Build New Research Space – Lake Nona
VA Medical Center, Orlando, FL

Contract VA248-12-C-0320, Project 675-900

DESIGN ANALYSIS REPORT
Final Design Submittal

Prepared for
Orlando VA Medical Center
5201 Raymond St.
Orlando, FL 32803

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Site Narrative

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The project is a vertical expansion of an existing building; therefore the new floor will follow the structure and exterior skin envelope of the existing first floor. The only exception to this will be the addition of an exit stairway at the north end of the west tower (the side of the building to receive the vertical expansion). Existing surveys of the area and the utility site plan for the first floor indicate no utilities in the area of the new stairway. No parking areas or service areas will be displaced by the stairway addition. Some re-grading of the area may be necessary to route storm water sheet flow around the new stairway. A new pad for a new emergency generator will be added near the new stairway.

Existing landscaping will be disturbed during construction. The design intent is to “re-install” the disturbed areas to the condition they were in at construction start; this is based on the assumption that the initial landscape design accommodated the future construction (which it appears it does).

Architectural – Building Shell Narrative

Prepared by:

VOA Associates Inc.

The new second floor Laboratory Addition of approximately 22,400 square foot, including shell space, over the now under construction New Orlando VA Medical Center SimLEARN National Center will follow the construction system established by the one story SimLEARN National Center. This existing building that the Laboratory will be constructed on top of has been structurally engineered to ultimately grow to be a five story building and thusly has foundations and columns structurally engineered for this purpose. The new Second Floor Laboratory addition will follow the basic footprint previously master planned on the North Northwest side of the SimLEARN National Center. As the second floor addition is a Laboratory the floor to floor height will need to exceed the current master planned floor to floor height for this floor which is currently set at 15 foot floor to floor. Laboratories have a need for 9 foot minimum ceiling heights due to the need to have different types of large equipment within them. Also the above ceiling plenum needs to be oversized due the Laboratories needing complete exhaust air removal. Together these Laboratory issues provide a need for a 17 foot floor to floor height of the Level 2 to Level 3 addition.

The current SimLEARN National Center plans call for a future group of three Pedestrian Elevators in the public lobby at complete build out and for a future single Service Elevator. The scope of the new Laboratory needs to have at least one of the Pedestrian Elevators built out and the single Service Elevator built out. The single Service Elevator is located in the proposed west wing expansion of the SimLEARN National Center.

Stairways in the current SimLEARN National Center: plans call for a stairway in the lobby to be added into a shaft developed in the SimLEARN plans. Additionally a new stair will need to be added at the north end of the new Laboratory plan to meet life safety exiting requirements. This north stair extends the current building footprint. The second floor mechanical space also extends past the current footprint, creating an overhang.

Stairs are to be steel structure with precast terrazzo treads and precast terrazzo risers. The handrails will be tempered glazed vertical panels with stainless steel guardrail and bottom rail. Interior stairwell finishes will be paint over paintable surfaces such as gypsum wallboard or CMU depending on wall and stairwell.

Elevators will be 9’ – 0” high cab, two-stop machine roomless, one at 3,500 LB and one at 5,000 LB rating. No elevator machine room will be required. Elevator floors will be terrazzo with manufacturer’s standard stainless steel cab interior walls, and ceiling. Elevator doors will be manufacturer’s standard stainless steel 8’ tall.

Steel post-and-beam system will be added to the existing structural framing to create a new exterior overhang. The extents of the second floor slab extend over the first floor creating a new line of columns at the front exterior of the building as well as at the mechanical room extension. These columns will be clad with a metal panel column wrap to match the existing metal panels on the project.

The exterior skin of the new second floor addition is to follow the master plan with the skin either being glazed with curtain wall on one façade, and clad with either metal panels or cement plaster on either CMU or cold formed metal studs on the other façade. Please see the model of the exterior of the building for a graphic depiction of these materials and systems.

Exterior skin with punched openings will have fixed glazed panels in painted hollow metal frames. These panels will be set into steel stud walls finished on the exterior with fiber mesh faced gypsum wall board and three coat Portland cement plaster (stucco) totaling 7/8" thickness. Portions of this wall will be 2 ½" thicker than others to create minor shadow lines and portions of this wall will be 3 5/8" thicker to create major shadow lines. Varying thicknesses will be achieved with built-up lightgauge metal framing over the exterior walls.

Exterior curtainwall will be double-glazed insulated panels, Solarban 70 or equal, to match the existing curtainwall system.

The roof will be steel deck with rigid insulation, average thickness at least 6" uniform thickness. Roof slopes will be achieved with lightweight concrete topping. A single ply modified bitumen roof assembly will be provided with minimum 10/10 year warranty (anticipating future additions). Parapet liners will be glass matt faced exterior gypsum sheathing coated with 2-coat Portland cement plaster (stucco). A metal coping finished to match the curtainwall glazing mullions will be provided as a uniform coping throughout.

Due to cost concerns the original design for the curtain wall on the east elevation at the future roof garden was modified to be a cement plaster wall on cold formed metal studs with punched window openings.

It should be noted that vertical expansion over an occupied space has the potential to be disruptive to the occupants.

Building Interior Design Narrative

Prepared by:
VOA Associates Inc.

Interior Design features and materials selected for the construction of the Laboratory will be durable, smooth, easily cleaned, provide ease of maintenance, and contribute to the creation of a comfortable, productive and safe laboratory environment. The main criteria for laboratories are chemical resistance, smoothness, durability and ease of cleaning. Finish materials will be selected based upon these and other project specific set of criteria. Consideration will also be given to the corrosive chemical activity of disinfectants, decontamination gases/vapors and other chemicals used in the Laboratory.

Flooring in the laboratories will be a resinous floor to provide a seamless, nonabsorbent and slip resistant material. This flooring will resist the adverse effects of laboratory chemicals, detergents, cleaning materials and decontamination chemicals. Wall base will be integral to the resinous flooring. Flooring in the public areas and corridors will be a seamless, heat welded sheet vinyl flooring with a rubber base, there will be 2 different sheet goods to provide a flooring pattern to match the first floor terrazzo patterning. Offices will have broadloom carpet.

Elevator lobby will have wood paneling similar to the first floor.

Ceilings in general laboratories will typically be a cleanable acoustical ceiling tile typically coated with a clear vinyl finish. Ceilings in the BSL3 suite typically will be a moisture resistant gypsum board ceiling which forms part of the barrier for the suite. Glass wash, and autoclave rooms typically have gypsum board ceilings painted with epoxy paint. Public areas and lobby will have the same tegular lay in ceiling tile as was used on the first floor.

Toilet rooms will have porcelain tile on the floor and wet walls. Finish selections for the public toilets were based on the first floor finishes, including the toilet partitions and glass mosaic accent tile.

The millwork in the lab itself will be stainless steel.

Laboratory Functional Planning Narrative

Prepared by:
Thomas Gyllstrom, AIA
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The scope of work delineates the second floor of the West Tower for the 22,415 gross square footage expansion. The laboratories will encompass approximately 6,970 net square feet of the available floor space. The balance of the square footage will house mechanical spaces, stairs, lobby, elevators, main corridors, public toilets and miscellaneous chases for piping and ductwork. The structural system and exterior wall system will also consume some of the gross square footage.

Programmatically, the user group desires an “open lab” concept where there are no separately walled off laboratories. Potential users will be PI’s that will occupy a portion of the open lab for the duration of their grant funding. Therefore the lab spaces and benches should be flexible in accommodating a change in occupants and equipment. The basic open laboratory area is planned for a BSL 2 level. A BSL3 lab of approximately 1,709 sf is included in the planning to provide flexibility for research activity. The current first floor of the SIM Center below shows a freight elevator in the area of vertical expansion for access to the labs above for equipment, materials and supplies. The planning also includes support space in the form of PI offices (4 – 2 person offices), an open office space for 8 occupants and one large divisible conference room for 40 persons (divided for 25/15).

