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




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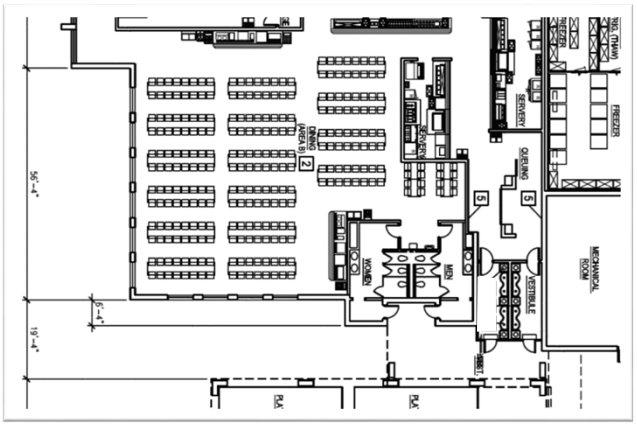
Speed of access, cleanliness and outdoor environments

Barracks, Dorms and Dining

Outdoor to Indoor

Outdoor to Indoor



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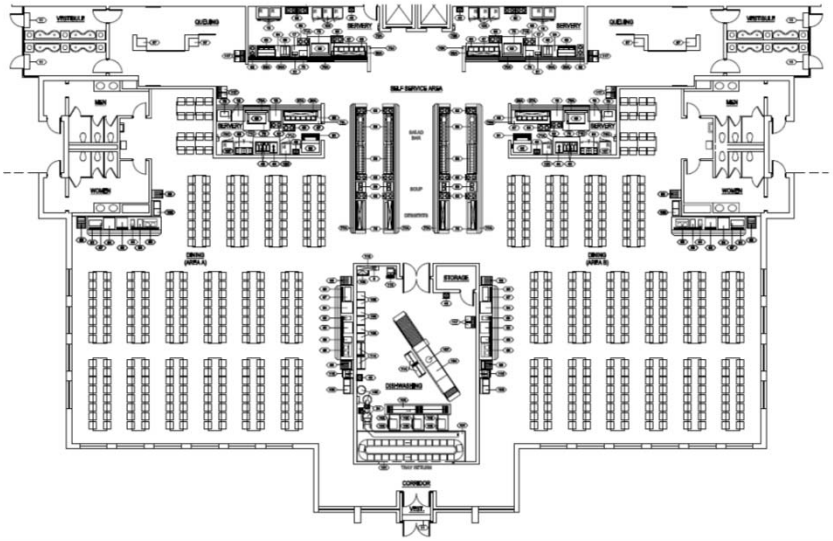
Feeding 2600 people in 90 minutes...



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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

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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

US Army Corps of Engineers® Louisville District

US Army Corps of Engineers® Norfolk District

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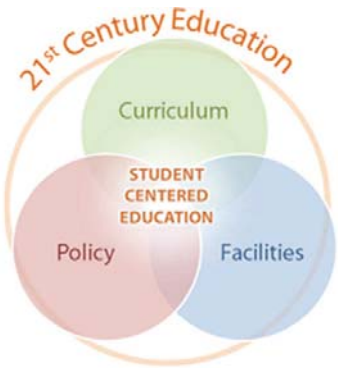
DoDEA Schools



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

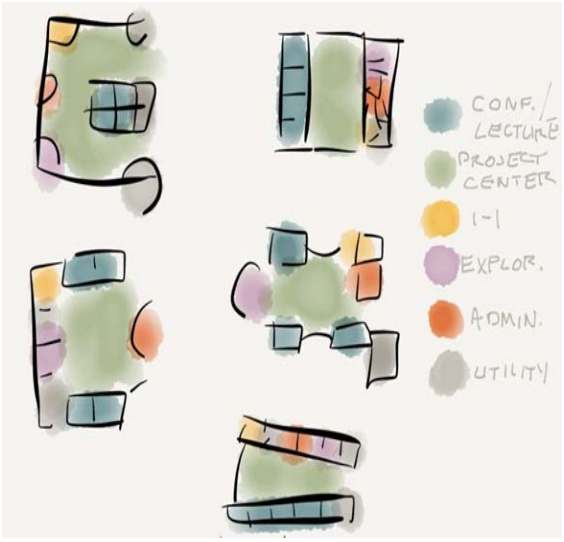
- Current Best Practices in Pedagogies and Facility Design to achieve Excellence in Education
- Global Awareness and Connectedness
- Sense of Community – micro to macro
- Secure Environment – both physically and psychologically
- Resilient and Energy – efficient
- Sustainable Features = Teaching Tools

