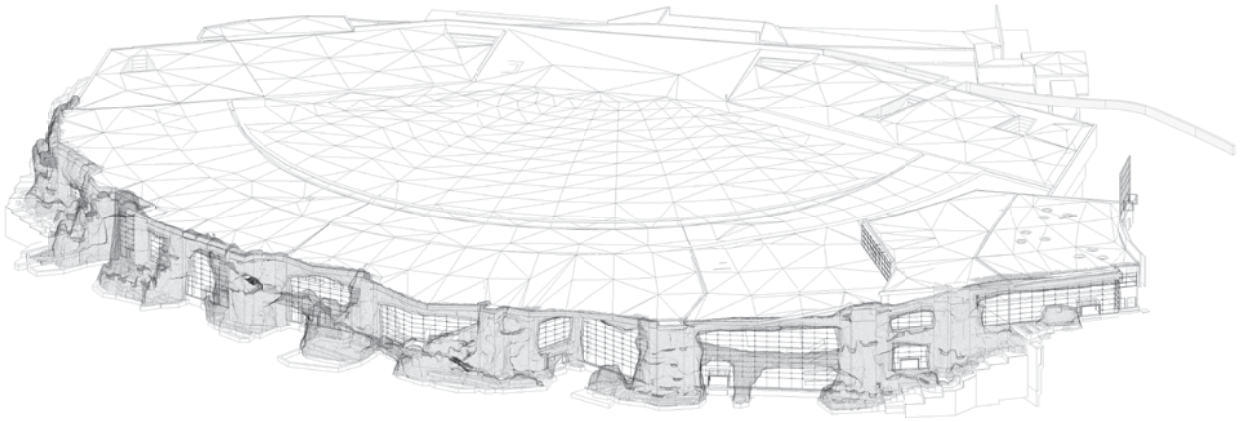


CURTAIN WALL DEVELOPMENT

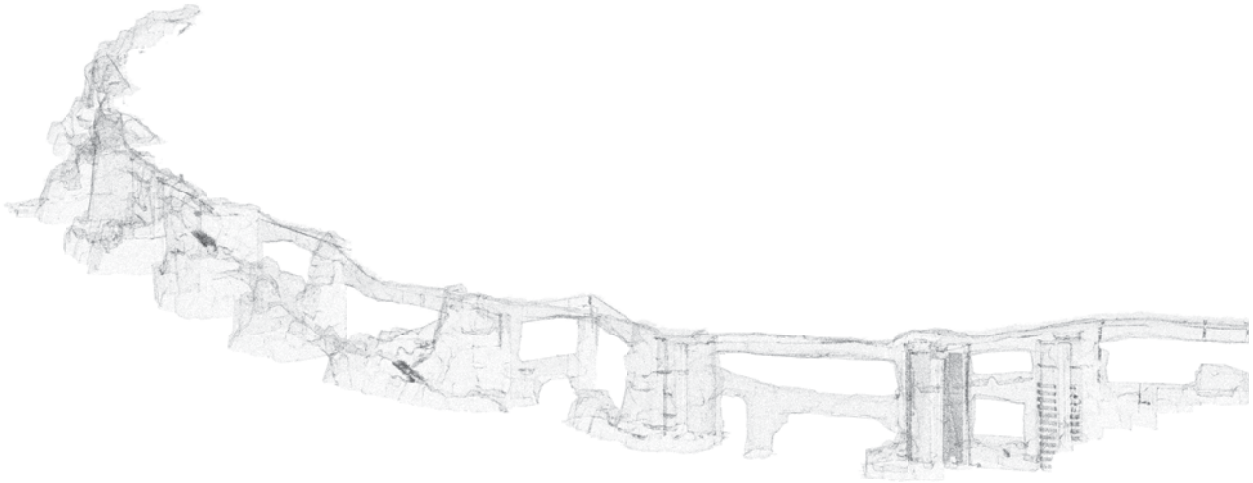
An additional physical model helped develop the final piece of the project. A laser cut model, rebuilt from the 3D scan helped coordinate the rock wall with the placement of the curtain wall.




Roof
Structure
Floor plates
Curtain wall
Columns
Metal enclosure wall
Concrete core walls
Footings
Foundation
Rockwork
Substrate (fiberglass or metal lathe)
Rebar
Knee walls (support rock work)
Piles



Revit model



Point cloud from 3D laser scan and meshed together in Rapidform

CONSTRUCTION DOCUMENTS

During the time the west wall was being developed, the team designed the interior of the building in the Revit model. The geometry and sheer scale of the project elevated the level of complexity and coordination required when working in this model. With the details of the curtain wall finalized, the clash-detection software, Navisworks, was employed to find and resolve thousands of discrepancies between the many systems of the building. This happened both internally by design teams, as well as in group sessions with the contractor. The fast-track delivery of the building allowed both design and construction to happen simultaneously.

