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Hoberman Associates is a multidisciplinary practice that specializes in transformable design—the design and development of products, structures, and environments that change their size and shape.

We believe that a world undergoing accelerating change needs an adaptive, interactive approach to design.

Whether that’s inventing a rapidly deployable shelter, collaborating with architects in developing the next generation of adaptive buildings, or redefining portability in the children’s products market, our clients seek us out to shape change—and inspire it.

Background

Hoberman Associates, Inc. (HAI) was founded in 1990 by designer Chuck Hoberman, whose international career seamlessly fuses art, design, engineering, and architecture. HAI was founded with the primary aim to design behavior – to create objects that have the living qualities of organisms.

Throughout its history HAI has focused on fostering a dynamic relationship between product and user. Its unique approach has been most prominently demonstrated in the Hoberman Toy line, founded in 1995. Subsequent design explorations include rapidly deployable tents, miniature medical instruments, and juvenile products.

In recent years HAI has embarked on a series of architectural collaborations to create adaptive buildings. Working with architectural firms in America, Europe and Asia, Hoberman is creating responsive shading and ventilation surfaces, operable roofs and canopies, and retractable facades for multi-use spaces.

The primary motivation for our architectural projects is to achieve energy savings and enhanced building environments within the context of advanced sustainable strategies. Our role is concurrently creative and technical, and our work is justified by its performance, including environmental impact, architectural integration and visitor experience.

Theory of Transformation

Hoberman Associates’ work is centered on the fundamental idea that a designed object can transform the way a natural organism does. While the smooth transformation of size and shape is ubiquitous in the natural world, it is rare among man-made objects.

The creation of transforming objects requires a new design theory, a conceptual framework that draws on mathematics, mechanics and structural engineering to integrate change as a basis for design.

Through years of exploration and experimentation we have identified critical parameters for the successful creation of transforming objects. The process of transformation should be:

- Complete & fully three-dimensional
- Smooth & continuous
- Reversible & repeatable

These attributes result in functional benefits for products, such as ease of use, fluid responsiveness and adaptability. They lead to an integrated design approach where structure and mechanism are combined, which offers the ability to build transforming structures at both large and small scale.
Statement of Qualifications

HOBERMAN ASSOCIATES, INC

Approach

We believe that behavior itself can be designed into a product or place. By doing so, an indelible experience and connection is made with the user or occupant.

Our unique designs require a unique approach. Over the years, we have developed a work process that results in the consistent creation of surprising, effective and economical designs. This methodology emerges from the core philosophy of Transformable Design:

**Design and engineering are intertwined.**

Our engineers are passionate about design; our designers are fluent with technology. Both work side by side, and structure their contributions so that tasks and milestones are managed as an integrated process.

**Invention is the starting point.**

Innovation occurs when the creative concept emerges in concert with the technical means to realize it. For us, this defines the inventive process itself.

Invention is a key aspect of commercial strategy. Products that are functionally differentiated from their competitors and that are protected by strong intellectual property have the best chance to excel in the market. Our clients can draw from our ever-expanding pool of patents and we often create new patentable inventions as part of the development process.

**Success means taking the creative spark to its full potential and destination.**

In common with many of our clients, our management team has combined decades of experience as manufacturers. For years, we created, manufactured and sold our toy line to major retailers. The rigors of successfully executing a manufacturing business inform all of our designs.

We’ve learned that great ideas will not succeed in practice without attention to detail, containment of costs, and a thorough understanding of market context. We meet these criteria every day through close and collaborative communication with our clients.

Ultimately, success is when our designs are in users’ hands, or are surrounding them within a transforming environment - then the original creative spark reignites for them, closing the circle.
CAPABILITIES

Services

- Original concept generation for specialized applications
- Creation of parametric design models, customized in consultation with our clients
- Development of custom parametric applications as constraint-based design tools
- Design & engineering services up to the stage of final drawing & specification package for fabrication
- Extensive in-house prototyping capability
- Access to rapid-prototyping technologies
- Specialized analysis for transformable structures including interference issues, materials analysis, operational issues, reliability, maintenance and durability
- Oversight of manufacturing, fabrication, testing and installation
- Strategic consultation on Intellectual Property issues
- Licensing of patent rights for existing Hoberman properties

Disciplines

- Mechanical Engineering
- Electrical Engineering/Control Systems Integration and Solutions
- Structural Engineering (in association with Adaptive Building Initiative)
- Environmental Analysis (in association with Adaptive Building Initiative)
- Industrial Design
- Sculptural Design
- Business Development and Support
Nowhere do the disciplines of art, architecture, and engineering fuse as seamlessly as in the work of inventor Chuck Hoberman, internationally known for his “transformable structures.” Through his products, patents, and structures, Hoberman demonstrates how objects can be foldable, retractable, or shape-shifting. Such capabilities lead to functional benefits: portability, instantaneous opening, and intelligent responsiveness to the built environment.

Hoberman is the founder of Hoberman Associates, a multidisciplinary practice with clients ranging across sectors including consumer products, deployable shelters, and space structures. Examples of his commissioned work include the transforming LED screen that served as the primary stage element for the U2 360° world tour and the Hoberman Arch in Salt Lake City, installed as the centerpiece for the Winter Olympic Games (2002). Other noteworthy commissions include a retractable dome for the World’s Fair in Hanover, Germany (2000); the Expanding Hypar (1997) at the California Museum of Science and Industry; the Expanding Sphere (1992) at the Liberty Science Center, Jersey City, New Jersey; and the Expanding Geodesic Dome (1997) at the Centre Georges Pompidou in Paris.

