VIRGINIA TECH
WAR MEMORIAL HALL

ODINSON

Presentation Agenda

1. Introduction
2. Project Analysis
3. Wellness Hub Challenge
4. Enclosure Challenge
5. Structural Systems
6. Mechanical Systems
7. Electrical Systems
8. Construction Mgmt.
9. Conclusion
Project Delivery Method

INTRODUCTION

PROJECT ANALYSIS

WELLNESS HUB

ENCLOSURE

STRUCTURAL

MECHANICAL

ELECTRICAL

CONST. MGMT.

CONCLUSION
Virtual Reality

Mechanical Site Analysis
Electrical Site Analysis

Design Guides

- LEED USGBC
- Virginia Tech
- WELL
- ODINSON
- AEI Build ASCE
AEI Build

INTRODUCTION

The process of designing, documenting, constructing, and operating buildings when implemented properly results in enhanced performance, efficiency, and value.

Warren Lotz Design Principles:
- Integrated Whole Building
- Early Involvement of Subcontractors
- Parametric Modeling and Collaborative Design

To design, document, construct, and operate energy efficient buildings for buildings, communities, building owners, and individuals that control the transmission of light, energy, moisture, and waste.

Warren Lotz Design Principles:
- High Performance Construction
- Innovative Center Focused
- Open to Systems to Make Designing

To analyze our understanding of the design, construction, and operation of buildings and to identify opportunities for improvement in the performance of buildings, to identify opportunities for improvement in the performance of buildings, and to develop strategies for achieving these objectives.

To design the construction of buildings with sustainable and cost-saving values to optimize their performance and minimize their impact on the environment and natural resources. The AEI Build design process emphasizes sustainability and environmental stewardship.

To design, document, construct, and operate buildings for buildings, communities, building owners, and individuals that control the transmission of light, energy, moisture, and waste.

Warren Lotz Design Principles:
- High Performance Construction
- Innovative Center Focused
- Open to Systems to Make Designing

Virginia Tech 2047 Master Plan

INTRODUCTION

Proposed Building

Existing Building

CONCLUSION
Project Goals

- Sustainable Design
- Innovative Solutions
- Maximize Student Wellness

WELLness Plan

War Memorial Hall Project Goals
- Deliver a sustainable project that helps maintain the energy usage of the facility.
- Design an innovative building that will remain cutting edge for years to come.
- Provide a facility that promotes health and wellness for students.

Key Design Concepts:
- Space
- Wellbeing
- Integration
- Environmental
- Design

WELLness Plan

- Enhanced Student Opportunities
- War Memorial Hall
- Design
- Innovation
- Excellence

- Exchange Sustainable Gawith
- War Memorial Hall will share the principles of social, economic, and environmental sustainability.

- Live Past, Present, and Future
- War Memorial Hall will pay tribute to the rich history of Virginia Tech, new design will reflect the existing architecture but will complement it and symbolize innovation of the past, bridging the present and future.

- Leverage Innovative Technologies
- War Memorial Hall will utilize innovative and advanced technologies to enhance the building. These technologies will be used to enhance student experiences.

- ODSINON
- Design Elements
- Occupant Comfort
- Design Sensibility
- Innovation and Evolution
- Energy Efficiency
- Site Setting
- Resource Management
- Sustainability
- Accessibility
- Applicability
- Applicability

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Wellness Hub Goals

- Create cohesive envelope
- Modernize existing spaces
- Maximize daylighting
Architecture – Wellness Hub

Wellness Hub Support Spaces
Architecture – Office Space

Wellness Hub
Roof Membrane

Lintel Enclosure
Glass Wall Enclosures

Structural Design
Scope of Work

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Structural Design Drivers

- Widen Student Opportunities
- Encourage Sustainable Growth
- Link Past, Present and Future
- Leverage Innovative Technologies
Gravity System

King Post Truss
East-West Braced Frame

North-South Moment Frame
Wellness Hub Analysis
Office Addition

Office Gravity System
Office Braced Frame System

Foundation System

- Design Assumptions
  - Schnabel Engineering Report
  - Boring Sites B-1 and B-2
  - Allowable Bearing Pressure
  - 2.5’ frost line
Foundation System

Summary

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Mechanical Specialty

Mechanical Design Drivers

- Widen Student Opportunities
- Encourage Sustainable Growth
- Link Past, Present and Future
- Leverage Innovative Technologies
# Mechanical Plant Selection

## Decision Matrix - Mechanical Plant Selection

<table>
<thead>
<tr>
<th>WELLness Plan</th>
<th>Widen Student Opportunities</th>
<th>Encourage Sustainable Growth</th>
<th>Link Past, Present and Future</th>
<th>Leverage Innovative Technologies</th>
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<tbody>
<tr>
<td>Factor</td>
<td>Thermal Comfort</td>
<td>Space Standard</td>
<td>Energy Efficiency</td>
<td>Life Cycle</td>
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<td></td>
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<td>Construction Feasibility</td>
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<td>Accessibility</td>
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<td>Geothermal System</td>
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<tr>
<td>Central Utility Plant</td>
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</tbody>
</table>

**Outcome:** War Memorial Hall will utilize a Chilled Beam system.

### Description of Factors

- **Thermal Comfort:** Quality of thermal comfort achieved by system. Ability to maintain setpoint and gradient of temperature in space.
- **Space Standard:** How the central plant integrates with existing campus facilities. Utilizes space effectively.
- **Noise:** Noise level that the system generates while in operation.
- **Energy Efficiency:** Energy efficiency of the system.
- **Life Cycle:** Life cycle of the system.
- **Construction Feasibility:** How well the system integrates into the existing architecture of War Memorial Hall. How well it fits into overall design.
- **Accessibility:** How easily the system can be accessed by maintenance personnel for required maintenance.
- **Maintainability:** Maintainability such as prestation.
- **Appeal:** How appealing the system is to the general public from a sustainability and technology perspective.

