What the Education Design Community Can Learn from the Military

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Learning Objectives

• Adapt military design ideas for speed of access, cleanliness, and outdoor environments into an educational facility design

• Understand how the layout and design of a DoD elementary school facilitated 21st Century learning pedagogies.

• Adapt military design ideas for resiliency and efficiency

• Learn from several case studies
Agenda

• Speed of access, cleanliness, and outdoor environments
  – Various barracks and dormitories
  – Fort Jackson dining halls
• 21st Century vs. Traditional
  – Barkley Elementary School
• Resiliency and green building
  – New AFSOC campus

Speed of access, cleanliness and outdoor environments
Barracks, Dorms and Dining

Outdoor to Indoor
Outdoor to Indoor

Feeding 2600 people in 90 minutes...
From outside to inside

Getting outside...in any weather
Getting outside...in any weather

Adaptive reuse & green building
### What they require

- 30% energy use reduction over ASHRAE 90.1
- Daylighting for 75% of classrooms
- 30% solar for domestic hot water heating
- 30% water use reduction
- Enhanced commissioning
- Low Impact Design for stormwater management
- Low-emitting, recycled, green materials

*Minimum LEED Silver performance*

### What they get

- Ft Jackson & Benning dorms
  - 37-42% energy savings
  - 40-60% water savings
  - LEED Silver performance
- Ft Jackson dining hall
  - 26% energy savings
  - 40% water savings
  - LEED Gold performance

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**21st century learning & green building**
DoDEA

Department of Defense Education Activity
- Manages education for children of military families around the world
- +/-170 schools around the world serving nearly 80,000 students
  - DoDDS and DDESS
- Global school district with similar challenges to other large districts
  - Need for Standards in educational pedagogies and environments...because transitional client base
  - 3 to 5 year planning cycle from design to occupancy

21ST CENTURY SCHOOL CASE STUDY: Barkley Elementary School

- DoDEA Owned/Operated
- Located at Ft. Campbell, KY
- Serves 740 Pre-K thru 5th grade military dependent children
- $38M total construction cost for 141,972 SF plus site amenities
  - $208/SF - estimate of building cost only
- Designed in 2012/13
- Completion expected 2015/16 school year
DoDEA Schools

Guiding Principles
- Provide student-centered facilities for all learners
- Be flexible and adaptable
- Be global community-centered

Mission
- Educate, Engage and Empower each student to succeed in a dynamic world

Vision
- To be among the world’s leaders in education, enriching the lives of military-connected students and the communities in which they live.

DoDEA Schools – Design Goals

• Current Best Practices in Pedagogies and Facility Design to achieve Excellence in Education
• Global Awareness and Connectedness
• Sense of Community – micro to macro
• Secure Environment – both physically and psychologically
• Resilient and Energy – efficient
• Sustainable Features = Teaching Tools
21st Century Education

Learning by experiencing
- Active vs. passive learning
- Individuality
- Creativity
- Socialization
- Problem solving
- Connectivity

A Learning “Neighborhood”

- Learning Studios
  - Smaller (< typ classroom)
  - Lecture/Group Sessions
- Learning Hub
  - Larger neighborhood “commons”
  - More learning stations
  - Varied modal learning
  - Opportunities for interaction
- Group & 1-to-1 Rooms
  - Higher Acoustic Separation
  - Teacher-to-team /student learning
  - Older kids’ project teams
  - Younger kids’ specialized centers
A Learning “Neighborhood”
A Learning “Neighborhood”

“Neighborhood” Connections

Whole School as a Community
Interior Program Highlights

• First Floor:
  – Gym & “Commons” with stage
  – Info Center with Flex Lab
  – Art Lab
  – Music
  – LIMS Studio
  – OT/PT Lab
  – Admin
  – Health Clinic
Exterior Program Highlights

- To be built on the site of existing middle school, while it remains open
- Drop-offs and Drives
- Parking and Circulation
- Playgrounds and Outdoor Learning Areas
  - Outdoor seating/amphitheater
  - Patio with shade structures
  - Rainwater harvesting for educational purposes
  - Bio-swale for educational purposes
Barkley Elementary School

Project Sustainability Requirements

DoDEA Academic Instruction: Sustainability and Energy Efficiency Program

• Use the “Building as a Teaching Tool” for Green Buildings
• 40% Energy Usage Reduction over ASHRAE 90.1-2007
• Daylighting for 75% of Classrooms
• 30% Solar for Domestic Hot Water Heating
• 30% Water Use Reduction
• Low Impact Design for Stormwater Management
• Share the Building with Community