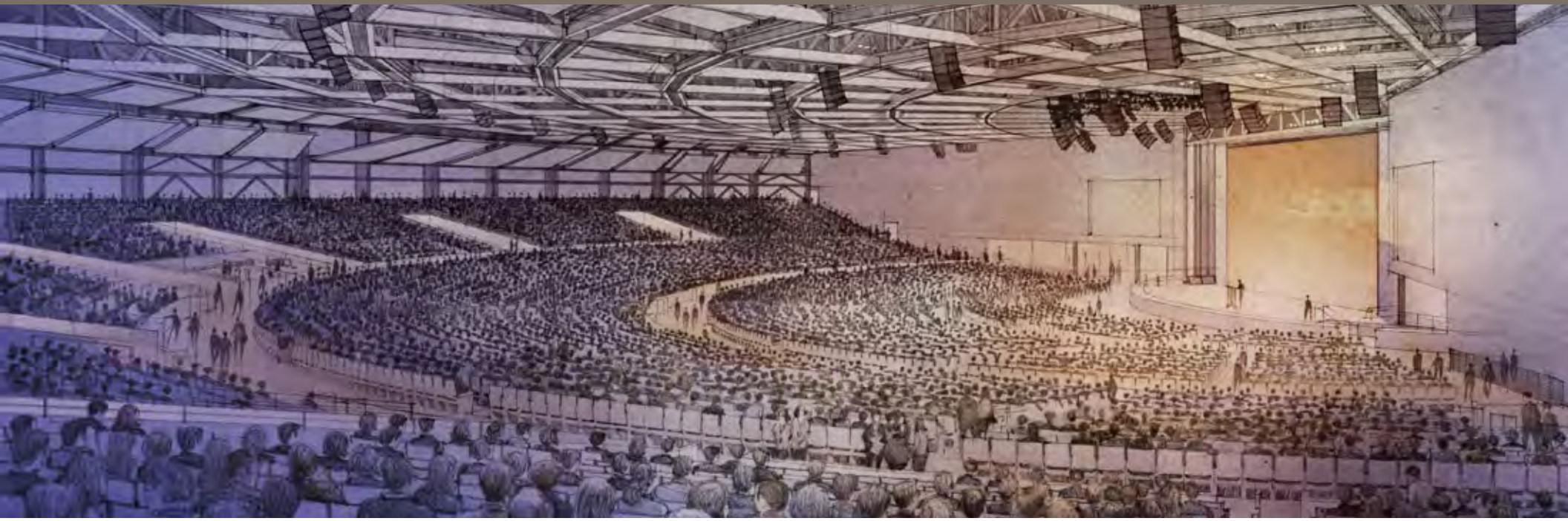
The documentation of the rockwork was then turned over to the theming contractor while coordination for systems such as structure, storm water drainage, and waterfalls continued with the architect's guidance.

THE AUDIENCE EXPERIENCE

The vast scale and advanced technology of Deep Space is designed for one prime purpose: To enhance the audience experience.

The bowl-shaped auditorium creates excellent views from every seat. Despite the large size, the gradual slope promotes a sense of community and improves learning instilled in the venue.

The design team conducted extensive studies to determine best options for moving people quickly and safely through its levels. The size of monitors, screen resolution, and screen placement were chosen so that the audience can easily see presentations from every angle and from up to 270 feet away in the last row.