The functional planning of the laboratory spaces is based on a modular grid – a 10’-6”x 11’-0” grid is superimposed over the existing structural grid to allow for a systematic and flexible planning approach in laying out the lab casework and equipment. Since the floor plan is curvature in form, the rigid grid does not “fit” the shape as efficiently as within a square or rectangular floor plan, but none-the-less provides a very efficient layout for lab casework configurations. The “off grid” spaces that intersect curving walls provide opportunities for storage space, mechanical and pipe chases, entry vestibules into the labs, and hard wall spaces for lab equipment such as rooms for refrigerators, -20/-80 freezers, fume hoods, glass wash areas, and any specialized rooms such as for a radioisotope hood., and walk-in coolers and freezers; these spaces are requested by the user groups.

The floor plan presented in this 100% submission shows the superimposed grid on the curved floor plan. The main access corridor to the lab spaces is against the future “courtyard” east wall at the bottom of the plan; the open lab space is along the west window wall (allowing maximum access to daylight and views). The lab support spaces are between the corridor and open lab area. Multiple entry vestibules are shown to allow safe exiting from the large open lab space as well as minimize traffic “through’ the lab. 30 inch deep lab benches are placed back to back east to west in the space/grid which allows a working clearance of 5’-6” between benches.(This is the minimum recommended – 6’ is preferred, but the existing structural grid does not accommodate this dimension. With a 10’-6” wide grid, the existing columns do not interfere with the bench placements and is very efficient in terms of layout and clearances.) Lab casework can be “fixed” or completely flexible or a mixture of both depending on the VA’s budget. The casework can be configured for cabinets/drawers or kneeholes or equipment below the lab top and (in an open lab) have adjustable shelves above. House utilities such as compressed air, electrical outlets, data links, vacuum, are delivered to the bench top from above ceiling via umbilical drops through the casework. Specialty gases will be accommodated by point-of-use cylinders with appropriate cylinder anchoring systems. Sinks are shown at regular intervals at the top end of the casework run and have a separate faucet for RO/DI water – final polishing of this water will be point of use units typically mounted on the wall above the sink. Fume hoods are placed in working alcoves off the lab area to minimize the disturbance of walking traffic behind the user – the alcoves also allow flexible user use. Flammable or Corrosive materials can be kept in rated cabinets below the hoods and vented appropriately. Alcoves can be utilized for Bio-Safety Cabinet placement as well, although BSCs can be placed out in the open lab area with little consequence to mechanical exhaust and air requirements.

The BSL 3 lab is placed at the "plan north" end of the floor plate as remote as possible from the public elevators/admin spaces. BSL 3 labs require a dedicated entry vestibule with doors from the corridor to the vestibule and a door from the vestibule into the lab area for separation purposes. MEP requirements are more "containment" oriented; any exhaust is HEPA filtered and Level 2 -3 BSCs are used. All walls are floor to floor with a "hard" drywall ceiling and sealed to prevent transfer of air flow into other surrounding spaces.

Finally, the south end adjacent to the public elevators will house the offices, conference rooms, open offices and any other needed office support type spaces.

Structural Narrative

Prepared by:
Carl W. Jenne, P.E.
TLC Engineering

STRUCTURAL DESIGN CRITERIA

CODES AND REFERENCES

International Building Code (IBC), 2009 Edition

ASCE 7-05 Minimum Design Loads for Buildings and Other Structures

VA Physical Security Design Manual: Life Safety Protected, July 2007

VA Structural Design Manual for Hospital Projects, August 2009

ACI 318 Building Code Requirements for Reinforced Concrete, 2008 Edition

AISC Manual of Steel Construction, 13th Edition

MATERIALS

Concrete: For foundations and slab on grade, f'c = 3000 psi; For floor slab, f'c = 4000 psi. Flyash limited to 20% of the cementitious material.

Reinforcing Steel: ASTM A 615, with 60 ksi yield

Welded Wire Fabric: ASTM A185

Structural Steel Wide Flange Shapes: ASTM A 992, with 50 ksi yield

Square and Rectangular Steel Tubes: ASTM A500, Grade B, with 46 ksi yield

Other Structural Steel: ASTM A 36, 36 ksi yield

Anchor Bolts: ASTM F1554, Grade 36

Bolts: ASTM A325

WIND LOAD CRITERIA

Design Wind Speed	110 mph
Importance Factor	1.0
Building Category	II
Exposure Category	C

SEISMIC CRITERIA

SDS	0.10

SD1	0.06
Seismic Design Category	A
SS	0.095
S1	0.037
Seismic Importance Factor	1.0
Seismic Use Group	II
Seismic Site Classification	D

DESIGN LIVE LOADS

Corridors	100 PSF
Offices	80 PSF
File and Computer Rooms	125 PSF
Mechanical Areas	150 PSF
All Future Floors	100 PSF
Roof	20 PSF
Future Roof not designed as future floor	20 PSF

DESCRIPTION

The SimLEARN National Center is proposed as a second story addition to a structure currently under construction. The first story of the latter building was designed to accommodate future vertical expansion. The original expansion was four additional occupied floors and a mechanical penthouse level. The first floor height is 18’-0”. Future floors are planned to be 15’-0” floor to floor height and 18’-0” floor to floor height at the mechanical penthouse.

The original design scheme has been altered in this design to a floor to floor height of 18’. As a result, the future planning was also altered to eliminate one of the future floors and the mechanical penthouses. This design will be able to accommodate three additional floors – for a total of four stories overall. There will be no mechanical penthouses; instead, mechanical areas will be provided at each floor.

Similar to the original, the floor construction will be a composite concrete slab on metal deck supported by steel beams for the floors. Exterior walls will be a combination of non-load bearing precast concrete panels and light gage framing with sheathing. Steel moment frames of wide flange beams and columns will provide vertical and lateral load support for the structure and future vertical expansion. Shallow foundations under structural columns and slab on grade will be used.

FOUNDATION SYSTEM

A soils report was prepared for the original project by Nodarse & Associates, dated April 10, 2012.

Based on the recommendations in the report, column footings are shallow foundations with an allowable bearing pressure of 6000 psf. The foundations bear at least 48" below finish grade. Wall foundation to support the exterior precast panels have an allowable bearing pressure of 3000 psf.

FRAMING SYSTEM

Framing systems will be consistent with the original design. Steel moment frames will be provided for lateral resistance. The floor framing is composite concrete slab and metal deck on steel beams designed as unshored. The slab is 3 ½" concrete on 2", 20 gage, type VL galvanized metal deck. The steels beams are typically spaced at 6'-0" on center. The roof slab in this design is designed as a future floor.

There is overhanging slab being added in this design. The original design was for this overhanging slab to be supported by new columns added around the outside. However, we note that in this design it is shown as cantilevered. Further verification will be necessary to evaluate this configuration.

The columns will extend 2'-0" above the top of slab to allow for splicing on of the future columns. The construction makeup of the future floors is anticipated to be the same as the current floor.

PROGRESSIVE COLLAPSE

Due to the structure being over three floors with the future expansion, it is designed for progressive collapse according to UFC 4-023-03 and VA Physical Security Design Manual: Life Safety Protected. The tie force method and enhanced local resistance will be used. In the tie force method, the building is mechanically tied together to enhance ductility and develop alternate load paths. These ties are developed in the concrete slab and columns.

BLAST ANALYSIS

The building envelope will be designed for the design threat and deformations listed in Chapter 6 of the VA Physical Security Design Manual: Life-Safety Protected. Department of Defense (limited access) software will be used to analyze the effects of explosions consistent with VA standards.%

Mechanical HVAC Analysis

Prepared by:
Mark G. Hertz, P.E.
&
Stephen T. Steffe, P.E.
AKEA, Inc.

