THE ATLANTIC TEAM
THE A - TLANTIC TEAM
THE ATLANTIC TEAM
THE ATLANTIC TEAM
THE ATLANTIC TEAM
Architects
ATLANTA TEAM

Bryce Carter
Stanford University

Damian Jakubowski
Aalborg University
Structural Engineers
ATLANTIC TEAM

Ming Hong
Stanford University

Marcella Suta
Stanford University
Construction Managers

ATLANTIC TEAM
Joao Santus
Denmark Technical University

Mechanical, Electrical, Plumbing

ATLANTIC TEAM
“It was a pleasure and a privilege to be a part of Atlantic Team’s process this year. Their commitment to embracing the spirit of interdisciplinary collaboration and industry innovation led to their Transition phase deep into the course, which was both risky and challenging, but ultimately rewarding. I am proud of the resulting product, process, and most importantly, TEAM that have emerged from this course.”
Project Location

Madison, WI
„77 Square Miles Surrounded by Reality“
Wisconsin | USA
Project Location

Madison, WI

“Built on an isthmus and surrounded by lakes, Madison blends the city and campus, green spaces and urban areas, to create a place unlike anywhere else. Take a trip around the sun with us and explore for yourself.”
Team Process | Transparency

TRANSPARENCY DEFINITION
Lack of hidden agendas or conditions, accompanied by the availability of full information required for collaboration, cooperation, and collective decision making.
Decision Matrix

TEAM

JAKOB JØRGENSEN
ARCHITECTURAL OWNER

„Decision matrix is not only about buildings performances, but about the design that drives you to challenge yourselves.”
Madison
Winter
Analysis

TEAM

Humid Continental Climate
Hot & Humid Summers; Cold & Snowy Winters
Wind Analysis

Spring

Summer

Fall

Winter

- 2-5 mph
- 5-7 mph
- 7-10 mph
- 10-15 mph
- 15-20 mph
- 20+ mph
Team
Sun Path
Average Temperatures

DRY BULB TEMP
(degrees F)

- 28% < 32
- 55% 32 - 68
- 15% 68 - 79
- 2% 79 - 100
- 0% > 100
Average Precipitation and Snowfalls
Analysis

Humid Continental Climate
Hot & Humid Summers; Cold & Snowy Winters
Site Analysis

Challenges, Hazards, Opportunities

Challenges Lead to Innovation
Team Challenges

- Tight Site
- Diurnal Temperature Variation
- Pedestrian Traffic
Hazards

- High Water Table
- Low Overall Sun Exposure
- Weak Soil Types
Opportunities

Lake Mendota
Opportunities

Outdoor Culture

Muir Woods

Memorial Terrace
“Education should influence people’s lives beyond the boundaries of the classroom within the state”
Shan Shui (literally: "mountain-water") refers to a style of traditional Chinese painting that involves or depicts scenery or natural landscapes, using a brush and ink rather than more conventional paints. Mountains, rivers and often waterfalls are prominent in this art form.
Footprint
山 | Mountain
Journey
水 | Water
山水
Floor Plans

The Journey Through the Building
From the Water to the Mountain
Architecture

2nd Floor

- Small Classroom
- Large Classroom
- Faculty Office
- Student Office
- Egress
- Bathroom
- Journey
Natural Elements

Architecture and MEP Collaboration

Building Adaptation to Local Conditions

Glare Analysis, Natural Ventilation, Green Walls
Daylight and Lighting

Average Daylight Factor
2.8%

70% of Building Area
250 Lux
Glare and Shading

Northwestern Corner Facade
Natural Ventilation
3rd Floor
Natural Ventilation Section
Biophilia

Green Wall

Negligible Air Quality Benefits
Indoor Climate

Mechanical, Electrical, and Plumbing

Mechanical System Information

Adapt the System to the Climate
Climate Considerations

High Range of Temperature
Compact footprint
Minimize MEP Interactions
Energy Demands