## Central Utility Plant

[Diagram of Central Utility Plant]

- Chiller Plant
- Steam Plant
- War Memorial Hall

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Mechanical System Selection

### Chilled Beams

- **Thermal Control**: Quality of thermal comfort and energy efficiency of the system, ability to maintain comfort and control the temperature in space.
- **Moisture Control**: Ability of system to control and handle moisture; minimizes condensation problems.
- **Noise**: Level of sound that the system generates while in operation.
- **Energy Efficiency**: Energy efficiency of the system.
- **Construction Readability**: How well the system integrates into the existing architecture of the building and how well it fits into the overall design.
- **Aesthetics**: Integration into existing architectural design, how well it blends with the interior design.
- **Modularity**: How modular the system can be to modify or change its configuration to meet changing needs.
- **Aptitude**: How the system performs when subjected to extreme conditions or in specific situations.

### Decision Matrix - Mechanical System Selection

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<thead>
<tr>
<th></th>
<th>Wellness Plan</th>
<th>Encourage Sustainable Opportunities</th>
<th>Link Past, Present, and Future</th>
<th>Leverage Innovative Technologies</th>
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<tbody>
<tr>
<td><strong>Chiller</strong></td>
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<td><strong>Fan Coil Units</strong></td>
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<td><strong>Return</strong></td>
<td>4</td>
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</table>

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Ventilation

Hydroponic Phytoremediation Walls
Plumbing System

Pool Cogeneration System
Pool Wave Harvesting

Green Roof Runoff
Fire Protection

New Addition Sprinkler Riser

New Addition Standpipe

Most Remote Area

Building Controls
Electrical Design Drivers

- Widen Student Opportunities
- Encourage Sustainable Growth
- Link Past, Present and Future
- Leverage Innovative Technologies

Power Objectives

- Reliable
- Safe
- Sustainable
Secondary Distribution

Emergency Distribution

• Cleaner
• No fuel storage
• Avoid earthquake considerations
• Flexible
• Less intrusive

<table>
<thead>
<tr>
<th>Inverter Sizing Calculations</th>
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<tbody>
<tr>
<td>Area (SF)</td>
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<td>-----------</td>
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<td>222.369</td>
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</tbody>
</table>
Sustainable Power

- Solar PV
- Vibration Harvesting
- Wave Harvesting
- Solar Blinds
- Spin Room Harvesting

Frictionless Access Control
Lighting Objectives

- sDA of 40%
- Student Wellness
- Highlight History

Daylight Harvesting
Solar Shades

Occupant Wellness
Rooftop Memorial

Construction Management
Construction Management Plan Drivers

- Widen Student Opportunities
- Encourage Sustainable Growth
- Link Past, Present and Future
- Leverage Innovative Technologies

Site Logistics Plan

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Emergency Management Plan

Safety Through Technology

spot-r by triax®
Safety Through Technology

Schedule

War Memorial Hall Construction Milestone Recap

- Notice to Proceed
- Substantial Completion
- Final Completion/Turnover
Construction Budget: Base Bid

<table>
<thead>
<tr>
<th>Uniformat II Category</th>
<th>Cost</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>A Substructure</td>
<td>$211,250</td>
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<tr>
<td>B10 Superstructure</td>
<td>$2,492,750</td>
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<tr>
<td>B20 Enclosure</td>
<td>$3,887,000</td>
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<tr>
<td>B30 Roofing</td>
<td>$1,309,750</td>
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<tr>
<td>C Interiors</td>
<td>$6,168,500</td>
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<tr>
<td>D10 Conveying</td>
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<tr>
<td>D20 Plumbing</td>
<td>$2,197,000</td>
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<tr>
<td>D30 HVAC</td>
<td>$6,168,500</td>
<td>14.6%</td>
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<tr>
<td>D40 Fire Protection</td>
<td>$7,098,000</td>
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<tr>
<td>D50 Electrical</td>
<td>$1,436,500</td>
<td>3.4%</td>
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<tr>
<td>E Equipment &amp; Furnishings</td>
<td>$1,816,750</td>
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<tr>
<td>F Special Construction</td>
<td>$4,013,750</td>
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<td>General Conditions</td>
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<tr>
<td>Pre-Construction Fee</td>
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<tr>
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<td>$42,250,000</td>
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</table>

Construction Budget: Incl. Alternates

<table>
<thead>
<tr>
<th>WAR MEMORIAL HALL BUDGET SUMMARY</th>
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</thead>
<tbody>
<tr>
<td>Base Bid</td>
</tr>
<tr>
<td>Renovations and Additions</td>
</tr>
<tr>
<td>BASE BID TOTAL = $42,250,000</td>
</tr>
<tr>
<td>Alternates</td>
</tr>
<tr>
<td>Alternate #1: Wellness Hub</td>
</tr>
<tr>
<td>Alternate #2: Building Enclosure</td>
</tr>
<tr>
<td>ALTERNATES TOTAL = $5,713,770</td>
</tr>
<tr>
<td>WAR MEMORIAL HALL GRAND TOTAL WITH ALTERNATES = $47,963,770</td>
</tr>
</tbody>
</table>
Conclusion

Project Goals Recap

- Sustainable Design
- Innovative Solutions
- Maximize Student Wellness
VIRGINIA TECH
WAR MEMORIAL HALL

ODINSON