GENERAL

All work shall be as prescribed in the Request for Proposal (RFP), subsequent project revisions, VA HVAC Design Manual, and all applicable codes and VAMC design guides.

This contract includes all mechanical heating, ventilating, and air-conditioning (HVAC) work for the 2nd floor vertical expansion of the SimLEARN facility, as well as provision for the future 3rd and 4th floor expansions. Demolition will be completed as required. All new mechanical HVAC equipment, distribution ductwork/piping, and controls shall be provided.

AIR HANDLING UNITS

The New Research Space of approximately 22,000 square feet (SF) is to be served by three, independent, variable air volume (VAV) air handling units (AHUs) based on their respective service. These units will serve the general administration/common spaces, open wet laboratory spaces, and the biosafety level (BSL) 3 suite.

The ADMIN AHU (S-AHU-3) will be provided to serve the approximately 13,000 SF of administrative, support, common, and shell spaces associated with the expansion. The unit has been estimated to provide approximately 12,000 cfm of supply air to the facility based on the mixed airflow condition of return air and approximately 20% outdoor air (OA). The unit will include a hydronic cooling coil, variable speed plug fan array, pre-filters, after-filters, and associated controls. The unit will not be connected to the generator for standby power operations.

The BSL AHU (S-AHU-4) will be provided to serve the approximately 5,200 SF of BSL-2 open wet lab space associated with the expansion. The unit has been estimated to provide approximately 16,500 cfm of 100% OA to the open research lab spaces. The unit will include a hydronic preheat coil, hydronic cooling coil, variable speed plug fan array, pre-filters, after-filters, final-filters, and associated controls. The unit will be connected to the generator for standby power operations.

The BSL AHU will be provided to serve the approximately 1,700 SF of BSL-3 lab space associated with the expansion. The unit has been estimated to provide approximately 5,500 cfm of 100% OA to the BSL-3 suite. The unit will include a hydronic preheat coil, hydronic cooling coil, variable speed plug fan array, pre-filters, after-filters, final-filters, and associated controls. The unit will be connected to the generator for standby power operations.

EXHAUST SYSTEMS

The expansion will include the provision for new roof-mounted exhaust systems serving the additional program areas of the 2nd floor expansion. The new systems will include a duplex general exhaust system for the BSL-2 lab, a duplex fume exhaust system for the BSL-2 lab, a duplex radio-isotope exhaust system for the BSL-2 lab, a duplex general exhaust system for the BSL-3 lab, two rooftop exhausters, and two electrical room ventilation exhausters.

The two rooftop general exhaust systems will serve the general exhaust needs of the expansion including toilets, housekeeping, and soiled holding areas. The systems will be roof-mounted, constant air volume (CAV), mushroom-type exhausters complete with isolation control damper. The distribution ductwork associated with this system will be shop/field-fabricated galvanized steel intended to serve the dirty, but non-hazardous spaces. The combined systems have been estimated to flow approximately 1,600 cfm of general exhaust. The systems will <u>not</u> be connected to the generator for standby power capabilities.

The duplex general exhaust system serving the BSL-2 lab will be roof-mounted, mixed-flow, high-plume, VAV system with constant discharge stack velocity complete with isolation and OA bypass control dampers. The system will include two fans each sized at 65% capacity to allow for a slight reduction in airflow due to a single fan failure. The system will serve the BSL-2 general exhaust grilles located in the lab areas. The distribution associated with this system will include shop/field-fabricated galvanized steel ductwork. The system has been estimated to flow approximately 16,000 cfm of combined exhaust (10,500 cfm) and outdoor airflows. The system will be connected to the generator for standby power operations.

The duplex fume exhaust system serving the BSL-2 lab will be roof-mounted, mixed-flow, high-plume, CAV system with constant discharge stack velocity complete with isolation and OA bypass control dampers. The system will include two fans each sized at 150% capacity to allow for full airflow redundancy due to a single fan failure. The system will serve the BSL-2 lab's multiple chemical fume hoods. The distribution associated with this system will include shop/field-fabricated 304L stainless steel ductwork. The system has been estimated to flow approximately 9,500 cfm of combined exhaust (6,300 cfm) and outdoor airflows. The system will be connected to the generator for standby power operations.

The duplex radio-isotope fume exhaust system serving the BSL-2 lab will be roof-mounted, mixed-flow, high-plume, CAV system with constant discharge stack velocity complete with isolation and OA bypass control dampers. The system will include two fans each sized at 150% capacity to allow for full airflow redundancy due to a single fan failure. The system will serve the BSL-2 lab's single radio-isotope fume hood. The distribution associated with this system will include shop/field-fabricated 316L stainless steel ductwork. The system has been estimated to flow approximately 1,400 cfm of combined exhaust (900 cfm) and outdoor airflows. The system will be connected to the generator for standby power operations.

The duplex fume exhaust system serving the BSL-3 lab will be roof-mounted, mixed-flow, high-plume, CAV system with constant discharge stack velocity complete with isolation and OA bypass control dampers. The system will include two fans each sized at 150% capacity to allow for full airflow redundancy due to a single fan failure. The system will serve the BSL-3 lab's general exhaust grilles located in the lab areas. The distribution associated with this system will include shop/field-fabricated 304L stainless steel ductwork. The system has been estimated to flow approximately 8,500 cfm of combined exhaust (5,600 cfm) and outdoor airflows. The system will be connected to the generator for standby power operations.

As with any roof mounted equipment, future vertical expansion (above the labs) will be disruptive to laboratory operations as this equipment is relocated.

AIR TERMINAL UNIT SYSTEMS

The expansion will be served by two types of distributed air terminal unit (ATU) systems. The venturi type ATUs specified as airflow control valves that will serve the BSL-2 and BSL-3 lab spaces and the butterfly damper type ATUs that will serve the non-lab, administrative and common spaces. The new lab ATU systems will include VAV pressure-independent venturi-type electronically-actuated air valves, variable flow hydronic reheat coils, and controls. The non-lab office ATU systems will include VAV pressure-independent butterfly-type electronically-actuated dampers, variable flow hydronic reheat coils, and controls.

All of the conditioned supply airflows being delivered to the expansion will be controlled by an ATU system. All exhaust serving the BSL-2 and BSL-3 lab areas will also be controlled by airflow control valves. The ATUs will manage the space temperature, relative humidity, and relative pressure for their independent zones per VA standards.

COOLING SYSTEMS

The AHUs serving the expansion include variable flow hydronic chilled water (CHW) cooling coils for discharge air temperature control and dehumidification of the supply airflow. The CHW serving these coils shall be provided by the existing CHW pumps located in the first floor mechanical room connected to the existing 8” piping risers located for the future expansion of the tower. The coils will be sized with an entering water temperature of 44 deg F with a 14 deg F temperature rise. The load has been estimated to be approximately 260 tons flowing about 444 gpm of CHW.

The Northeast stairwell has an existing fan coil unit on the first floor to be demolished for the second floor design project. The stairwell will now be an unoccupied space and will not require air conditioning after allowances are made for the cooled adjacent spaces and cooling infiltration from the interior stairwell doors.

HEATING SYSTEMS

The AHUs and ATUs serving the expansion include variable flow hydronic heating hot water (HHW) coils for preheat and reheat air temperature control of the supply airflow. The HHW serving these coils comes from the existing HHW system pumps located in the first floor mechanical room connected to the existing 4" piping risers located for the future expansion of the tower. The preheat coils will be sized with an entering water temperature of 180 deg F with a 30 deg F temperature drop. The reheat coils will be sized with an entering water temperature of

180 deg F with a 20 deg F temperature drop. The load has been estimated to be approximately 830 MBH flowing about 73 gpm of HHW.