Hoberman’s work has been exhibited several times at the Museum of Modern Art in New York. In 2008 his commissioned installation Emergent Surface was part of the exhibit “Design and the Elastic Mind.”

In 2008, alongside Buro Happold Principal Craig Schwitter, Hoberman formed the Adaptive Building Initiative (ABI). The joint venture united Hoberman’s design vision with Buro Happold’s 30 years of engineering excellence to develop retractable façades, responsive shading and ventilation, operable roofs, and canopies for the built environment. Between 2009 and 2010, ABI realized four adaptive architectural installations: an adaptive façade for the POLA’s Ginza, Tokyo headquarters; an operable roof for Aldar Central Market in Abu Dhabi; a dynamic entrance for the Wyss Institute at Harvard University; and a kinetic façade for the Simons Center at Stony Brook University, New York.

Hoberman holds a bachelor’s degree in sculpture from Cooper Union and a master’s degree in mechanical engineering from Columbia University. He won the Chrysler Award for Innovation and Design in 1997. Hoberman is a Visiting Scholar at Harvard University’s Wyss Institute for Biologically Inspired Engineering.
Matthew began his work at Hoberman as an engineer for the company’s largest sculptural installations, and was the lead mechanical designer for a 22 meter retractable arch for the 2002 Salt Lake City Winter Olympic Medal Ceremonies. In 2006, he designed a 12 meter expanding double helix for the Discovery World Museum in Milwaukee, Wisconsin. Most recently, he was the project leader for the 380 square meter expanding screen that serves as the centerpiece for the U2 360° world tour. His expertise in geometric and kinematic rationalization was essential in designing the largest moving LED screen ever built.

In addition to large sculptural projects, Matthew has been integral in the growth of Hoberman’s product development capabilities. Some of his award winning designs include; the Sonic FX Musical Sphere, the Brain Twist Transforming Puzzle, and the Switch-Pitch color changing ball. In 2006 he designed the RDS tent system for Johnson Outdoors, currently the fastest deployable tent on the market that meets all of the US Marine Corp’s stringent field requirements. Matthew shares a number of patents and patent’s pending with Chuck Hoberman for these designs.

In his spare time Matthew enjoys competing in endurance races, having completed numerous marathons and half-Ironman triathlons and has summited Mt Kilimanjaro. In 2000 he completed the world’s longest annual open water swimming race, the Manhattan Island Marathon Swim, a delightful 28.5 mile swim around the entire island of Manhattan.

### Disciplines
- Mechanical Engineer, Product Design

### Qualifications
- BSME

### Education
- Lehigh University 1993-1997

### Hoberman
- 2000 – Present

### Other
- Founding Board Member, Adaptive Building Initiative, 2008 - Present

### Key project information
- **Expanding Icosahedrons, Royal Caribbean Cruise Lines**

- **Transforming Tetrahedron, Papagayo Museum**
  - Villahermosa, Mexico, 2005

- **RDS Tent System, Johnson Outdoors**
  - Binghamton, New York, USA, 2006

- **Expanding Video Screen, U2 360° World Tour**
  - 2009-2010

- **Wyss Institute, Harvard University**
  - Boston, Massachusetts, USA, 2010

- **PERCS Expanding Satellite, Naval Research Laboratory**
  - Washington, DC, USA, 2011 Projected Launch

- **Hoberman Arch, Winter Olympics**
  - Salt Lake City, Utah, USA, 2002

- **Expanding Helicoid, Discovery World**
  - Milwaukee, Wisconsin, USA, 2006

- **Emergent Surface, Museum of Modern Art**
  - New York, New York, USA, 2008

- **Expanding Sphere for Deutsche Telekom**
  - Hanover and Berlin, Germany, 2010

- **Simons Center, Stony Brook University**
  - Stony Brook, New York, USA, 2010
ZIGGY DROZDOWSKI  BSEng
Director of Technology

Ziggy joined Hoberman Associates in 2004 as a core team member. His educational background has helped him to introduce a more modular systems approach to Hoberman’s well established kinematics and mechanical expertise. Ziggy has designed and implemented the motion control systems on all of Hoberman’s most recent sculptural installations, and has specified systems for the large shade arrays designed for Audiencia Provincial and Tribunal Superior de Justicia in Madrid. His work has also been integral in advancing the company’s use of digital modeling tools through more advanced scripting and simulation techniques for both mechanical and motion design.

Disciplines
Control System Design, 3D Modeling

Qualifications
BSEng (Electrical Engineering and Acoustics)

Education
The Cooper Union, 2000-2004

Memberships
ACADIA

Hoberman
2004 – Present

Other
Automation and Controls, Adaptive Building Initiative, 2008 - Present

Key project information

Expanding Helicoid, Discovery World
Milwaukee, Wisconsin, USA, 2006

Adaptive Fritting, Harvard Graduate School of Design
Cambridge, Massachusetts, USA, 2009

POLA Ginza Façade
Tokyo, Japan, 2009

Wyss Institute, Harvard University
Boston, Massachusetts, USA, 2010

Audiencia Provincial, Ciudad de Justicia
Madrid, Spain, 2006-2011

Emergent Surface, Museum of Modern Art
New York, New York, USA, 2008

Aldar Central Market
Abu Dhabi, United Arab Emirates, 2006-2011

Expanding Sphere for Deutsche Telekom
Hanover and Berlin, Germany, 2010

Simons Center, Stony Brook University
Stony Brook, New York, USA, 2010

Tribunal Superior de Justicia, Ciudad de Justicia
Madrid, Spain, 2006-2011
CRAIG HOLLAND  BA
Director of Business Operations

Craig Holland, a graduate of the University of Massachusetts at Amherst, has spent his entire career helping emerging businesses achieve success. After earning a Commonwealth Scholar distinction for his studies in Economic Theory, Craig worked for Digi-Block, Inc., a Boston-based start-up that manufactured and distributed a research-based system that allows students to discover arithmetic and basic algorithms visually. As a manager of Digi-Block’s consulting division, Craig was responsible for recruiting, training, setting protocol, and managing operations for its 30 consultants nationwide.