- Heating: 39%
- Cooling: 21%
- Lighting: 19%
- Ventilation: 13%
- Miscellaneous: 8%
Sources of Energy

- Grid energy: 74%
- Renewables: 26%
System Scheme

**Primary Systems**
- CoGeneration Facility
- PV panels & Solar Collectors
- Earth Tubes

**Secondary Systems**
- Displacement Ventilation
- Standard Ventilation
Floor Plans

Mechanical, Electrical, and Plumbing
Mechanical

2\textsuperscript{nd} Floor

- Air return ducts
- Air supply ducts
- Vertical shaft
- Air handling unit
- Air supply diffuser
- Air return grill dropped ceiling
- Air return grill
Mechanical

3rd Floor

- Air return ducts
- Air supply ducts
- Vertical shaft
- Air handling unit
- Air supply diffuser
- Air return grill
- Dropped ceiling
- Air return grill
Mechanical

4th Floor

Air return ducts
Air supply ducts
Vertical shaft
Air handling unit
Air supply diffuser
Air return grill
dropped ceiling
Air return grill
Fan coil unit
Renewables
Mechanical, Electrical, and Plumbing

Solar Panels, Collectors, and Earth Pipes
Minimizing the Use of Fossil Fuels for MEP
Solar Devices

### Photovoltaic panels

<table>
<thead>
<tr>
<th></th>
<th>Number of Panels</th>
<th>Total Area (ft²)</th>
<th>Net Energy Output (kWh/day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solar panels</td>
<td>93</td>
<td>1330 sqft</td>
<td>54.6</td>
</tr>
<tr>
<td>Electricity from PV panels</td>
<td>70</td>
<td>1510 sqft</td>
<td>190</td>
</tr>
</tbody>
</table>

### Mechanical

Heating

- Solar collectors: 42%
- Electricity from PV panels: 12%
- Electricity from Grid: 46%
Kinetic Plates

Mechanical Interactions with Users

Creates Sustainable User Habits

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Daily</td>
<td>0.34kWh</td>
</tr>
<tr>
<td>Weekly</td>
<td>1.7kWh</td>
</tr>
<tr>
<td>Semester</td>
<td>25.5kWh</td>
</tr>
</tbody>
</table>
Earth tubes

Mechanical

3 Parallel Ducts  6 Feet Deep  100 Feet Long
PV Panels / Solar Collector

Mechanical

- PV Panels
- Solar Collectors
- Access Area
50% Clear Sky Annually
4405 Sun Hours

1,425 kWh/year/m²
3.9 kWh/day/m²
Steel Timber Hybrid System

LATERAL EARTH PRESSURE RESISTING SYSTEM
HVFA Concrete Retaining Wall

WIND RESISTING SYSTEM
Precast HVFA Concrete Shear Wall

GRAVITY RESISTING SYSTEM
Steel Frame (80% Recycled)

FLOOR SYSTEM
Glulam & CLT

EXTERIOR RAMP SYSTEM
Fiber Reinforced Polymer Beam

FOUNDATION
HVFA Isolated Footing Concrete

Sustainable Material
Local Supplier
Integration With Architecture
Prefabrication System
Panelized Construction

Structural Engineering
Section A

Permanent RC retaining wall, thickness 14 in

3 Layers of 3x0.6” Strand Anchor
Angle 15°
Spacing 7 ft

Soldier Pile and Permanent Strand Anchor

Structural Engineering
Retaining Wall
Silty clay

Bearing pressure 4 ksf

Frost line -5 ft

Foundation Material
High-volume fly ash concrete 4000 psi
Fly ash contain: 60% of the cementitious material