CONTROL SYSTEMS

The mechanical systems serving the expansion will be managed through a dedicated direct digital control (DDC) system interfaced with the existing Johnson Controls, Incorporated (JCI) building automation system (BAS). The existing system and new controllers shall all communicate through the open-protocol LONworks. The systems being managed include the AHUs, ATUs, exhaust fans, zone environmental controls, and the communication of demand requirements for CHW and HHW serving the expansion. The system controllers will be connected to individual uninterruptible power supply (UPS) units and the generator for standby power capabilities.

The control system network upgrade will consist of an internet protocol (IP) addressable router for connection to the building's switch, various building level controllers (BLCs) with associated master-slave/token-passing (MS/TP) field-bus controllers and input/output (I/O) modules to manage the I/O points required for systems management.

Each of the office ATUs will be managed by a physically attached MS/TP terminal-level controllers (TLCs) which include a wall-mounted zone controller to manage the environmental conditions (space temperature, relative humidity, and zone occupancy) for each of the respective thermal zones. The zone occupants will each have the ability to adjust setpoints as well as manage occupancy override functions at each zone's thermostat.

Each of the lab ATUs will be managed by a MS/TP networked, physically attached TLC provided by the lab ATU manufacturer. These controllers are stand-alone type that interface with the BAS to communicate controlled supply and offset airflow values with calculated general exhaust values to maintain the fixed offset airflow values. The zone occupants will not have the ability to adjust setpoints for the lab or BSL-3 spaces. All adjustments must be BAS provided.

ENERGY LIFE CYCLE COST ANALYSIS

As required per the VA design standards, an Energy Life Cycle Cost Analysis (ELCCA) was provided for the project.

To help reduce the energy costs associated with safely operating this facility, energy recovery options were considered for analysis of their energy savings potential, capital costs for systems implementation, and operations & maintenance (O&M) costs for extending the system's life cycle. All of these were combined into a total life cycle cost for each alternative being studied.

This study included the following alternatives:

- Base Option: Constant Volume Operations without Energy Recovery
- Alt #1: Constant Volume Operations with Sensible Only-Based Energy Recovery
- Alt #2: Constant Volume Operations with Enthalpy-Based Energy Recovery
- Alt #3: Variable Volume Operations without Energy Recovery

The lowest life cycle cost associated with the base option and alternatives is Alternative #3. Due to the fact that energy conservation is a significant consideration for the VA combined with the knowledgeable O&M staff at the VA who will be maintaining the facility, Alternative #3 is the preferred recommendation for this facility. The VA design standards do allow for this option to be implemented without requesting a deviation from the VA's contracting officer.

Air System Information

Air System Name	**AHU-3 (AD)**		Number of zones	**20**	
Equipment Class	**CW AHU**		Floor Area	**12496.0**	ft²
Air System Type	**VAV**		Location	**Orlando, Florida**	

Sizing Calculation Information

Calculation Months	**Jan to Dec**	Zone CFM Sizing	**Peak zone sensible load**
Sizing Data	**Calculated**	Space CFM Sizing	**Individual peak space loads**

Central Cooling Coil Sizing Data

Total coil load	**35.8**	Tons	Load occurs at	**Aug 1600**	
Total coil load	**429.8**	MBH	OA DB / WB	**94.0 / 76.0**	°F
Sensible coil load	**317.1**	MBH	Entering DB / WB	**81.8 / 66.8**	°F
Coil CFM at Aug 1600	**11004**	CFM	Leaving DB / WB	**55.0 / 53.7**	°F
Max block CFM at Aug 1600	**11004**	CFM	Coil ADP	**52.0**	°F
Sum of peak zone CFM	**11684**	CFM	Bypass Factor	**0.100**	
Sensible heat ratio	**0.738**		Resulting RH	**45**	%
ft²/Ton	**348.9**		Design supply temp.	**55.0**	°F
BTU/(hr-ft²)	**34.4**		Zone T-stat Check	**12 of 20**	OK
Water flow @ 14.0 °F rise	**61.43**	gpm	Max zone temperature deviation	**1.2**	°F

Supply Fan Sizing Data

Actual max CFM at Aug 1600	**11004**	CFM	Fan motor BHP	**0.00**	BHP
Standard CFM	**10962**	CFM	Fan motor kW	**0.00**	kW
Actual max CFM/ft²	**0.88**	CFM/ft²	Fan static	**0.00**	in wg

Outdoor Ventilation Air Data

Design airflow CFM	**3331**	CFM	CFM/person	**87.65**	CFM/person
CFM/ft²	**0.27**	CFM/ft²			

Air System Information

Air System Name .... **AHU-3 (AD)**
Equipment Class .... **CW AHU**
Air System Type .... **VAV**

Number of zones **20**
Floor Area .... **12496.0** ft²
Location .... **Orlando, Florida**

Sizing Calculation Information

Calculation Months .... **Jan to Dec**
Sizing Data .... **Calculated**

Zone CFM Sizing .... **Peak zone sensible load**
Space CFM Sizing .... **Individual peak space loads**

Zone Sizing Data

Zone Name	Maximum Cooling Sensible (MBH)	Design Airflow (CFM)	Minimum Airflow (CFM)	Time of Peak Load	Maximum Heating Load (MBH)	Zone Floor Area (ft²)	Zone CFM/ft²
Zone 1	24.0	1117	269	Oct 1500	7.3	746.0	1.50
Zone 2	5.3	248	110	Aug 1400	0.8	306.0	0.81
Zone 3	12.1	561	150	Jul 1500	0.7	417.0	1.35
Zone 4	11.5	532	137	Oct 1600	2.4	379.0	1.40
Zone 5	15.4	716	163	Oct 1600	3.4	451.0	1.59
Zone 6	5.1	238	238	Jul 1500	1.2	715.0	0.33
Zone 7	5.6	260	7	Jul 1500	0.2	117.0	2.23
Zone 8	19.7	917	553	Sep 1600	6.7	1536.0	0.60
Zone 9	11.5	532	17	Jul 1100	2.7	291.0	1.83
Zone 10	4.0	185	26	Jul 1500	1.8	435.0	0.43
Zone 11	23.7	1101	275	Jul 1100	10.2	762.0	1.45
Zone 12	23.4	1088	257	Jul 1100	10.1	713.0	1.53
Zone 13	4.6	214	85	Jul 1500	1.1	652.0	0.33
Zone 14	10.1	471	33	Jul 1600	1.4	553.0	0.85
Zone 15	13.8	639	113	Jul 1800	3.7	312.0	2.05
Zone 16	5.7	265	6	Jul 1500	0.2	98.0	2.70
Zone 17	6.1	313	313	Jul 1500	1.4	870.0	0.36
Zone 18	18.1	840	74	Jul 1400	3.0	1231.0	0.68
Zone 19	25.4	1181	362	Jul 1700	8.7	1459.0	0.81
Zone 20	5.7	265	143	Jul 1400	1.8	453.0	0.58

Zone Terminal Sizing Data

Zone Name	Reheat Coil Load (MBH)	Reheat Coil Water gpm @ 30.0 °F	Zone Htg Coil Load (MBH)	Zone Htg Water gpm @ 30.0 °F	Mixing Box Fan Airflow (CFM)
Zone 1	11.7	0.78	0.0	0.00	0
Zone 2	2.6	0.17	0.0	0.00	0
Zone 3	3.1	0.21	0.0	0.00	0
Zone 4	4.6	0.31	0.0	0.00	0
Zone 5	6.0	0.40	0.0	0.00	0
Zone 6	5.0	0.33	0.0	0.00	0
Zone 7	0.3	0.02	0.0	0.00	0
Zone 8	15.6	1.04	0.0	0.00	0
Zone 9	3.0	0.20	0.0	0.00	0
Zone 10	2.3	0.15	0.0	0.00	0
Zone 11	14.6	0.98	0.0	0.00	0
Zone 12	14.3	0.95	0.0	0.00	0
Zone 13	2.4	0.16	0.0	0.00	0
Zone 14	1.9	0.13	0.0	0.00	0
Zone 15	5.5	0.37	0.0	0.00	0
Zone 16	0.3	0.02	0.0	0.00	0