WELCOME

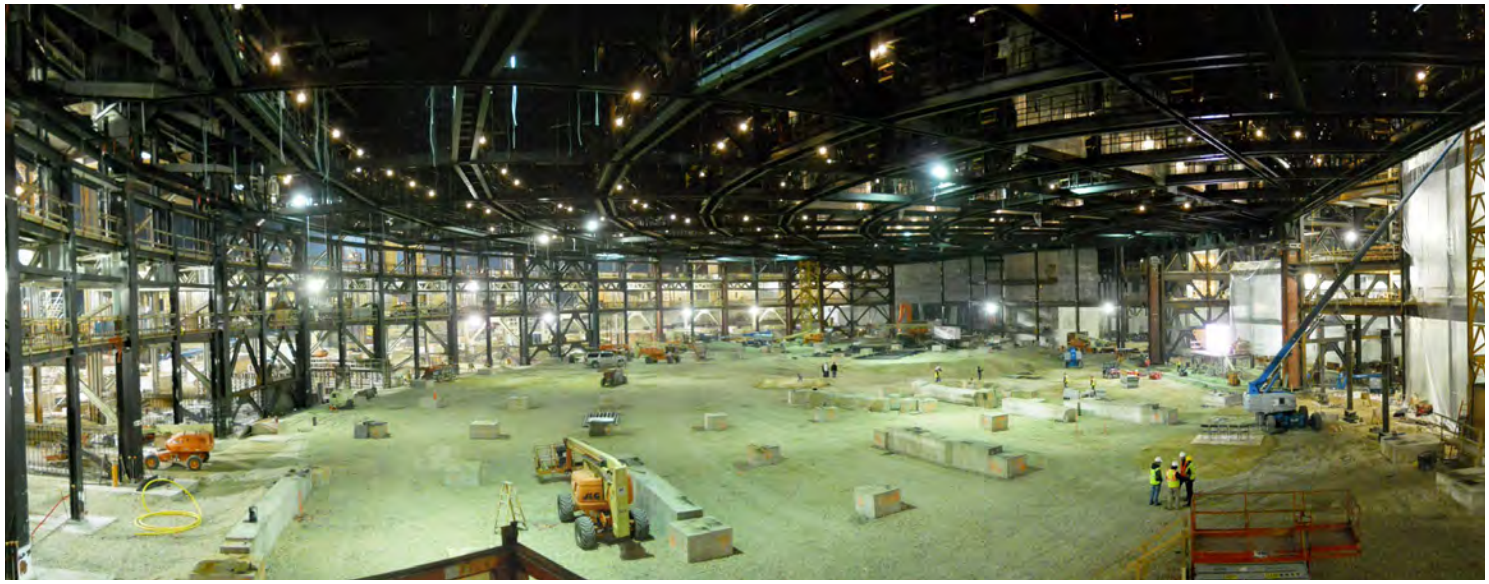
CONTRACTOR'S INNOVATION

Early in the project, the decision was made to strand jack the auditorium roof into place. Trusses were complete south to north. Essentially, the work was planned "upside down". What normally would be installed last had to be installed first. A detailed bay-by-bay schedule showed steel leave-outs to drop duct in, common use hangers were developed to minimize interferences, and last to be installed in an area was the roof deck.

Tight quarters and short construction times forced out of the box thinking for any opportunity to prefabricate. One such opportunity was the prefabrication of 42 escalators, which was unprecedented. The escalators were completely assembled, started, and tested in an offsite warehouse. The escalators were then trucked to the site and installed in three days. The total installation time of 24 weeks was cut down to nine.

Prefabrication of HVAC was also critical. 138 pieces of prefabricated duct work were installed in four weeks in the Back of House Mechanical rooms. The long-span roof trusses were also preassembled in a Minneapolis fabrication shop to ensure fit before shipping the 5,300lb of catwalks and 84,000 square feet of reinforcing cages for the shotcreted rock wall.

Deep space is a nearly one million-square-foot facility beneath eight acres of green roof.