Structural Engineering
Foundation Detail

Isolated Footing

Foundation Detail

B = 7.4 ft | D = 1.6 ft
B = 8.8 ft | D = 1.8 ft
B = 2 ft from CL | D = 1.4 ft

Silty clay
Bearing pressure 4 ksf
Structural Engineering

Prefabricated CLT Floor Details

CLT floor panels prefabricated with Glulam Beams

Glulam Beam to Steel Beam Connection
ETABS Model and Results

Roof displacement = 0.3 in
Max drift H/500 = 1.3 in
OK
Design Loads

<table>
<thead>
<tr>
<th>Area</th>
<th>Live Load, psf</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ordinary flat, pitched, and curved roofs</td>
<td>20</td>
</tr>
<tr>
<td>Roofs used for roof gardens</td>
<td>100</td>
</tr>
<tr>
<td>Office</td>
<td>50</td>
</tr>
<tr>
<td>1st floor lobbies and corridors</td>
<td>100</td>
</tr>
<tr>
<td>2nd floor corridor</td>
<td>80</td>
</tr>
<tr>
<td>Stairs and exit ways</td>
<td>100</td>
</tr>
<tr>
<td>Auditorium with fixed seats</td>
<td>60</td>
</tr>
<tr>
<td>Classrooms</td>
<td>40</td>
</tr>
<tr>
<td>Restrooms</td>
<td>60</td>
</tr>
<tr>
<td>Instructional Lab</td>
<td>60</td>
</tr>
<tr>
<td>Partition</td>
<td>15</td>
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</table>

Wind Load

<table>
<thead>
<tr>
<th>Height (ft)</th>
<th>Windward Pressure (psf)</th>
<th>Leeward Pressure (psf)</th>
<th>Total Pressure (psf)</th>
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<tbody>
<tr>
<td>15</td>
<td>12.1</td>
<td>6.3</td>
<td>18.4</td>
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<td>32</td>
<td>14.1</td>
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<tr>
<td>56</td>
<td>15.5</td>
<td>8.5</td>
<td>24</td>
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</tbody>
</table>

Snow Load: 22 psf
1st Floor Framing Plan

- W14x43 Column
- 14” Concrete Shear Wall
- 14” Concrete Retaining Wall
- W12x16 FRP Beam
2nd Floor Framing Plan

- W14x43 Column
- 14” Concrete Shear Wall
- 14” Concrete Retaining Wall
- 5 7/16” x 18” Glulam Beam
- W12x16 FRP Beam
- W18x71 Beam
- W18x97 Beam
- W18x119 Beam

Floor Panels:
CrossLam Grade V2.1 5 Layers 5.48”
2hrs Fire Rating
3rd Floor Framing Plan

- W14x43 Column
- 14” Concrete Shear Wall
- 14” Concrete Retaining Wall
- 5 7/16” x 18” Glulam Beam
- W12x16 FRP Beam
- W18x71 Beam
- W18x119 Beam

Floor Panel:
- CrossLam Grade V2.1 5 Layers 5.48”
- 2hrs Fire Rating
4th Floor Framing Plan

Structural Engineering

- W14x43 Column
- 14” Concrete Shear Wall
- 14” Concrete Retaining Wall
- 5 7/16” x 18” Glulam Beam
- W12x16 FRP Beam
- W18x71 Beam
- W18x130 Beam

Floor Panel:
CrossLam Grade V2.1 5 Layers 5.48”
2hrs Fire Rating
Structural Engineering

Roof Plan and Connection Details

Steel Beam to RC Wall Moment Connection

Timber Beam to RC Wall Connection

- W14x43 Column
- 14” Concrete Shear Wall
- 14” Concrete Retaining Wall
- 5 7/16” x 18” Glulam Beam
- W16x26 Beam
- W18x71 Beam
Site Logistics

Site Access, Equipment, and Plan

“Let’s Float it in on a Barge!”