Zone Name	Reheat Coil Load (MBH)	Reheat Coil Water gpm @ 30.0 °F	Zone Htg Coil Load (MBH)	Zone Htg Water gpm @ 30.0 °F	Mixing Box Fan Airflow (CFM)
Zone 17	6.5	0.43	0.0	0.00	0
Zone 18	4.2	0.28	0.0	0.00	0
Zone 19	14.5	0.97	0.0	0.00	0
Zone 20	4.1	0.28	0.0	0.00	0

Space Loads and Airflows

Zone Name / Space Name	Mult.	Cooling Sensible (MBH)	Time of Load	Air Flow (CFM)	Heating Load (MBH)	Floor Area (ft²)	Space CFM/ft²
Zone 1							
2A105B LARGE Conf Room	1	24.0	Oct 1500	1117	7.3	746.0	1.50
Zone 2							
2A105 SMALL Conf Room	1	5.3	Aug 1400	248	0.8	306.0	0.81
Zone 3							
2A106 Open Office	1	12.1	Jul 1500	561	0.7	417.0	1.35
Zone 4							
2A107 Break Room	1	11.5	Oct 1600	532	2.4	379.0	1.40
Zone 5							
2A109 Office	1	8.4	Oct 1600	390	1.9	242.0	1.61
2A108 Office	1	7.0	Oct 1600	326	1.5	209.0	1.56
Zone 6							
2A110 Storage	1	0.5	Jul 1500	22	0.1	65.0	0.34
2AC01-02-03 Corridor	1	4.6	Jul 1500	234	1.1	650.0	0.36
Zone 7							
2A117 IT	1	5.6	Jul 1500	260	0.2	117.0	2.23
Zone 8							
2A101 Lobby	1	19.7	Sep 1600	917	6.7	1536.0	0.60
Zone 9							
2A104 Vending	1	11.5	Jul 1100	532	2.7	291.0	1.83
Zone 10							
2A102 Mens Toilet	1	1.6	Jul 1500	76	0.7	193.0	0.40
2A103 Womens Toilet	1	2.4	Jul 1400	109	1.1	242.0	0.45
Zone 11							
2BC01S Corridor	1	23.7	Jul 1100	1101	10.2	762.0	1.45
Zone 12							
2BC01N Corridor	1	23.4	Jul 1100	1088	10.1	713.0	1.53
Zone 13							
2BCO3 Corridor	1	1.1	Jul 1500	55	0.3	153.0	0.36
2B131 Storage	1	1.1	Jul 1500	50	0.3	154.0	0.33
2B130 Mens Toilet	1	0.5	Jul 1500	23	0.1	69.0	0.33
2B129 Womens Toilet	1	0.5	Jul 1500	23	0.1	69.0	0.33
2B128 HAC	1	0.6	Jul 1500	30	0.2	92.0	0.33
2B136 Trash	1	0.8	Jul 1500	38	0.2	115.0	0.33
Zone 14							
2B140 Mech Rm (BL3)	1	10.1	Jul 1600	471	1.4	553.0	0.85
Zone 15							
2B133 Office	1	6.9	Jul 1800	320	1.8	156.0	2.05
2B134 Office	1	6.9	Jul 1800	320	1.8	156.0	2.05
Zone 16							
2B137B IT	1	5.7	Jul 1500	265	0.2	98.0	2.70
Zone 17							
2BC02 Corridor	1	6.1	Jul 1500	313	1.4	870.0	0.36

Zone Name / Space Name	Mult.	Cooling Sensible (MBH)	Time of Load	Air Flow (CFM)	Heating Load (MBH)	Floor Area (ft²)	Space CFM/ft²
Zone 18							
2B138 Mech Rm	1	18.1	Jul 1400	840	3.0	1231.0	0.68
Zone 19							
2B139 Shell Space	1	25.4	Jul 1700	1181	8.7	1459.0	0.81
Zone 20							
2B138A Mech Rm	1	5.7	Jul 1400	265	1.8	453.0	0.58

	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Aug 1600 COOLING OA DB / WB 94.0 °F / 76.0 °F			HEATING DATA AT DES HTG HEATING OA DB / WB 37.0 °F / 31.1 °F		
ZONE LOADS	**Details**	**Sensible (BTU/hr)**	**Latent (BTU/hr)**	**Details**	**Sensible (BTU/hr)**	**Latent (BTU/hr)**
Window & Skylight Solar Loads	4620 ft²	64997	-	4620 ft²	-	-
Wall Transmission	1715 ft²	3765	-	1715 ft²	4070	-
Roof Transmission	12491 ft²	41706	-	12491 ft²	20507	-
Window Transmission	4620 ft²	21472	-	4620 ft²	44213	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	0 ft²	0	-	0 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	11037 W	37532	-	0	0	-
Task Lighting	746 W	2541	-	0	0	-
Electric Equipment	16180 W	55124	-	0	0	-
People	38	9650	9310	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**236785**	**9310**	**-**	**68790**	**0**
Zone Conditioning	-	254277	9310	-	65728	0
Plenum Wall Load	0%	0	-	0	0	-
Plenum Roof Load	0%	0	-	0	0	-
Plenum Lighting Load	0%	0	-	0	0	-
Return Fan Load	11004 CFM	0	-	3331 CFM	0	-
Ventilation Load	3331 CFM	62789	103358	1008 CFM	34281	0
Supply Fan Load	11004 CFM	0	-	3331 CFM	0	-
Space Fan Coil Fans	-	0	-	-	0	-
Duct Heat Gain / Loss	0%	0	-	0%	0	-
>> Total System Loads	**-**	**317065**	**112668**	**-**	**100009**	**0**
Central Cooling Coil	-	317065	112687	-	-14469	0
Terminal Reheat Coils	-	0	-	-	114478	-
>> Total Conditioning	**-**	**317065**	**112687**	**-**	**100009**	**0**
Key:	**Positive values are clg loads Negative values are htg loads**			**Positive values are htg loads Negative values are clg loads**		

Air System Information

Air System Name	**AHU-4 (BL2)**		Number of zones	**13**	
Equipment Class	**CW AHU**		Floor Area	**5165.0**	ft²
Air System Type	**VAV**		Location	**Orlando, Florida**	

Sizing Calculation Information

Calculation Months	**Jan to Dec**	Zone CFM Sizing	**Peak zone sensible load**
Sizing Data	**User-Modified**	Space CFM Sizing	**Individual peak space loads**

Central Cooling Coil Sizing Data

Total coil load	**90.2**	Tons	Load occurs at	**Aug 1600**	
Total coil load	**1081.9**	MBH	OA DB / WB	**94.0 / 76.0**	°F
Sensible coil load	**618.3**	MBH	Entering DB / WB	**94.0 / 76.0**	°F
Coil CFM at Aug 1600	**14736**	CFM	Leaving DB / WB	**55.0 / 53.9**	°F
Max block CFM	**15175**	CFM	Coil ADP	**50.7**	°F
Sum of peak zone CFM	**15266**	CFM	Bypass Factor	**0.100**	
Sensible heat ratio	**0.572**		Resulting RH	**52**	%
ft²/Ton	**57.3**		Design supply temp.	**55.0**	°F
BTU/(hr-ft²)	**209.5**		Zone T-stat Check	**12 of 13**	OK
Water flow @ 10.0 °F rise	**216.50**	gpm	Max zone temperature deviation	**0.0**	°F