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"

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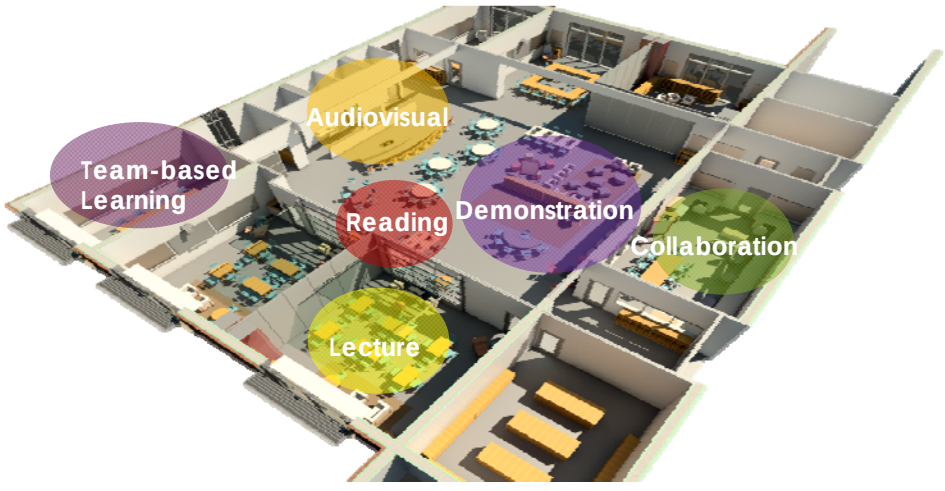
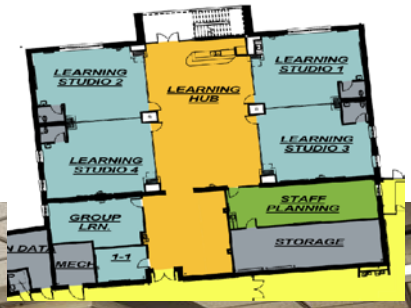
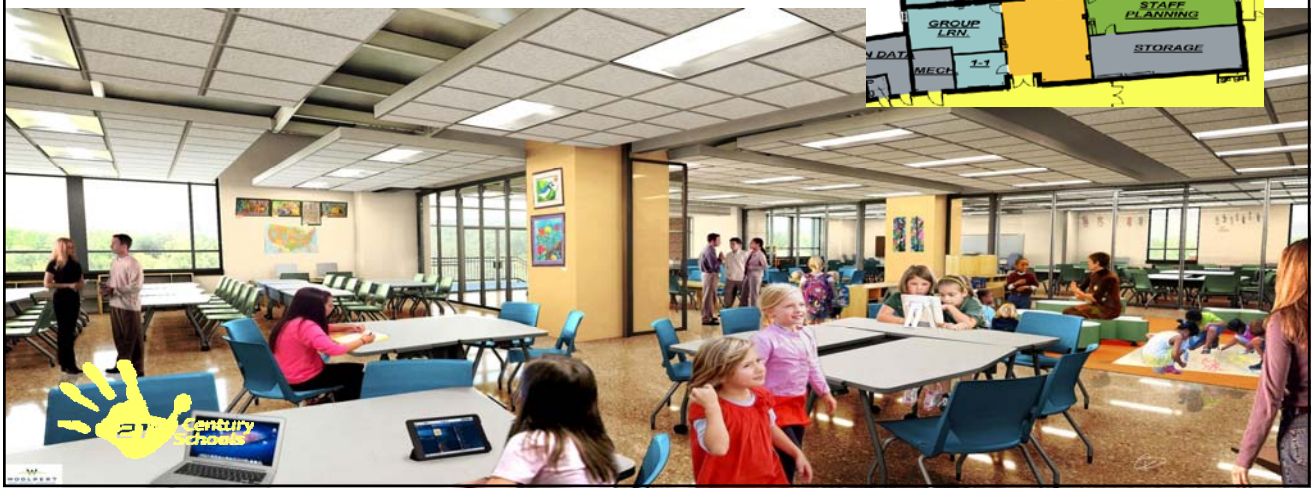
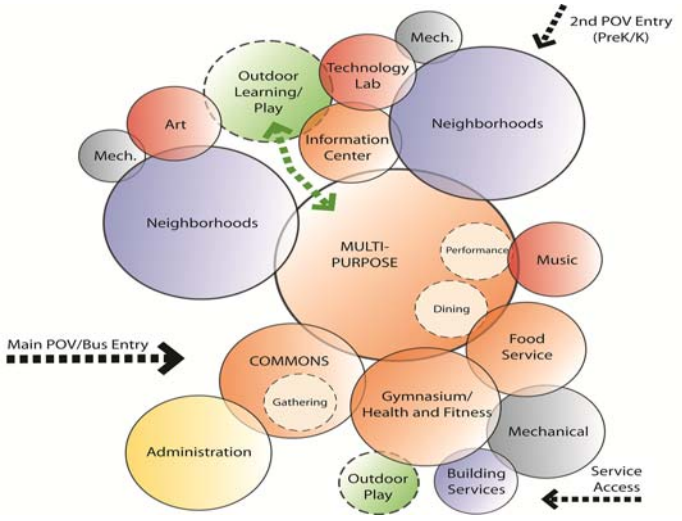