After leaving Digi-Block in 2003, Craig founded The Archive, a café, and media center in the East Williamsburg neighborhood of Brooklyn. The facility quickly became a successful staple of the neighborhood and is today a community landmark.

Craig joined Hoberman Associates in 2006 to manage growth in its product design division. His responsibilities include operational and financial management, recruitment of new talent, and all external outreach and communication. Craig helps structure successful client relationships by ensuring proper allocation of internal resources, communicating client concerns within Hoberman, and applying a business perspective to the design process that balances market viability with aesthetic considerations.

Most recently Craig has taken on an operations and marketing management role for the Adaptive Building Initiative (ABI) -- a joint venture between Hoberman Associates and Buro Happold. In this capacity he has helped frame the vision for ABI’s external presence, its strategic focus, and management of its daily business operations.

Disciplines
Business Operations, Product Strategy

Qualifications
BA (Social Thought and Economic Theory)

Education
University of Massachusetts, Amherst 1996-2000

Hoberman
2006 – Present

Other
Operations and Marketing Management, Adaptive Building Initiative, 2008 - Present

Statement of Qualifications
The new Campus of Justice in Madrid is the largest single site dedicated to law courts in Europe. Following the master plan, Foster + Partners has designed two distinct circular buildings, the larger of which is the Audiencia Provincial (Appeals Court).

This building has been designed to minimize unwanted solar gain, while allowing natural daylight inside. As a key part of this environmental strategy, Hoberman was contracted to develop several customized shading systems. Within the Audiencia Provencial, the shading units will occupy the central circular atrium along with the eight peripheral atria.

The atrium roof is populated with a unique series of hexagonal shading cells, which, when extended cover the triangulated roof grid. When retracted their profiles ‘disappear’ into the structural profiles of the roof. The shading system utilizes the Strata™ system from Adaptive Building Initiative (ABI), Hoberman’s joint venture with Buro Happold.

During the day, the primary function of the system will be sun shading. An algorithm combining historic solar gain data with real-time sensing of light levels will control the shading units. Environmental analysis was conducted through ABI.

Key project information

<table>
<thead>
<tr>
<th>Architect</th>
<th>Foster + Partners</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dates</td>
<td>Project start 2006</td>
</tr>
<tr>
<td></td>
<td>Anticipated completion 2011</td>
</tr>
<tr>
<td>Location</td>
<td>Madrid, Spain</td>
</tr>
<tr>
<td>Type</td>
<td>Indoor</td>
</tr>
<tr>
<td>Material</td>
<td>Aluminum</td>
</tr>
<tr>
<td>Major dimensions</td>
<td>Largest array covers approximately 700m²</td>
</tr>
<tr>
<td>Actuation</td>
<td>Each unit driven by a servo motor with custom array control</td>
</tr>
</tbody>
</table>

Role

Shading System Design Principal, Technology Inventor and Patent Holder, Consultant to Architect

Services provided

Concept Design, Kinematic and Geometric Rationalization, Mechanical Engineering, Control System Design, Full Specification Package
ADAPTIVE ARCHITECTURE
Tribunal Superior de Justicia

The new Campus of Justice in Madrid is the largest single site dedicated to law courts in Europe. Following the master plan, Foster + Partners has designed two distinct circular buildings: the smaller of which is the Tribunal Superior de Justicia (High Court).

Environmentally, the building has been designed to minimize unwanted solar gain, while allowing natural daylight inside. As a key part of the environmental strategy, Hoberman was contracted to develop customized shading systems. Within the Tribunal Superior de Justicia, the shading units will occupy the central atrium which has a trapezoidal plan.

The shading system consists of series of four-sided shading cells implementing the Strata™ system from Hoberman’s joint venture with Buro Happold, Adaptive Building Initiative (ABI). Covering the triangulated roof grid when extended, their retracted profiles ‘disappear’ into the structural grid of the roof.

During the day, the primary function of the system will be sun shading. An algorithm combining historic solar gain data with real-time sensing of light levels will control the shading units. Environmental analysis was conducted through ABI.

Key project information

Architect  
Foster + Partners

Dates  
Project start 2006
Anticipated completion 2011

Location  
Madrid, Spain

Type  
Indoor

Material  
Aluminum

Major dimensions  
450m² Total coverage

Actuation  
Each unit driven by a servo motor with custom array control

Role  
Shading System Design Principal, Technology Inventor and Patent Holder, Consultant to Architect

Services provided  
Concept Design, Kinematic and Geometric Rationalization, Mechanical Engineering, Control System Design, Full Specification Package

Rendering by Foster + Partners
Hoberman designed a dynamic installation for the Stony Brook Foundation’s new Center for Geometry and Physics. Serving as both the building’s artistic centerpiece and as a functional piece of shading, the installation is a floor-to-ceiling composition of Adaptive Building Initiative’s Tessellate™ panels. Hoberman designed each panel to have a unique geometric pattern of perforations that mirrors the research focus of the building’s resident scientists and mathematicians. As these patterns align and diverge, the visual effect is of sparse geometric patterns — hexagons, circles, squares, and triangles — that blossom into an opaque mesh. The result is a kinetic surface that spans 124 square meters and imbues the building with the functional capacity to dynamically change its opacity and sculpt the quality of light within.

