



Energy Conservation in Training Facilities

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Issues

- Training facilities are among major energy users on installations (along with data centers, hospitals and dining facilities)
- Environmental requirements for older training facilities are most often set based on requirements to temperature and humidity of the previous generation of equipment and electronics components
- In many cases simulation equipment is conditioned using DX units connected to training modules with condensers rejecting heat in the air-conditioned spaces
- Power conditioners used in these facilities are often installed and reject heat in the air-conditioned bays increasing cooling loads
- Simulator equipment often rejects heat in the air-conditioned bays as well
- Supporting computers are often installed in the same large bays as simulation equipment and thus the whole bay needs to be conditioned to the level required by the electronic equipment
- Computer rooms are typically air-conditioned using Computer Room Air Conditioners (CRAC units), which control environment in the whole room rather than within computer racks

Temperatures in computer rooms are unnecessary lower than are needed in these spaces



Problem: Unnecessary low room air temperature resulting in discomfort, energy waste and condensation on cold surfaces = mold these spaces

Solution: Obtain state-of-the-art requirements from PEO STRI and reprogram AC systems.

Environmental Requirements for Virtual Training Systems

- Environmental requirements for Virtual Training Systems are most often set based on the sensitivity to temperature and humidity of the equipment and electronics component that comprise the system.
- These value will vary based on the type of equipment and electronics the systems utilizes.
- Examples:
 - From the Close Combat Tactical Trainer (CCTT) Specification:
 - The equipment shall be designed to operate in an environment with a temperature range of 60 to 85°F and a relative humidity of 40 to 75 percent non-condensing, unless otherwise specified.
 - From the AH-64 Combat Mission Simulator Specification:
 - Simulator Room – Cockpit and motion system are required to operate normally in a comfort controlled environment at a temperature of 75°F (+/- 10%) at 50% (+/- 5%) relative humidity.
 - Computer Complex - The AH-64 CMS computer complex is required to under process controlled conditions at a temperature 70°F (+/- 5%) at 50% (+/- 5%) relative humidity
 - ...transitions in temperature due to operation mode variations must not result in the development of relative humidity above 70% or below 30% in the temperature ranges given.
- Since the building blocks that most Virtual Training Systems utilize are similar, these requirements should not vary greatly across systems.

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Heat Cascading in Flight and Vehicle Simulator Buildings



Problem: Condensers reject heat into large high bay AC spaces
Solution: Work with contractors to duct heat stream from condensers outside the building in summer

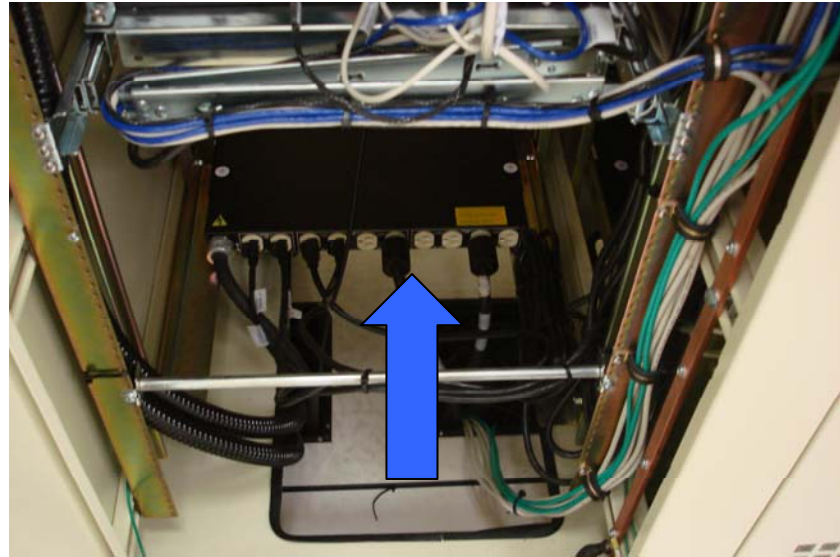
Poor selection of power conditioners location



Problem: are installed and reject heat into the air-conditioned bays increasing cooling loads

Solution: Install power conditioner in a separate space with less stringent environmental requirements, cascade air from air conditioned space in the space with a power conditioner. Use heat for heating spaces with a heating load and/or for supply air reheat.

Inefficient Air Distribution (in computer rooms)



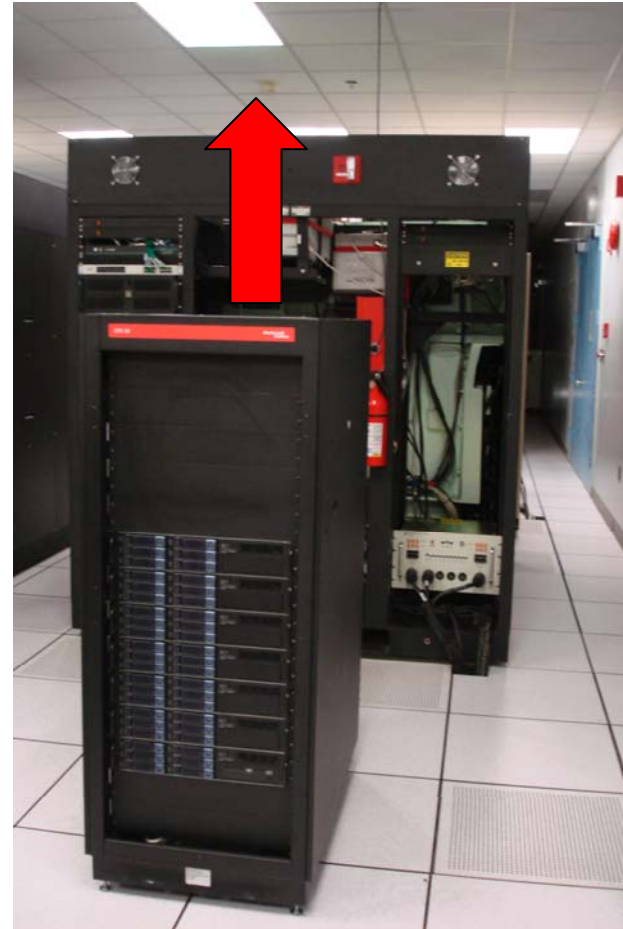
Problem: Simulators and computer racks are cooled by using fans built-in equipment which bring cooler air from the surrounding space into the equipment and exhaust heated air back into the space. Cooling load is unnecessary high

Solution: Duct exhaust air into the central system and use warm air for heating of other spaces in the building requiring heating or for supply air reheat needed for humidity control

Inefficient Air Distribution (in high simulators bays)



Inefficient Air Distribution (in training rooms)



Some Examples of Good Practices



Flight simulator supply and return are ducted to central systems



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PUMP VOLTAGE	208/230	S/PHASE	1.0 AMP.

REFRIGERANT TYPE: ALL TYPES EXCEPT R-713

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INSTALL IN A PROTECTED AREA IF AMBIENT TEMPERATURE IS BELOW 32°F IF POSSIBLE, OTHERWISE DRAIN DURING WINTER MONTHS.

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THE COIL(S) USED IN THIS UNIT IS UL LISTED FOR POTABLE WATER.

Refrigeration heat recovery for supply air reheat

Summary

While designing and retrofitting training facilities using advanced computers requiring less energy can significantly reduce energy consumption by itself, designing and retrofitting training facilities with advanced AC equipment and system concepts, efficient air distribution, heat recovery will further improve the overall facility energy consumption