“Not a Chance, Damian”
Limited Access Site

Construction Management

Just-In-Time Delivery

ORDERING  PLANNING  PRE-ARRANGING  INSPECTION  PACKING  LOADING  STRAPPING  LEAVING
Other Equipment

- CAT 336F L Excavation $2,500/Month
- John Deere 410e Hauling $1,500/Month
- Forklift Interiors $1,300/Month
- Telehandler Façade $3,900/Month
Crane Selection

Liebherr EC-B 5 Tower Crane

Footprint: 10’ x 10’
Max. radius: 150’
Cost: $20,000 / Month

Construction Management

Max. radius: 150’
Cost: $20,000,000 / Month

<table>
<thead>
<tr>
<th>m</th>
<th>r</th>
<th>m/kg</th>
<th>r</th>
<th>m/kg</th>
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<td>17,5</td>
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<table>
<thead>
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<td>49,5</td>
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<td>50,0</td>
<td>2500</td>
<td>2.4</td>
<td>51,0</td>
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</table>
Small Site Construction Safety

RFID Tracking of Equipment

On-site Equipment Analysis

Weekly Safety Meetings and Equipment Updates
Construction Management

Pedestrian Safety and Site Integration

Protective Scaffolding  Noise Reduction Walls  Paintable Construction Exteriors
Local Construction Material Producers

- Precast Concrete
- Crane and Equipment
- WI Labor Council
- Steel Supplier
- Wood Supplier
- Ready-mix Concrete
- Glass Supplier

3 Miles
20 Miles
60 Miles
Construction Management

TVD Evolution

| Date       | Original Estimate | Delta
<table>
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<tr>
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<tr>
<td>02.mar</td>
<td>$2,000,000</td>
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<td>09.mar</td>
<td>$4,000,000</td>
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<td>16.mar</td>
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## Final Estimation

### Initial Target Value: $10,500,000

<table>
<thead>
<tr>
<th>Item</th>
<th>Estimated Value</th>
<th>Target Value</th>
<th>Value Delta</th>
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</thead>
<tbody>
<tr>
<td>A Substructure</td>
<td>$576,620</td>
<td>$735,000</td>
<td>$158,380</td>
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<tr>
<td>B Shell</td>
<td>$2,891,011</td>
<td>$2,964,238</td>
<td>$73,227</td>
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<tr>
<td>C Interiors</td>
<td>$1,354,657</td>
<td>$1,575,000</td>
<td>$220,343</td>
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<tr>
<td>D Services</td>
<td>$3,224,171</td>
<td>$3,161,133</td>
<td>($63,038)</td>
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<tr>
<td>E Equipment and Furnishing</td>
<td>$272,500</td>
<td>$309,154</td>
<td>$36,654</td>
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<tr>
<td>F Specialty Construction</td>
<td>$286,000</td>
<td>$510,761</td>
<td>$224,761</td>
</tr>
<tr>
<td>G Building Sitework</td>
<td>$596,852</td>
<td>$470,110</td>
<td>(126,742)</td>
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<tr>
<td>H General Conditions</td>
<td>$885,650</td>
<td>$761,264</td>
<td>(124,386)</td>
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**Total Estimated Value:** $10,087,460

**Total Target Value:** $9,955,950

**Value Delta:** $131,510

### Final Estimation: $10,087,460
Facade design is the best example of our team’s integration.
Team

Initial Idea
Team
Critique and Criteria

Initial Idea

All Glass Facade
Completely open to outside
Make Nature a Part of Building Through Views From Interior

Winter Presentation

Positive Feedback on Building Design as a Whole
Façade Addressed by mentors as being a problem
Brainstormed Solutions
Critique and Criteria

**Fishbowl**

All Glass Façade not up to Wisconsin Building Code

Required a Full Façade Restructure

Structural Connections Need Insulation
Fishbowl Follow-up

Meeting with John Nelson

3 Goals for Changing Façade

Aim for up to 40% Glazing for Maximum Building Performance
Satisfy all Codes as Required in Wisconsin
Think that performance is more important than the aesthetic
Final Façade Design
Team
West Facade
Building’s Envelope