A second, complementary installation, an artistic steel gate, was created for an adjoining art gallery. After gallery hours, the gate’s static perforated steel panels create an undulating field of curved, intersecting lines. By day, these panels cleanly fold together to create a three-dimensional sculpture within the gallery. Parametrically generated by the planar slicing of a twisted cubic form, the stacked form creates twisting, open volumes — a play on positive and negative space — with dynamic sight lines that change as visitors walk around it.

Both installations were delivered through Hoberman venture Adaptive Building Initiative and partner A. Zahner Co.

**Key project information**

**Architect**  Perkins Eastman  
**Date**  2010  
**Location**  Stony Brook University  
Stony Brook, NY, USA  
**Type**  Indoor  
**Material**  Stainless steel, glass  
**Major dimensions**  5.4m high x 6.7m wide  
**Actuation**  8 Stepper-driven linear actuators  

**Role**  Shading System Design Principal, Technology Inventor and Patent Holder, Consultant to Architect  

**Services provided**  Concept Design, Kinematic and Geometric Rationalization, Mechanical Engineering, Control System Design, Full Specification Package
ADAPTIVE ARCHITECTURE
Wyss Institute at Harvard University

The Wyss Institute for Biologically Inspired Engineering commissioned Hoberman to create an installation for the main entrance to its new home at Harvard University. An installation in two parts, it encompasses the main sliding glass doorway and an adjacent moving glass partition-wall.

Hoberman utilized Adaptive Building Initiative’s technology Adaptive Fritting™ for both installations. The Institute’s door is adorned with a gradated pattern of hexagonal dots in slender floor-to-ceiling panels that continually shift in transparency. Together these panels run through a computer-controlled routine both random and choreographed — until approached by a visitor to the Institute, which triggers a sequence that precludes the door’s opening.

Stepping through the doorway presents visitors with a full-color partition wall, for which Hoberman explored the merging of 3-dimensional design with 2-dimensional artwork. A grid of twelve custom Adaptive Fritting™ units continually shifts its color, transparency, and imagery, at moments aligning into one of two alternate images. Fitting with the focus of the Wyss Institute, the artwork is based on photographs from nature and architecture; custom software created by Hoberman was used to abstract the images and apply a custom color-palette complementing the Institute’s interior design and architecture.

Both installations were delivered through Hoberman venture Adaptive Building Initiative and its network of partners.

Key project information

Architect: Payette
Date: 2010
Location: Harvard University
Type: Indoor
Material: Acrylic, aluminum, steel, glass
Major dimensions: 2 installations, each approximately 3m high x 3.6m wide
Actuation: 24 Servo motors

Role
Shading System Design Principal, Technology Inventor and Patent Holder, Consultant to Architect

Services provided
Concept Design, Kinematic and Geometric Rationalization, Mechanical Engineering, Control System Design, Full Specification Package
ADAPTIVE ARCHITECTURE
Aldar Central Market

Abu Dhabi’s historic Central Market is being transformed into a dynamic new quarter with markets, shops, offices, apartments, and hotels. One of the oldest sites in the city, Central Market will be a reinterpretation of the traditional marketplace and a new civic heart for Abu Dhabi. The project comprises a combination of lower-rise, ecologically sensitive levels of retail, roof gardens—forming a new public park—and three towers.

Using the Hoberman venture Adaptive Building Initiative’s adaptive shading system, Permea™, Hoberman Associates developed several exterior shading roofs for three public squares within the retail complex.

The kinetic design works off of an operable grid. In its covered configuration, the shading roof will resemble a traditional coffered Islamic roof. When retracted, the roof will become a slender lattice that complements the Foster team’s designs for fixed shading.

Roof system construction and testing for first public square completed in Spring 2010 and opened to the public in Fall 2010. Additional public squares are currently under construction.

Key project information

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Date</td>
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<tr>
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<td>280m² Total coverage</td>
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<tr>
<td>Actuation</td>
<td>Each unit driven by a single servo motor with custom array control</td>
</tr>
<tr>
<td>Role</td>
<td>Shading System Design Principal, Technology Inventor and Patent Holder, Consultant to Architect</td>
</tr>
<tr>
<td>Services provided</td>
<td>Concept Design, Kinematic and Geometric Rationalization, Mechanical Engineering</td>
</tr>
</tbody>
</table>
ADAPTIVE ARCHITECTURE
POLA Ginza Façade

Hoberman Associates was requested by POLA, a Japanese cosmetics manufacturer, to develop an adaptive shading system for its new showroom building in Tokyo in the Ginza district. This system has been developed in collaboration with design architect, Yasuda Atelier, and executive architect Nikken Sekkei.

The fourteen-story building, which opened in October 2009, has approximately 185 individually controlled shutter mechanisms that are housed within the double glazing of the façade. Each shutter has dimensions of approximately one by three meters, and is made of an acrylic sheet that has been formed into a curved surface.