Preheat Coil Sizing Data

Max coil load	**28.0**	MBH	Load occurs at	**Des Htg**	
Coil CFM at Des Htg	**2002**	CFM	Ent. DB / Lvg DB	**37.0 / 50.0**	°F
Max coil CFM	**15175**	CFM			
Water flow @ 20.0 °F drop	**2.80**	gpm			

Supply Fan Sizing Data

Actual max CFM	**15175**	CFM	Fan motor BHP	**0.00**	BHP
Standard CFM	**15117**	CFM	Fan motor kW	**0.00**	kW
Actual max CFM/ft²	**2.94**	CFM/ft²	Fan static	**0.00**	in wg

Outdoor Ventilation Air Data

Design airflow CFM	**15175**	CFM	CFM/person	**111.58**	CFM/person
CFM/ft²	**2.94**	CFM/ft²			

Zone Sizing Summary for AHU-4 (BL2)

Project Name: 039-12 Lake Nona Skin Loads 06/16/2016
Prepared by: AKEA, Inc 09:40AM

Air System Information

Air System Name .... **AHU-4 (BL2)**
Equipment Class .... **CW AHU**
Air System Type .... **VAV**

Number of zones **13**
Floor Area .... **5165.0** ft²
Location .... **Orlando, Florida**

Sizing Calculation Information

Calculation Months .... **Jan to Dec**
Sizing Data .... **User-Modified**

Zone CFM Sizing .... **Peak zone sensible load**
Space CFM Sizing .... **Individual peak space loads**

Zone Sizing Data

Zone Name	Maximum Cooling Sensible (MBH)	Design Airflow (CFM)	Minimum Airflow (CFM)	Time of Peak Load	Maximum Heating Load (MBH)	Zone Floor Area (ft²)	Zone CFM/ft²
Zone 1	5.1	279	38	Jul 1500	0.2	105.0	2.65
Zone 2	5.0	272	37	Jul 1500	0.2	102.0	2.66
Zone 3	9.4	516	70	Jul 1500	0.3	192.0	2.69
Zone 4	10.1	554	43	Jul 1500	0.2	121.0	4.58
Zone 5	9.0	495	40	Jul 1500	0.2	110.0	4.50
Zone 6	5.7	312	43	Jul 1500	0.2	120.0	2.60
Zone 7	10.8	589	80	Jul 1500	0.3	224.0	2.63
Zone 8	16.6	908	137	Jul 1500	0.5	347.0	2.62
Zone 9	44.2	2414	323	Aug 1700	3.3	821.0	2.94
Zone 10	42.9	2348	314	Aug 1700	3.2	797.0	2.95
Zone 11	45.6	2495	333	Oct 1600	3.4	845.0	2.95
Zone 12	56.6	3094	395	Oct 1600	4.8	1004.0	3.08
Zone 13	18.1	989	149	Jul 1500	0.6	377.0	2.62

Zone Terminal Sizing Data

Zone Name	Reheat Coil Load (MBH)	Reheat Coil Water gpm @ 20.0 °F	Zone Htg Coil Load (MBH)	Zone Htg Water gpm @ 20.0 °F	Mixing Box Fan Airflow (CFM)
Zone 1	0.7	0.07	0.0	0.00	0
Zone 2	0.7	0.07	0.0	0.00	0
Zone 3	1.3	0.13	0.0	0.00	0
Zone 4	0.8	0.08	0.0	0.00	0
Zone 5	0.7	0.07	0.0	0.00	0
Zone 6	0.8	0.08	0.0	0.00	0
Zone 7	1.5	0.15	0.0	0.00	0
Zone 8	2.4	0.25	0.0	0.00	0
Zone 9	7.8	0.78	0.0	0.00	0
Zone 10	7.6	0.76	0.0	0.00	0
Zone 11	8.0	0.80	0.0	0.00	0
Zone 12	10.4	1.04	0.0	0.00	0
Zone 13	2.7	0.27	0.0	0.00	0

Space Loads and Airflows

Zone Name / Space Name	Mult.	Cooling Sensible (MBH)	Time of Load	Air Flow (CFM)	Heating Load (MBH)	Floor Area (ft²)	Space CFM/ft²
Zone 1							
2A124-E Hoods	1	5.1	Jul 1500	279	0.2	105.0	2.65
Zone 2							
2A124-F Hoods	1	5.0	Jul 1500	272	0.2	102.0	2.66
Zone 3							

Zone Name / Space Name	Mult.	Cooling Sensible (MBH)	Time of Load	Air Flow (CFM)	Heating Load (MBH)	Floor Area (ft²)	Space CFM/ft²
2A119 Radio Iso Hood	1	6.3	Jul 1500	342	0.2	127.0	2.69
2A119B Radio Iso Storage	1	3.2	Jul 1500	174	0.1	65.0	2.68
Zone 4							
2A120 Freezers	1	10.1	Jul 1500	554	0.2	121.0	4.58
Zone 5							
2A121 Glasswash	1	9.0	Jul 1500	495	0.2	110.0	4.50
Zone 6							
2A122 Hoods	1	5.7	Jul 1500	312	0.2	120.0	2.60
Zone 7							
2A123 Equipment	1	10.8	Jul 1500	589	0.3	224.0	2.63
Zone 8							
2A117 Lav Circ/Vest	1	16.6	Jul 1500	908	0.5	347.0	2.62
Zone 9							
2A124-A Open Lab	1	44.2	Aug 1700	2414	3.3	821.0	2.94
Zone 10							
2A124-B Open Lab	1	42.9	Aug 1700	2348	3.2	797.0	2.95
Zone 11							
2A124-C Open Lab	1	45.6	Oct 1600	2495	3.4	845.0	2.95
Zone 12							
2A124-D Open Lab	1	56.6	Oct 1600	3094	4.8	1004.0	3.08
Zone 13							
2A116 Lab Circ/Vest	1	18.1	Jul 1500	989	0.6	377.0	2.62

Air System Design Load Summary for AHU-4 (BL2)

Project Name: 039-12 Lake Nona Skin Loads 06/16/2016
Prepared by: AKEA, Inc 09:40AM

	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Aug 1600 COOLING OA DB / WB 94.0 °F / 76.0 °F			HEATING DATA AT DES HTG HEATING OA DB / WB 37.0 °F / 31.1 °F		
ZONE LOADS	**Details**	**Sensible (BTU/hr)**	**Latent (BTU/hr)**	**Details**	**Sensible (BTU/hr)**	**Latent (BTU/hr)**
Window & Skylight Solar Loads	1034 ft²	17254	-	1034 ft²	-	-
Wall Transmission	18 ft²	69	-	18 ft²	40	-
Roof Transmission	5165 ft²	18016	-	5165 ft²	7966	-
Window Transmission	1034 ft²	5705	-	1034 ft²	9296	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	0 ft²	0	-	0 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	5165 W	17564	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	53960 W	183837	-	0	0	-
People	136	34535	33320	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**276980**	**33320**	**-**	**17302**	**0**
Zone Conditioning	-	292309	33320	-	14346	0
Plenum Wall Load	0%	0	-	0	0	-
Plenum Roof Load	0%	0	-	0	0	-
Plenum Lighting Load	0%	0	-	0	0	-
Return Fan Load	14736 CFM	0	-	2002 CFM	0	-
Ventilation Load	14736 CFM	326031	430284	2002 CFM	58956	0
Supply Fan Load	14736 CFM	0	-	2002 CFM	0	-
Space Fan Coil Fans	-	0	-	-	0	-
Duct Heat Gain / Loss	0%	0	-	0%	0	-
>> Total System Loads	**-**	**618339**	**463604**	**-**	**73302**	**0**
Central Cooling Coil	-	618339	463604	-	0	0
Preheat Coil	-	0	-	-	28000	-
Terminal Reheat Coils	-	0	-	-	45302	-
>> Total Conditioning	**-**	**618339**	**463604**	**-**	**73302**	**0**
Key:	**Positive values are clg loads Negative values are htg loads**			**Positive values are htg loads Negative values are clg loads**		