A Learning "Neighborhood"





"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

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Commons Area

Art Room

21st Century Schools

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Info Center

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

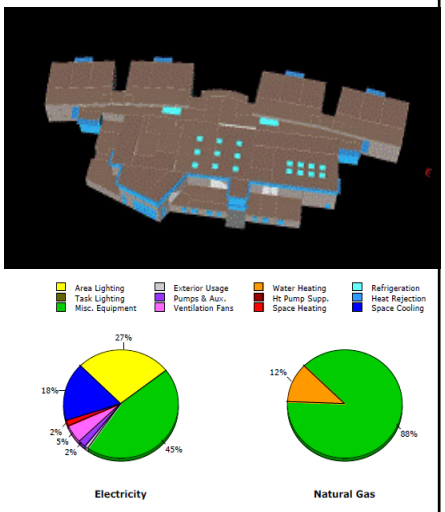
Energy Conservation

Goal & Reference	Energy Use Intensity (EUI)
Baseline or "typical" primary school in climate zone 4	64 kBtu/sf/yr
40% better than ASHRAE 90.1-2007 DoDEA's Goal	38.4 kBtu/sf/yr
School built to ASHRAE Advanced Energy Design Guide (AEDG) for K-12 Schools (50% Energy Savings) • Approximately 47% better than ASHRAE 90.1-2007	32 kBtu/sf/yr **Barkley ES**: 19.1 kBtu/sf/yr 59% savings
Net-zero Schools: (actual post-occupancy data) • Richardsville Elementary (KY) • Turkey Foot Middle School (KY)	 16.6 kBtu/sf/yr 21.7 kBtu/sf/yr

Reducing Energy Use Intensity

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

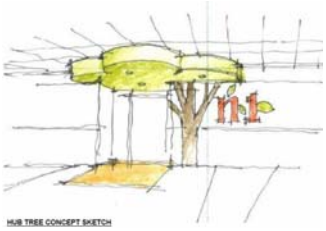
The Owner
- Equipment Loads and Behaviors
  - Buy efficient equipment
  - On-going measurement and monitoring of the building's performance
  - Energy saving policies/student buy-in



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

Renaissance Academy's dashboard and signage



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Question/Discussion Break…

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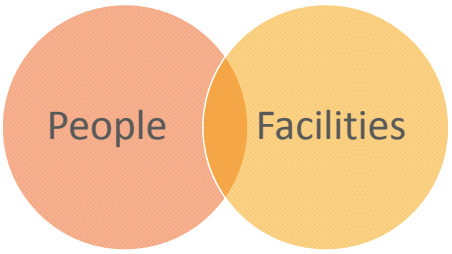
Resilient design