Key project information

Architect  Nikken Sekkei + Yasuda Atelier  
Date  2009  
Location  Tokyo, Japan  
Type  Indoor  
Material  Acrylic  
Major dimensions  185 Individual 1m x 3m units  
  930m² Total coverage  

Role
Shading System Design Principal, Consultant to Architect

Services provided
Concept Design, Kinematic and Geometric Rationalization, Mechanical Engineering

Photos by Mamoru Ishiguro
Hoberman created a dynamic installation for Harvard Graduate School of Design based on Adaptive Building Initiative’s shading technology, Adaptive Fritting™. As with standard fritted glass, this technology utilizes a graphic pattern in order to control heat gain and modulate light, while allowing sufficient transparency for viewing.

Adaptive Fritting™ builds on the practice of standard fritting with the addition of real-time dynamic motion via motorized control. While conventional fritting relies on a fixed pattern, Adaptive Fritting™ can control its transparency and modulate between opaque and transparent states. This performance is achieved by shifting a series of fritted glass layers so that the graphic pattern alternately aligns and diverges.

The installation at Gund Hall consists of six motorized panels comprising a 7.3 meter by 1.2 meter window, housed within a curved wall. These panels are programmed to form a dynamic field where light transmission, views, and enclosure continuously adapt and change. As the panels transform, the visual effect is of sparse dots blossoming into an opaque surface.

Winner of the Wyss Prize for Bioinspired Adaptive Architecture, the installation was commissioned for a joint exhibition and conference titled Ecological Urbanism: Alternative and Sustainable Cities of the Future.

Key project information

**Client**  
Harvard Graduate School of Design

**Date**  
2009

**Location**  
Harvard University  
Cambridge, Massachusetts, USA

**Type**  
Indoor

**Material**  
Aluminum, Acrylic

**Major dimensions**  
7.3m long x 1.2m high

**Actuation**  
6 Servo motors

**Role**  
Design Principal, Technology Inventor and Patent Holder

**Services provided**  
Concept Design, Kinematic and Geometric Rationalization, Mechanical Engineering, Fabrication and Testing, Installation, Control System Design and Implementation
KINETIC SCULPTURE

Expanding Sphere at CeBIT 2010

Hoberman installed an updated version of its classic Expanding Sphere at the center of the Deutsche Telekom (parent company of the T-Mobile brand) booth at the 2010 CeBIT trade fair in Hanover.

Hoberman was contracted by q~bus Mediatektur, the innovative Berlin-based company responsible for the design and realization of Deutsche Telekom’s 6000 square meter booth—a technologically sophisticated brand environment that included an interactive multi-user environment incorporating 25 megapixels of video displays.

Suspended centrally above this environment, the Expanding Sphere was “the heartbeat of the stand,” rhythmically pulsing and casting shadows onto the curved walls of the booth. The sphere, capable of expanding from 1.3 to 4.5 meters, is made from milled aircraft aluminum and has a refined geometry with curved struts and hubs and cleverly concealed assembly details; all powder-coated in white for a sleek, modern aesthetic.

Every hour, the booth would come alive in a multimedia brand presentation with the motto “big changes start from scratch,” the Expanding Sphere dynamically growing and interacting with an elaborate choreography of lighting and LED video displays.

The high visibility and dynamism of the sphere contributed to the exhibit’s success, drawing over 38,000 people daily, with more than 190,000 visitors total—well over half of all visitors to CeBIT 2010.

Key project information

Architect: q~bus Mediatektur
Date: 2010
Location: Hanover, Germany
Type: Indoor
Material: Powder-coated aluminum, steel
Major dimensions: 4.5m D extended; 1.3m D retracted
Actuation: Single 1hp servo motor

Role

Sphere Design Principal, Technology Inventor and Patent Holder, Consultant to Architect

Services provided

Kinematic and Geometric Rationalization, Mechanical Engineering, Fabrication and Testing, Installation, Control System Design and Implementation

Statement of Qualifications
KINETIC SCULPTURE
Expanding Video Screen for 360° Tour

Hoiberman Associates and Buro Happold, in support of Innovative Designs and its parent company Barco, created the centerpiece for the U2 360° tour – the Expanding Video Screen.

While large video screens are a familiar fixture for arena style rock concerts, U2 was looking for something unprecedented for its 360° tour – a giant screen that could change its size and shape.

Hoiberman, along with U2’s creative team of Willie Williams and Mark Fisher, and Frederick Opsomer of Innovative Designs, collaborated to conceptualize this fusion of architecture, stage scenery and extreme technology. They came up with a design for an elliptical video display, approximately the size of a tennis court that could morph into a 7-story high cone-shaped structure, enveloping the band as it extends.

To create the Expanding Video Screen's atypical design, Hoiberman and its structural engineering partners, Buro Happold, had to overcome multiple technical challenges. These included: designing a structure that could withstand high winds and inclement weather, last the rigors of an 18-month tour, and be able to assemble in eight hours and disassemble in six hours for transport.

Key project information

Client: U2 360° Tour
Date: 2009
Type: Outdoor
Material: Stainless Steel, Aircraft Aluminum
500,000 LED Pixels
Major dimensions:
- 24.5m long x 16.5m wide
- 7m high (Retracted)
- 20.5m high (Extended)
Screen Area: 380m²
Weight: 54,000kg
Actuation:
- Sixteen 2-ton & 24 1-ton chain hoists
- Eight 8-ton servo motors

Role:
Concept Co-Designer, Project Lead for Screen Mechanics

Services provided:
Concept Co-Design, Kinematic and Geometric Rationalization, Mechanical Engineering, Testing Oversight

Photos © Stufish
LIVE ENTERTAINMENT

Hoberman Arch for 2002 Winter Olympics

The Hoberman Arch is a 10.7m tall, 22m wide transforming curtain that was installed in front of the stage at Olympic Medals Plaza. It provided a magical, artistically engineered performance—including music, lighting, and dancers—to signal the start of each evening's medal ceremony, witnessed by an estimated 3.5 billion people worldwide. When open, it revealed the Olympic flame.