Minimum LEED Silver Certified
Energy Conservation

<table>
<thead>
<tr>
<th>Goal &amp; Reference</th>
<th>Energy Use Intensity (EUI)</th>
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<tbody>
<tr>
<td>Baseline or “typical” primary school in climate zone 4</td>
<td>64 kBtu/sf/yr</td>
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<tr>
<td>40% better than ASHRAE 90.1-2007 DoDEA’s Goal</td>
<td>38.4 kBtu/sf/yr</td>
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<tr>
<td>School built to ASHRAE Advanced Energy Design Guide (AEDG) for K-12 Schools</td>
<td>32 kBtu/sf/yr</td>
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<tr>
<td>• Approximately 47% better than ASHRAE 90.1-2007</td>
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<td>Net-zero Schools: (actual post-occupancy data)</td>
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<tr>
<td>• Richardsville Elementary (KY)</td>
<td>16.6 kBtu/sf/yr</td>
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<tr>
<td>• Turkey Foot Middle School (KY)</td>
<td>21.7 kBtu/sf/yr</td>
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<tr>
<td>Barkley ES:</td>
<td></td>
</tr>
<tr>
<td>• 19.1 kBtu/sf/yr</td>
<td>59% savings</td>
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<td>59% savings</td>
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Reducing Energy Use Intensity

Design Team
• Building Envelope
• Lighting Loads
• Heating and Cooling Loads
• Solar Hot Water Heating

The Owner
• Equipment Loads and Behaviors
  – Buy efficient equipment
  – On-going measurement and monitoring of the building’s performance
  – Energy saving policies/student buy-in
21st Century: Using the School as a Teaching Tool

• Meshing green design elements with interior finishes, furniture, signage, and curriculum
• Making energy saving technologies and renewables “visible” via an interactive “dashboard,” which also enables performance monitoring

Question/Discussion Break...
Resilient design

Resiliency

- Resilient Design Principles
  - Provide for basic human needs
  - Diverse and redundant systems are inherently more resilient
  - Simple, passive, and flexible systems are more resilient.
  - Locally available, renewable, or reclaimed resources are more resilient.
  - Anticipates interruptions and a dynamic future
  - Social equity and community contribute to resilience

The Resilient Design Institute (RDI)
Resilient Design Strategies

Infrastructure
- Transportation – multi-modal
- Communication – multi-modal as well
- Energy – distributed power; smart/micro-grids; local
- Water – distributed storage and treatment
- Grid-tied, district systems

Buildings
- Extremely efficient
- Local power and water, with local control
- Include storage – thermal, water, power
- Passive heating/cooling & ventilation
  - Orientation
  - Operable windows

Resilient Design Strategies
...are often most (or only) effective at a community, district or campus scale
- District Energy systems
- Storage
- Low Impact Development
- Microgrid(s)
- Net-zero energy or water
Princeton & Sandy

- Resilient design strategies
  - On site co-generation
  - Electrical microgrid
- University became a “place of refuge”
  - Community members could warm up, charge cell phones, use wireless, etc.

Resiliency Case Study: Initial Plan

**Scope**
- 50 Acre site – campus utilities and infrastructure - $15.5M
- Airfield Apron - $22.9M
- Hangar with maintenance shops – 70k sf - $57.2M

Operations facility – 21k sf
Warehouse – 33k sf
Group HQ – 5k sf
$42.2M
High Performance Building (Modeling)

- Designed to 30%+ efficiency over code
- 57% of interior spaces daylit
- Maximized PV potential of south-facing roof
  - Could provide 35% of energy; 50% of cost

Solar Ready Design

- Estimated energy use intensity (EUI) of buildings
  - Est. 883 MWh/yr
  - Equiv. to one acre of PV
- PV in conjunction with microgrid & generators to provide resiliency
Solar-Ready Design

- Rotated building orientations; re-designed roofs
- Increased south-facing roof area to 67,823 SF
- Increased the solar potential ten fold
Hybrid Micro-Grid

- Campus will be grid-connected
- Improve reliability
- Able to “island” if needed
- Accommodates future PV and generator power

Place-making and Pedestrians

- Resiliency design supports the mission
  - Places of respite
  - Places of gathering
  - Places of ceremony
A resilient campus...

Summary

- Speed of access, cleanliness, and outdoor environments
  - Barracks, dormitories, and dining halls
- 21st Century, green
  - Barkley Elementary School
- Resilient design
  - New AFSOC campus
THANK YOU!
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