Air & Water Tightness

Thermal Insulation

Avoiding Reflection
Pultruded FRP angle profile

- Fiber Reinforced Polymer
  - Thermal Insulation
  - High Moisture Resistance
  - Corrosion Resistance
  - Lightweight
Exterior Ramp

**Fabreeka Mechanical Properties**

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
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<tbody>
<tr>
<td>Tensile Strength</td>
<td>11,000 psi</td>
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<tr>
<td>Flexural Strength</td>
<td>25,000 psi</td>
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<tr>
<td>Compressive Strength</td>
<td>38,900 psi</td>
</tr>
<tr>
<td>Shear Strength</td>
<td>15,000 psi</td>
</tr>
</tbody>
</table>

**Fabreeka Thermal Break**

**FRP Deck**
Prefabrication

Façade Panel

Skeleton

20 gauge stainless steel sheet

Insulation
Construction Management

4D CAD Video
Milestone 1: Building Sitework Sept. 24

Milestone 2: Substructure Oct. 28
Construction Management

Technology in Construction Design

360

GLUE

TVD
STV
ETABS
Construction Management

Environmental Control

Sediment Traps

Erosion Control

Wheel Wash
Construction Management

4D CAD Video
Sustainability Challenge

TEAM

INTEGRATION
An act or instance of combining into an integral whole.
## Certificates

**LEED GOLD**

Building’s impact on the environment.
66/110
Gold 60-79 points

<table>
<thead>
<tr>
<th>Category</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sustainable Site</td>
<td>11/24</td>
</tr>
<tr>
<td>Water Efficiency</td>
<td>7/11</td>
</tr>
<tr>
<td>Energy &amp; Atmosphere</td>
<td>20/33</td>
</tr>
<tr>
<td>Materials &amp; Resources</td>
<td>8/13</td>
</tr>
<tr>
<td>Indoor Environmental Quality</td>
<td>15/19</td>
</tr>
<tr>
<td>Indoor in Operation &amp; Regional Priority</td>
<td>5/10</td>
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</tbody>
</table>

**WELL GOLD**

Building’s impact on the people.
70/100 Must fulfill 41 precondition + Optimizations
7 Concepts of the WELL Building Standard

<table>
<thead>
<tr>
<th>Concept</th>
<th>Score</th>
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<tbody>
<tr>
<td>Air</td>
<td>19/29</td>
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<tr>
<td>Water</td>
<td>7/8</td>
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<tr>
<td>Nourishment</td>
<td>8/15</td>
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<td>Light</td>
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<td>Fitness</td>
<td>9/11</td>
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<td>Comfort</td>
<td>5/10</td>
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<tr>
<td>Mind</td>
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## Sustainability Challenges

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<tr>
<th>Item</th>
<th>Application</th>
<th>Check</th>
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<tbody>
<tr>
<td>1. Space Efficiency</td>
<td>Site Efficiency</td>
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<tr>
<td>2. Air Quality</td>
<td>Displacement Ventilation</td>
<td>✔</td>
</tr>
<tr>
<td>3. Water</td>
<td>Tap Economizers</td>
<td>✔</td>
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<tr>
<td>4. Building</td>
<td>LEED Gold</td>
<td>✔</td>
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<tr>
<td>5. Leapfrog</td>
<td>Piezoelectric Plates</td>
<td>✔</td>
</tr>
<tr>
<td>6. Biomimicry</td>
<td>Green Walls and Façade</td>
<td>✔</td>
</tr>
<tr>
<td>7. Native</td>
<td>Materials and Suppliers</td>
<td>✔</td>
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<tr>
<td>8. Sustainable Performance</td>
<td>Energy from Natural Resources</td>
<td>✔</td>
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<tr>
<td>9. Zero Waste</td>
<td>Construction and Resources</td>
<td>✔</td>
</tr>
<tr>
<td>10. Reuse</td>
<td>Structure Materials</td>
<td>✔</td>
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</tbody>
</table>
Thank You!