The conceptual design of the Hoberman Arch combined pioneering mechanical and structural technology; the screen is both a mobile mechanism and load-resisting structure.

It is an example of structure/mechanism synergy in that the main struts provide the operational geometric symmetry and mechanical impulse, and also have the required strength to carry panel loads.

Key project information

- **Client**: 2002 Winter Olympics
- **Date**: 2002
- **Location**: Salt Lake City, USA
- **Type**: Outdoor
- **Material**: Aluminum, Steel, LUMAsite® (Fiberglass reinforced acrylic)
- **Major dimensions**: 10.7m tall, 22m wide
- **Actuation**: Two 30 Hp synchronized winches

Role

Design Principal, Technology Inventor and Patent Holder

Services provided

- Concept Design, Kinematic and Geometric Rationalization, Mechanical Engineering, Fabrication and Testing Oversight, Installation Oversight
KINETIC SCULPTURE
Emergent Surface

Based on new technologies for adaptive building skins, Emergent Surface is a wall that continuously reconfigures itself—portions selectively disappearing and reappearing. In one condition, the piece appears as a solid surface with three-dimensional curvature. In another, it resolves itself into seven slender poles, running floor to ceiling. And between these extremes lie an infinite variety of configurations.

These different states represent the physical embodiment of digital information. As such, Emergent Surface represents a kind of ‘material media’, operating not on bandwidths of light and sound, but in terms of variable solidity and permeability.

Emergent Surface utilizes Adaptive Building Initiative’s Strata™ shading system as a means to transform. This commission represented a significant advance in research and development of Strata™ and was the first structure to physically demonstrate its capabilities.

Key project information

Client Museum of Modern Art
Date 2008
Location New York, New York, USA
Type Indoor
Material Aluminum, Stainless Steel
Major dimensions 5.5m tall, 4m wide
Actuation 24 Servo motors and custom control system

Role
Design Principal, Technology Inventor and Patent Holder

Services provided
Concept Design, Kinematic and Geometric Rationalization, Mechanical Engineering, Fabrication Oversight, Assembly and Testing, Installation, Control System Design and Implementation

Statement of Qualifications
Beginning as a tight cluster, the Expanding Helicoid smoothly expands to fill the spiral staircase at the center of Discovery World’s permanent biotech exhibit. Visitors have the remarkable sensation of being inside the sculpture: As it contracts, it seems to disappear into the stairwell; as it expands, it seems to grow like a living plant. Bound by two spirals, like the DNA double helix it resembles, the helicoid itself is like a living organism, evolving as it expands.

Key project information

Client: Discovery World  
Date: 2006  
Location: Milwaukee, Wisconsin, USA  
Type: Indoor  
Material: Aluminum, Stainless Steel  
Major dimensions: 12m tall, 3.6m wide (when fully extended)  
Actuation: Single 3/4 Hp servo winch

Role

Design Principal, Technology Inventor and Patent Holder

Services provided

Concept Design, Kinematic and Geometric Rationalization, Mechanical Engineering, Fabrication Oversight, Assembly and Testing, Installation, Control System Design and Implementation

Photos by Nick Grygiel
The first outdoor installation of the Iris Dome appeared beside the German Pavilion at Expo 2000—the World’s Fair in Hannover, Germany. The Dome celebrated the reconstruction of Dresden’s legendary Frauenkirche Cathedral, which was destroyed during World War II. The structural profile recalled the dome of the original cathedral. Suspended on a colonnade, visitors could enter the cupola formed by the dome to view a scale model of the reconstructed cathedral.

**Key project information**

- **Client:** 2000 World’s Fair
- **Date:** 2000
- **Location:** Hanover, Germany
- **Type:** Outdoor
- **Material:** Aluminum, Steel
- **Major dimensions:** 10.2m tall (when fully extended), 6.2m diameter
- **Actuation:** Four synchronized hydraulic actuators

**Role**

Design Principal, Technology Inventor and Patent Holder

**Services provided**

Concept Design, Kinematic and Geometric Rationalization, Mechanical Engineering, Fabrication and Testing Oversight, Installation Oversight
The Hoberman Sphere has had many lives — as a popular children’s toy, a piece of public art, and now as a satellite. Hoberman Associates is adapting its popular sphere for use as a radar calibration satellite for the U.S. Naval Research Laboratory (NRL).

Navy scientists approached Hoberman, because they were seeking a perfectly spherical target that could be packed tightly into a rocket payload. Unlike inflatable structures, the Hoberman Sphere will last much longer in orbit and produce a superior cross-section for calibration of radar arrays. This global network of radar arrays study the Earth’s upper atmosphere, ionosphere, and connection with space.

Hoberman developed a comprehensive program for launching the satellite into space including: exploring various geometries to optimize radar cross-section, developing proprietary software for analyzing advanced kinetic structures with our partners Buro Happold, developing assembly and testing procedures to ensure successful launch, fabrication and assembly of the satellite, and designing and engineering the launch capsule that protects the sphere during launch.