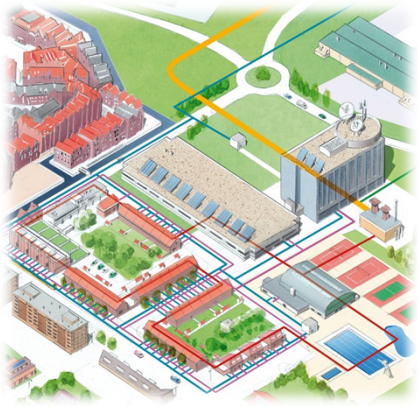
Resiliency



- 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

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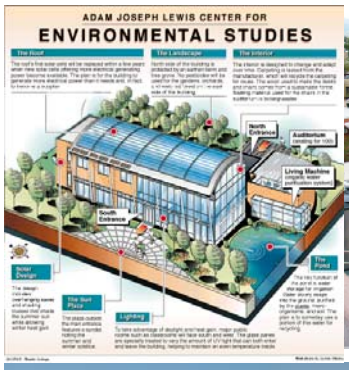
Resilient Design Strategies

…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




University of Arizona ice storage


Bowling Green State Univ. Dining Hall with water storage tanks
watertanksales.com

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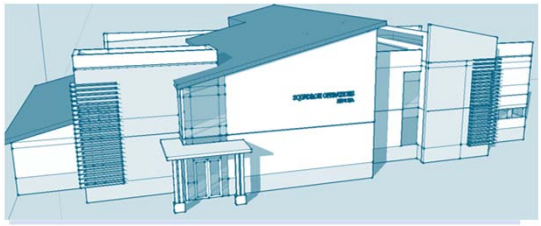
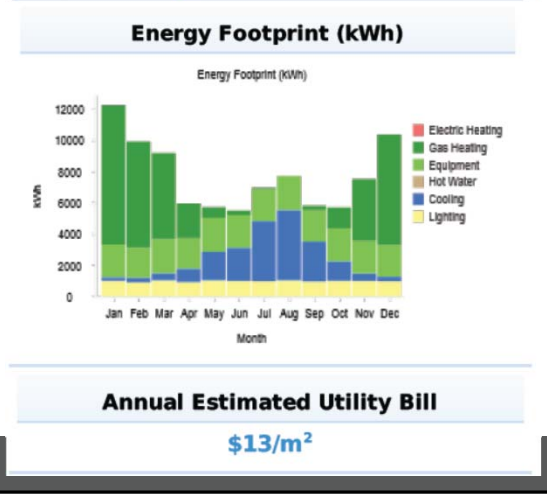
Princeton on October 30, 2012. *(Tony Kurdzuk/The Star-Ledger)*