Air System Information

Air System Name	**AHU-5 (BL3)**		Number of zones	**3**	
Equipment Class	**CW AHU**		Floor Area	**1666.0**	ft²
Air System Type	**VAV**		Location	**Orlando, Florida**	

Sizing Calculation Information

Calculation Months	**Jan to Dec**	Zone CFM Sizing	**Peak zone sensible load**
Sizing Data	**User-Modified**	Space CFM Sizing	**Individual peak space loads**

Central Cooling Coil Sizing Data

Total coil load	**24.0**	Tons	Load occurs at	**Jul 1600**	
Total coil load	**287.9**	MBH	OA DB / WB	**94.0 / 76.0**	°F
Sensible coil load	**164.6**	MBH	Entering DB / WB	**94.0 / 76.0**	°F
Coil CFM at Jul 1600	**3922**	CFM	Leaving DB / WB	**55.0 / 53.9**	°F
Max block CFM	**4008**	CFM	Coil ADP	**50.7**	°F
Sum of peak zone CFM	**4046**	CFM	Bypass Factor	**0.100**	
Sensible heat ratio	**0.572**		Resulting RH	**47**	%
ft²/Ton	**69.4**		Design supply temp.	**55.0**	°F
BTU/(hr-ft²)	**172.8**		Zone T-stat Check	**3 of 3**	OK
Water flow @ 10.0 °F rise	**57.62**	gpm	Max zone temperature deviation	**0.0**	°F

Preheat Coil Sizing Data

Max coil load	**22.5**	MBH	Load occurs at	**Des Htg**	
Coil CFM at Des Htg	**1608**	CFM	Ent. DB / Lvg DB	**37.0 / 50.0**	°F
Max coil CFM	**4008**	CFM			
Water flow @ 20.0 °F drop	**2.25**	gpm			

Supply Fan Sizing Data

Actual max CFM	**4008**	CFM	Fan motor BHP	**0.00**	BHP
Standard CFM	**3993**	CFM	Fan motor kW	**0.00**	kW
Actual max CFM/ft²	**2.41**	CFM/ft²	Fan static	**0.00**	in wg

Outdoor Ventilation Air Data

Design airflow CFM	**4008**	CFM	CFM/person	**97.75**	CFM/person
CFM/ft²	**2.41**	CFM/ft²			

Zone Sizing Summary for AHU-5 (BL3)

Project Name: 039-12 Lake Nona Skin Loads — 06/16/2016
Prepared by: AKEA, Inc — 09:42AM

Air System Information

Air System Name .... **AHU-5 (BL3)**
Equipment Class .... **CW AHU**
Air System Type .... **VAV**

Number of zones **3**
Floor Area .... **1666.0** ft²
Location .... **Orlando, Florida**

Sizing Calculation Information

Calculation Months .... **Jan to Dec**
Sizing Data .... **User-Modified**

Zone CFM Sizing .... **Peak zone sensible load**
Space CFM Sizing .... **Individual peak space loads**

Zone Sizing Data

Zone Name	Maximum Cooling Sensible (MBH)	Design Airflow (CFM)	Minimum Airflow (CFM)	Time of Peak Load	Maximum Heating Load (MBH)	Zone Floor Area (ft²)	Zone CFM/ft²
Zone 1	20.7	961	252	Jul 1800	3.7	268.0	3.59
Zone 2	46.6	2165	979	Jul 1500	1.6	985.0	2.20
Zone 3	19.8	919	377	Jul 1500	0.7	413.0	2.23

Zone Terminal Sizing Data

Zone Name	Reheat Coil Load (MBH)	Reheat Coil Water gpm @ 20.0 °F	Zone Htg Coil Load (MBH)	Zone Htg Water gpm @ 20.0 °F	Mixing Box Fan Airflow (CFM)
Zone 1	7.8	0.78	0.0	0.00	0
Zone 2	17.4	1.74	0.0	0.00	0
Zone 3	6.8	0.68	0.0	0.00	0

Space Loads and Airflows

Zone Name / Space Name	Mult.	Cooling Sensible (MBH)	Time of Load	Air Flow (CFM)	Heating Load (MBH)	Floor Area (ft²)	Space CFM/ft²
Zone 1							
2B122-F Open Lab	1	13.8	Jul 1800	642	2.4	184.0	3.49
2B123 Storage	1	6.9	Jul 1800	319	1.3	84.0	3.80
Zone 2							
2B122-A Open Circ.	1	25.0	Jul 1500	1164	0.9	535.0	2.18
2B122-B Open Lab	1	5.2	Jul 1500	244	0.2	109.0	2.24
2B122-C Open Lab	1	5.5	Jul 1500	257	0.2	116.0	2.22
2B122-D Open Lab	1	5.2	Jul 1500	244	0.2	109.0	2.24
2B122-E Open Lab	1	5.5	Jul 1500	257	0.2	116.0	2.22
Zone 3							
2B118 Vestibule	1	5.6	Jul 1500	259	0.2	117.0	2.21
2B118-B Lockers Entry	1	2.9	Jul 1500	133	0.1	57.0	2.32
2B120 Mens Locker	1	5.4	Jul 1500	251	0.2	113.0	2.22
2B121 Womens Locker	1	5.9	Jul 1500	276	0.2	126.0	2.19

	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1600 COOLING OA DB / WB 94.0 °F / 76.0 °F			HEATING DATA AT DES HTG HEATING OA DB / WB 37.0 °F / 31.1 °F		
ZONE LOADS	**Details**	**Sensible (BTU/hr)**	**Latent (BTU/hr)**	**Details**	**Sensible (BTU/hr)**	**Latent (BTU/hr)**
Window & Skylight Solar Loads	341 ft²	5739	-	341 ft²	-	-
Wall Transmission	2 ft²	7	-	2 ft²	5	-
Roof Transmission	1666 ft²	5785	-	1666 ft²	2735	-
Window Transmission	341 ft²	1585	-	341 ft²	3263	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	0 ft²	0	-	0 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	1666 W	5665	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	16660 W	56759	-	0	0	-
People	41	10411	10045	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**85952**	**10045**	**-**	**6003**	**0**
Zone Conditioning	-	90407	10045	-	4603	0
Plenum Wall Load	0%	0	-	0	0	-
Plenum Roof Load	0%	0	-	0	0	-
Plenum Lighting Load	0%	0	-	0	0	-
Return Fan Load	3922 CFM	0	-	1608 CFM	0	-
Ventilation Load	3922 CFM	74151	113333	1608 CFM	49841	0
Supply Fan Load	3922 CFM	0	-	1608 CFM	0	-
Space Fan Coil Fans	-	0	-	-	0	-
Duct Heat Gain / Loss	0%	0	-	0%	0	-
>> Total System Loads	**-**	**164558**	**123378**	**-**	**54444**	**0**
Central Cooling Coil	-	164558	123378	-	0	0
Preheat Coil	-	0	-	-	22490	-
Terminal Reheat Coils	-	0	-	-	31954	-
>> Total Conditioning	**-**	**164558**	**123378**	**-**	**54444**	**0**
Key:	**Positive values are clg loads Negative values are htg loads**			**Positive values are htg loads Negative values are clg loads**		

Electrical Design Analysis

Prepared by:
Kimberly Leino, E.I.
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AKEA, Inc.

GENERAL

All work shall be as prescribed in the Request for Proposal (RFP), subsequent project revisions, VA Electrical Design Manual, and all applicable NFPA codes and VAMC design guides.

This contract includes all electrical work for the 2nd floor vertical expansion of the SimLEARN facility, as well as provision for the future 3rd through 5th floor expansions. Demolition will be completed as required. All new electrical branch circuitry, lighting, wiring devices, panelboards, transformers, and systems equipment shall be provided.