Key project information

Client: Naval Research Laboratory
Dates: 2011 Launch
Location: Low Earth Orbit
Material: Aluminum
Major dimensions:
- 1.3m Diameter (retracted)
- 10.2m Diameter (maximum deployment)
Actuation: One-time tensioned spring deployment

Role:
Lead Designer, Technology Inventor and Patent Holder

Services provided:
Concept Design, Kinematic Optimization, Mechanical Engineering
OTHER TRANSFORMABLE PROJECTS/PRODUCTS

RDS Tent System

Johnson Outdoors, a major manufacturer of tents for both government and consumer markets, approached Hoberman in 2005 to develop a new line of large shelters for military use and crisis relief. Johnson’s strategic goal was to enter the growing market for rapid deployment, which they had not yet penetrated. The brief was simple: to outperform the competition in weight, speed, and durability.

Hoberman developed a unique patented system for Rapidly Deployable Shelters (RDS) under Johnson’s Eureka brand. With easier deployment and minimal time-consuming secondary connections, the RDS system uses fewer, larger, and more robust parts than competitive products. The result: Durable, affordable tents that withstand high winds, resist snow loads up to 10 pounds per square foot, and can be set up in minutes.

Buro Happold performed a complete structural analysis of the RDS, ensuring it met strict military load-bearing requirements.

The RDS comes in several sizes, the largest of which deploys to 65 square meters, and folds down to a .9m X 1m X 1.8m compact bundle. It won the Bronze IDEA award in 2008 in the Commercial Products Category.

Key project information

<table>
<thead>
<tr>
<th>Client</th>
<th>Johnson Outdoors, Eureka brand</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dates</td>
<td>Project start 2005</td>
</tr>
<tr>
<td></td>
<td>Project completion 2006</td>
</tr>
<tr>
<td>Type</td>
<td>Outdoor</td>
</tr>
<tr>
<td>Material</td>
<td>Aircraft Aluminum, Fabric</td>
</tr>
<tr>
<td>Major dimensions</td>
<td>65m² (largest model when fully deployed)</td>
</tr>
<tr>
<td>Actuation</td>
<td>Human deployment</td>
</tr>
</tbody>
</table>

Role

Design Principal, Technology Inventor and Patent Holder

Services provided

Concept Design, Kinematic Optimization, Mechanical Engineering, Fabrication and Testing Oversight
Hoberman works with an international multidisciplinary network of engineers, architects and manufacturers. Our partnerships enable us to bring in specialists that add the necessary capabilities to the project team, be it lighting and video design, structural and environmental analysis, or fabrication expertise.

**Adaptive Building Initiative**
In 2008, Hoberman and Buro Happold co-founded the Adaptive Building Initiative (ABI), dedicated to designing and delivering a new generation of buildings that optimize their configuration in real time by responding to environmental changes.

www.adaptivebuildings.com

**Buro Happold**
Buro Happold is a world-class integrated multidisciplinary company able to offer a complete range of services dealing with the built environment. Buro Happold engages in the engineering, design, management, and supervision of construction projects around the world. The practice undertakes most aspects of civil and structural engineering, environmental physics, and engineering services as well as specialist consulting services.

Buro Happold and Hoberman have a history of collaboration dating back to the Hoberman Arch for the 2002 Winter Olympics. More recent collaborations include the Rapidly Deployable Shelter and the Expanding Video Screen for U2.

www.burohappold.com

**A. Zahner Co.**
For well over 100 years A. Zahner Co. has pioneered advances in the architectural metal industry. Zahner’s work is now found in and around structures in Europe, Asia and North and South America. Headquartered in Kansas City, Missouri; U.S.A., the company maintains United States production facilities in Missouri and Texas. Zahner provides solutions for its clients through an integrated organization combining design services, engineering, fabrication and manufacturing, and construction.

In 2010, Zahner and Hoberman’s Adaptive Building Initiative formed a joint venture for the development of kinetic metal surfaces for architecture. Their first collaboration was the kinetic façade installation for the Simons Center at SUNY Stony Brook.

www.azahner.com
The Adaptive Building Initiative (ABI), founded in 2008, is a joint venture between Buro Happold and Hoberman Associates dedicated to designing a new generation of buildings that optimize their configuration in real time by responding to environmental changes.

Adaptation is essential to managing the problem of climate change. To meet this growing challenge, ABI creates the products, systems, and tools that achieve new levels of sustainable performance.

ABI designs and produces adaptive façades and building envelopes. By controlling light levels, solar gain, and thermal performance, our adaptive systems reduce energy usage, enhance comfort, and increase the flexibility of the built environment. Additionally, we develop adaptive strategies that can be effectively applied to a wide range of other building systems.

ABI draws on a portfolio of systems that we customize to deliver complete, comprehensive, and integrated solutions for specific projects. Successful delivery requires full involvement through project completion: Our offerings include design, engineering and analysis, prototyping, sourcing, control system integration, manufacturing and installation oversight, and whatever else the project requires.

This work is based on decades of experience in developing and delivering movable objects, ranging from architectural-scale structures to hand-held products. While an independent entity, ABI’s cross-disciplinary team combines the expertise of its parent companies, Buro Happold and Hoberman Associates. Our team draws in structural, mechanical, and electrical engineers; environmental analysts; architects; software engineers; building information modelers; and industrial designers.
Buro Happold, a founding partner with Hoberman of the Adaptive Building Initiative, is a world-class integrated multi-disciplinary company able to offer a complete range of services dealing with the built environment. In addition to ABI, Buro Happold and Hoberman Associates have collaborated on a number of key projects including the Olympic Arch, Rapidly Deployable Shelter, and Expanding Video Screen for the U2 360° world tour.

As a practice, Buro Happold engages in the engineering, design, management and supervision of construction projects throughout the world. The practice undertakes most aspects of civil and structural engineering, environmental physics and services engineering as well as specialist consulting services. Buro Happold practices from a world wide network of twenty-two offices located in twelve countries.