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



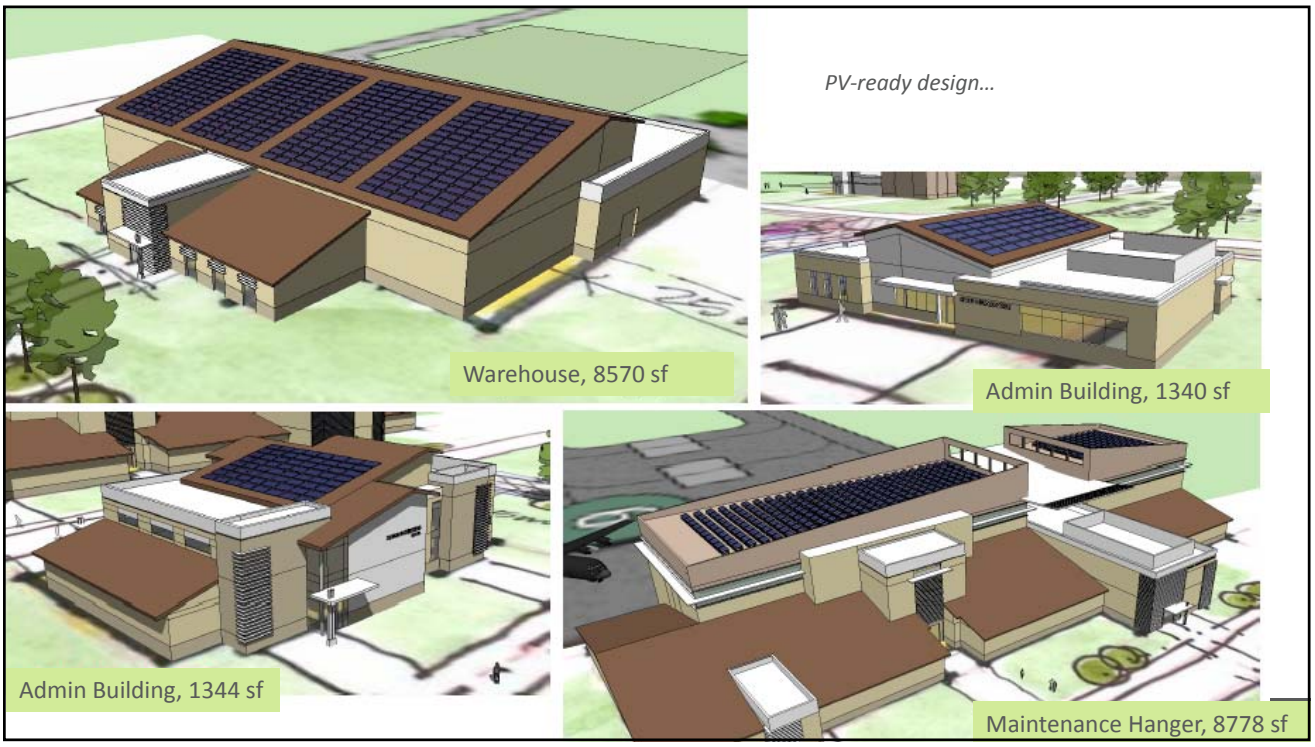


High Performance Building (Modeling)

- 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

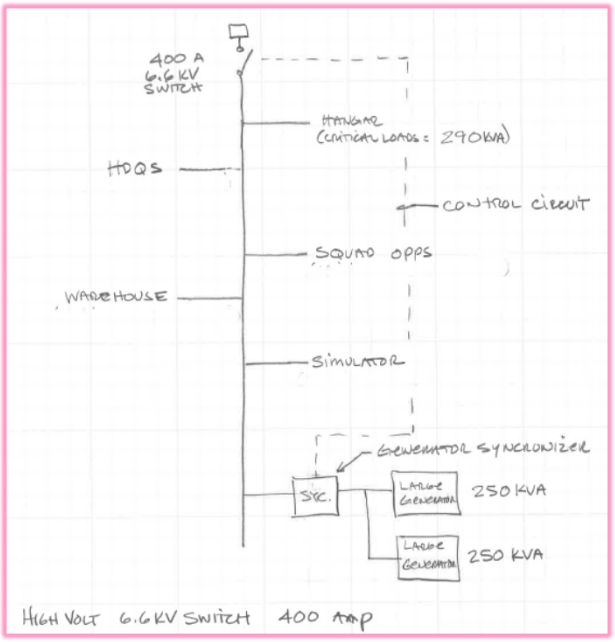


Solar-Ready Design

- 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



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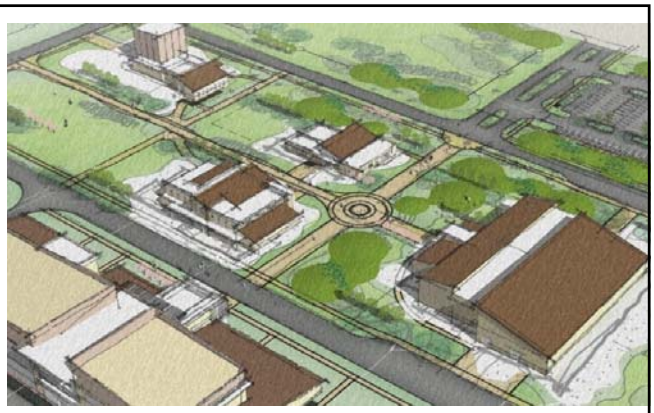
Place-making and Pedestrians

- Resiliency design supports the mission
  - Places of respite
  - Places of gathering
  - Places of ceremony



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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