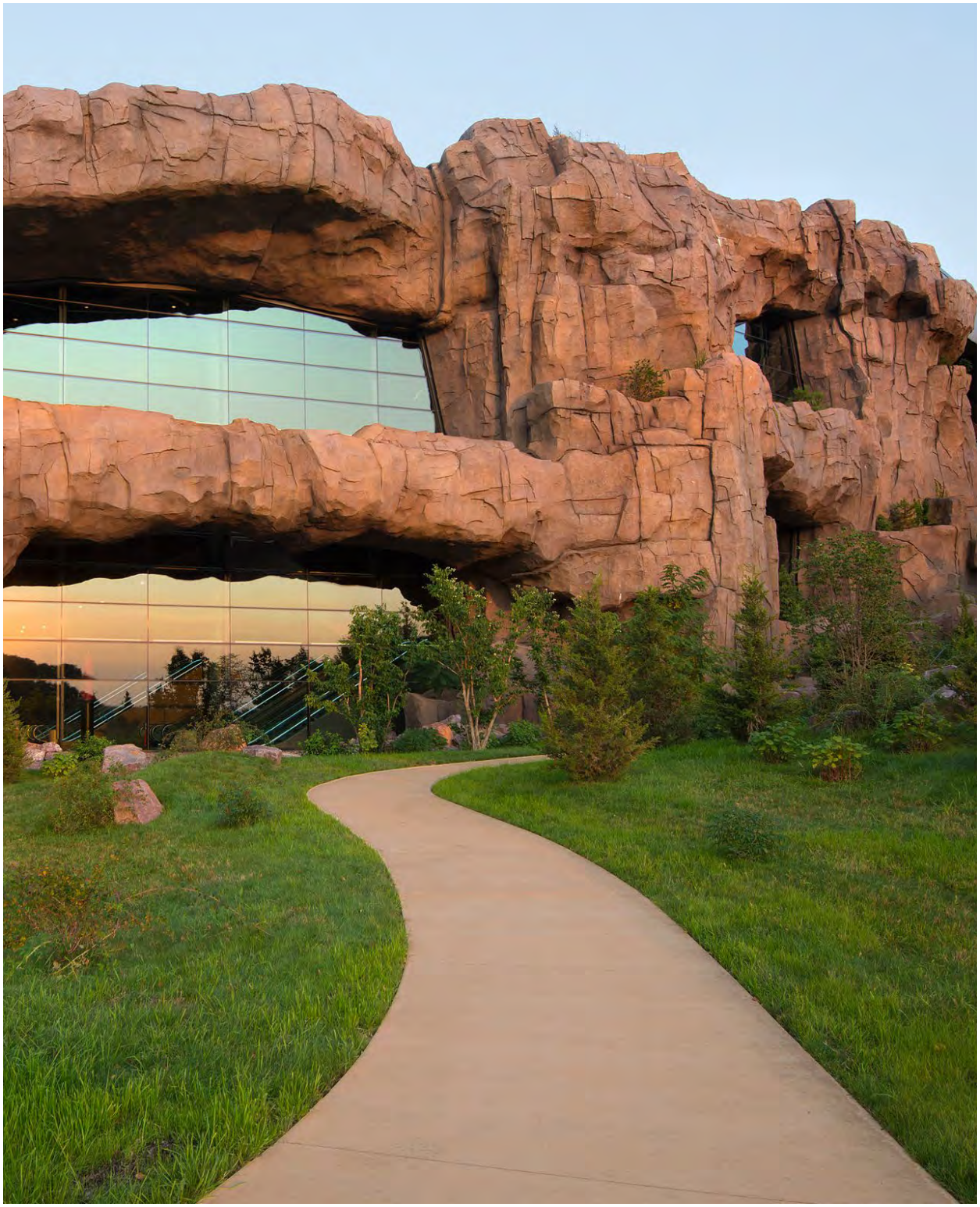


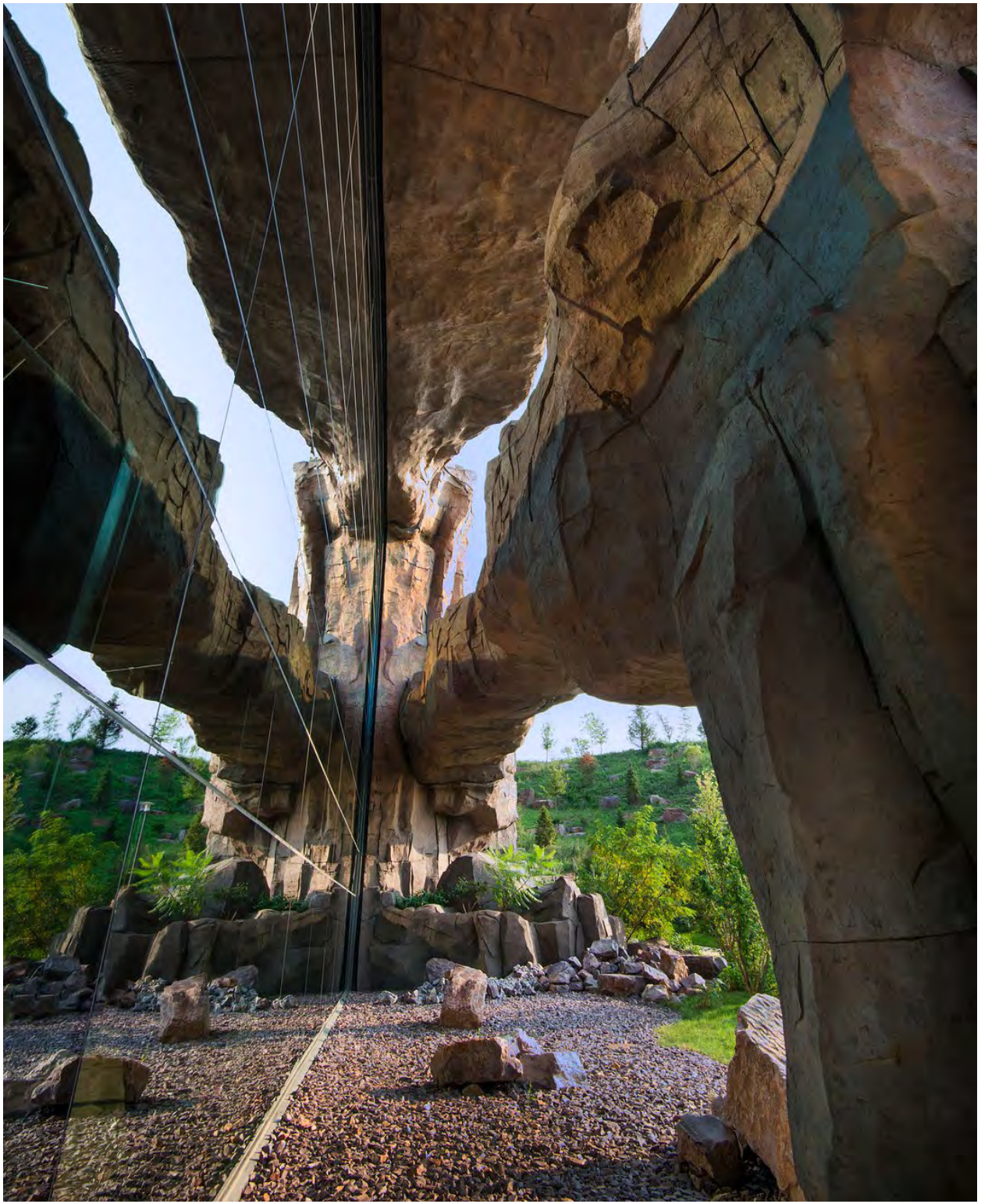
CONTRACTOR'S STATEMENT

For 3,500 construction professionals representing over 70 companies who worked here for more than three years, Deep Space will very likely be the most challenging, memorable, and rewarding project we will ever encounter. It has certainly been a once in a lifetime project for us and for many who worked on it. Construction professionals from all walks of life, trades, and career paths united around this job and accomplished amazing and innovating feats.

It is the efforts of the individual people, within the entire team, that made this project a collective success. Throughout the course of the project they dealt with accelerated schedules, changing details, and client-directed design changes. Crews worked seven days a week, three shifts, for extended periods of time to meet deadlines that allowed everyone to stay on track. This collaboration allowed us to move the project along quickly. We went from lifting the roof in place to using the building in just 10 months. The last piece of steel was set four months prior to the first performance.

Epic had a vision and a willingness to trust their design and construction partners. The architect and the design group applied their expertise to translate that vision into a design. The contractor and construction companies worked as partners to provide solutions and effective approaches to each challenge.





Owner: *Epic Systems Corporation*

Acoustical and AV Consultant: *Acoustic Dimensions*

AV Consultant: *Clair Brothers*

Civil Engineer: *D'Onofrio Kottke and Assoc., Inc.*