As is the case with all large-scale Hoberman projects, our structures combine pioneering mechanical and structural technology; they are both mobile mechanisms and load-resisting structures. For this reason, our projects require intense collaboration with Buro Happold, who optimize and certify our designs.

**Services**

- Extensive Building Services
- Structural Engineering
- Mechanical Electrical and Plumbing Engineering
- Infrastructure & Transport Planning
- Geotechnical Engineering
- Sustainable Building Design
- Sustainable Master Planning
- LEED Consultation
- Simulation Analysis
- Building Information Modeling
- Quantity Surveying
- Project Management
- Construction Expertise
OUR NETWORK

Curtis R. Priem Experimental Media and Performing Arts Center (EMPAC)

EMPAC is an experimental media and performing arts center that is constructed on a hillside on the campus of Rensselaer Polytechnic Institute as part of a $250m capital improvement campaign. The center is 50,000sqm with a 1200 seat concert hall and a 400 seat theater. It houses 2 state of the art studio environments for performing arts and cutting edge visualization research for the institute.

The design team was given a mandate to achieve LEED rating of silver to the university. Buro Happold has been responsible for LEED coordination with the design team and has assisted the client with the LEED accreditation process on this large and complicated project. Buro Happold’s services included defining sustainable design goals, identifying environmentally responsible design opportunities, explaining the intent of the LEED ratings and points, and performing LEED assessment at the various stages of design.

Buro Happold also provided the design team with expertise in energy efficient environmental control for the building. Computational Fluid Dynamics and Thermal modeling were used to optimize environmental control systems in the large concert hall and theaters and aid engineers in the selection and sizing of mechanical systems. The result is a reduction in energy consumption while ensuring occupant comfort.

Key project information

Client: Rensselaer Polytechnic Institute
Architect: Nicholas Grimshaw and Partners USA
Project value: $150M
Date: Completed 2008
Location: Troy, New York, USA

Services provided by Buro Happold

Structural Design, MEP Engineering, Sustainability/LEED, Ground Engineering
British Museum
This project consisted of structural and MEP engineering consultancy for the refurbishment of the Queen Elizabeth II Great Court at the prestigious British Museum in London, including design of the groundbreaking lattice roof which covers the central courtyard.

The roof is made up of intricate steel and glass lattice work which creates a delicate and unobtrusive canopy that does not necessitate supporting columns. Covering the roof with 20,000 square meters of glazing changed the environment below and in the neighboring museum spaces. Buro Happold MEP engineers ensured comfort through layering several different environmental mechanisms. The new MEP installations fit discreetly with minimum intervention into the building fabric and have reduced the potential fabric energy loss to the existing buildings by 55-65%.

Buro Happold were also involved in the refurbishment of the infrastructure of the Great Court which includes a new lower level, accommodating an education centre, schools area and African galleries. There are also lifts, two main staircases and a bridge link connecting to the upper galleries.

**Key project information**

<table>
<thead>
<tr>
<th>Client</th>
<th>British Museum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Architect</td>
<td>Norman Foster + Partners</td>
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<tr>
<td>Project value</td>
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<td>Date</td>
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<tr>
<td>Location</td>
<td>London, UK</td>
</tr>
</tbody>
</table>

**Services provided by Buro Happold**

Structural Engineering, MEP Engineering
Millenium Dome

One of the most recognized landmarks in the UK and the largest of its kind in the world, the Millennium Dome was completed in 1999 in readiness for the national turn-of-the-century celebrations. The Dome was built to house a series of exhibition spaces and core buildings.

The roof of the Dome is a huge cable net, 320m in diameter and clad in 80,000m² of tensioned PTFE coated glass fiber fabric. It is an innovative feat of engineering yet simple in concept, and was the recipient of the prestigious MacRobert Award in 1999. The roof surface is shaped like a spherical cap. Twelve 100m-high steel masts extend from the roof that support a tensioned net of steel cables, arranged radially on the surface of the Dome and held in place by hangar and tie-down cables at 25m intervals. An inner layer of covering reduces thermal gain and improves thermal and acoustic performance.

Key project information

Client: The New Millennium Experience Company Limited
Architect: Richard Rogers Partnership
Project value: £750M
Date: Completed 1999
Location: London, UK

Services provided by Buro Happold

Structural Engineering, Long Span and Lightweight Structures, Façade Engineering, Planning Supervision, Site Supervision, Quantity Surveying, Geotechnical Engineering, Waste Water Solutions, Site Infrastructure, Building Services Engineering, Fire Safety Design and Risk Assessment, Project Management
For over 110 years Zahner has pioneered advances in the architectural metal industry, by developing and applying the science of metal fabrication and aircraft-grade engineering technologies. Zahner is known throughout the world for precision craftsmanship in the production of designs by bold architects. The museum level craft and engineering that Zahner consistently provides can be found in both North & South America, Europe, Asia & the Middle East.

The heart of our product beats at the intersection of art and function. Our Inverted Seam™ roofs are stunningly smooth planes of metal which catch, control, and divert 100% of precipitation even during the heaviest storms. We’ve developed, as part of our Zira™ Visualization System, metal sun-screens engineered to allow maximum light-entry with minimal temperature displacement. Our Hands of the Artist program gives artists access to our engineers and craftsmen, enabling any artist to produce elegantly realized artworks whose quality matches that of the finest museums in the world. Our team is proud of the work we do, both large and small.

Services

- Consultation
- Design assist services
- Fabrication/manufacturing
- Installation/construction