Code Consultant: *Arup*

Contractor: J.P. Cullen

MEP Engineer, Fire, and Technology Consultant: *exp*

Façade Detailing: *Façade Concepts, Inc.*

Façade and Structural Engineer (Bldg): *Thornton Tomasetti*

Geotechnical Engineer: *GEI Consultants, Inc.*

Interior Design: *H. Krueger and Associates*

Interior Design: *Interiors LLC*

Landscape Design: *Linda Sievert LLC.*

Lighting Design: *Schuler Shook*

Moisture Protection Consultant: *Structural Research Inc.*

Structural Engineer Rockwork: *GRAEF-USA, Inc.*

Themeing Contractor: *The Nassal Company*

Sculpting: *TIVOLITOO, Inc.*

SUCCESS OF PROJECT

The Owner had very specific criteria for this project from the start. They needed a large venue within their corporate campus that would allow the gathering of clients during their User Group Meeting conference each fall.

The venue had to be column-free, with single rake seating that accommodated up over 11,000 guests and could empty quickly and conveniently to adjacent meeting spaces. The building needed to be virtually invisible from its neighboring office buildings, with the west-facing exposure simulating natural rock outcroppings as if the building had always been there.

The depth and span of structure, complexity of building geometry, and sheer scale of the project all posed significant challenges to the design team. From the very beginning, the Owner pushed the design to the limits, but with their support, this highly collaborative design team managed to meet and exceed all expectations. At the first large gathering at Deep Space, the Owner told one of the Architects, "I wouldn't change a thing!"