NORMAL POWER

The New Research Space is estimated to have a connected load of approximately 468 kVA – 563A at 480V/3PH. This includes lighting, general receptacles, HVAC equipment, elevators, projected lab equipment, and 20% spare capacity. The effective service shall be approximately 800A, at 480Y/277V, 3 phase, 4 wire.

NOTE: The premise of the design team proposal was the assumption all utility infrastructure necessary for the completion of the 2nd Floor addition would be accommodated in the first floor SimLEARN facility design. This information was not initially available. Since receiving the SimLEARN design documents and narrative, it has been determined that the Normal Power electrical utility service and infrastructure was only designed to accommodate the first floor of the SimLEARN facility. Optional Standby Power was not a consideration. To accommodate the electrical service for the new 2nd level research facility, a service entrance re-design/upgrade must be provided. This is to satisfy the requirement for not only the 2nd level, but also to provide for the future vertical expansion of 3 additional floors above..

PROPOSED NEW SERVICE:

Given the assumption that there will be no upgrade permitted to the SimLEARN electrical service entrance currently under construction, we propose adding a second service entrance from a new OUC pad mounted transformer, to provide a 2000A, 480Y/277V, 3PH, 4W service. Required site work would include a new concrete encased electrical duct bank to be routed from the existing OUC transformer location, to a point approximately 5’ outside the facility foundation wall. The new duct bank would then connect to an existing spare duct bank currently being installed for the SimLEARN facility. The new, second switchboard will be located in existing Normal Substation Room 1C120A. New switchboard branch feeders shall subsequently supply power to the second level research lab space.

New electrical rooms will be provided on the 2nd floor, stacked vertically above each of the electrical rooms on the first floor. Vertical space will be designated in each electrical room for conduits serving future floors.

OPTIONAL STANDBY POWER

Standby power will be derived from a new 250 kW diesel fuel generator. The generator will feed an emergency Panel 'ESM1'. Under standby power operation, loads are estimated around 244 kVA. This includes two elevators operating at the same time, selected lab equipment including freezers/refrigerators, HVAC units, and the BSL3 lab. Loads requiring standby power will be supplied via an automatic transfer switch located in the 2^{nd} level electrical room. The generator set will be provided in an exterior WP enclosure, with a skid mounted sub-base fuel tank.

PANELBOARDS

All panelboard buses will be sized to accommodate the loads per NEC. Panelboards shall be rated to accept the maximum available fault current. Quantity of breakers provided will ensure adequate branch circuits for laboratory requirements.

BRANCH CIRCUITRY

All conductors shall be copper; aluminum conductors are not allowed. Branch circuits shall extend from the designated panelboard to supply end utilization equipment/devices. Branch circuit conductors shall be sized for a voltage drop of not larger than 3%. Interior branch circuits shall be concealed in walls or above the ceiling, wherever possible. Branch circuit conductors shall be installed in new, EMT conduit raceway.

GENERAL RECEPTACLES

All 120V receptacles shall be 20A devices with NEMA 5-20R configuration, unless noted otherwise on drawings. Duplex receptacle quantity, location, and spacing shall be designed per owner's project requirements, including but not limited to, provisions for any special use areas and work stations. GFI receptacles shall be provided as indicated on plans. Dedicated circuits shall be provided for special equipment as required.

MECHANICAL AREA

The electrical equipment feeding the mechanical/HVAC equipment, such as VFD's, disconnect switches, motor starters, etc. will be installed in the same room as the equipment served.

ELEVATORS

Both the passenger and service elevators shall be served from the stand-by generator. Elevators shall be machine room-less type. Elevator recall shall be initiated upon activation of an elevator shaft or lobby smoke or heat detector. Activation of a shaft heat detector will initiate shunt-trip of the circuit breaker serving the respective elevator controller.

LIGHTING

Lighting in general shall be provided with energy saving fluorescent fixtures, using electronic ballasts (less than 10% THD) and T8 or compact fluorescent lamps, at 277V. All areas shall conform to lighting recommendations of the VA Electrical Design Manual. General light intensity basis of design foot candle values are listed for the following room types:

Laboratories:	50-75FC
Conference:	50FC
Offices (Gen.):	50FC
Lounge/Kitchenette:	20-30FC
Toilets:	30FC
Corridors:	10FC (at Floor level)
Electrical Rooms:	40FC
Telecom Rooms:	50FC
Stairways:	20FC

Direct/Indirect recessed fluorescent fixtures shall be used in all areas except restrooms. Lighting fixtures in the BSL3 Lab shall be circuited to the Standby Power branch panel. Restrooms will include wall mounted fluorescent fixtures above sinks and mirrors. Storage, supply, janitor, and utility spaces shall have either surface mounted wraparound style fixtures, or industrial style fixtures with wire guards and 4' T8 lamps. Occupancy sensors shall control the lighting in all offices and restrooms. Exit fixtures with LED lamps will be provided at NFPA 101 required locations. Selected egress path and exit fixtures shall have battery back-up ballast for emergency lighting.

TELECOMMUNICATIONS/DATA SYSTEMS

Existing communication equipment is located in Demarc Comm. Room 1C136. Backbone cabling between new telecom rooms and existing first floor room shall be multi-pair copper riser cables for voice and data. New voice/data outlets shall be provided in offices and selected lab locations. Horizontal cabling shall be UTP Cat 6. Cabling shall be routed in conduit and cable tray back to new IT rooms, and terminated in patch panels located in floor mounted racks. Combination voice/data outlets shall consist of a 4 ½" square box and ¾" single gang plaster ring with 4 jacks – 1 voice, 2 data, and 1 spare. A minimum 1" EMT conduit shall be provided from each outlet box to cable tray access.

FIRE DETECTION AND ALARM

Fire alarm system design shall be provided as an expansion of the existing facility fire detection and alarm system. New terminal cabinets, notification and power supply panels, initiating and detection devices and associated raceway and conductors shall be provided, all 100% compatible with the existing system. The existing fire alarm control unit is located in Demarc Comm. Rm. 1C136. Interface shall be provided for elevator control under alarm conditions.

SECURITY SYSTEM

The Lake Nona VA campus has an integrated PoE Video Assessment Surveillance System (VASS) that extends from the core hospital to all surrounding buildings. Design for the new second floor research area will provide compatible equipment, and tie into the campus system via the first floor SimLearn facility. New video cameras will be located for viewing of all corridors, lab entrances, and IT closets. Pelco PoE cameras will be the Basis of Design.

Likewise for the Physical Access Control System (PACS), the new research space shall be provided secure access control devices at lab entrances, and electrical and telecom rooms. Equipment/devices to include card readers, keypads, magnetic door locks or electric strikes, door position sensors, and motion sensors for intrusion detection. Conduit with power and signal conductors will be installed as required for a complete system.

PUBLIC ADDRESS SYSTEM

Design shall be provided as an expansion of the existing zoned PA system, and shall include ceiling speakers, amplifier cabinets, cabling and raceway as required, and be compatible with the existing system. The system will be connected to the campus wide public address system, via the existing head end equipment in main Communications Room 1C136.

LIGHTNING PROTECTION

The existing rooftop lightning protection system shall be extended to the new second floor roof, designed and installed per NFPA 780. Items to be provided include air terminals, connectors, conductors, bonding connections, and clamps.

DEMOLITION

This project includes the demolition and installation of exterior electrical work. New exterior devices shall be of the weatherproof type and enclosures shall be rated NEMA 3R. Exterior work includes equipment impacted by the vertical expansion of the existing building, such as lighting, lightning protection, receptacles, and HVAC power connections.

CALCULATIONS:

Electrical calculations performed to meet the requirements of this project design shall include:

1) Short Circuit calculations – ANSI C37 and IEEE 141 standards, via SKM Power Tools A_Fault software.
2) Voltage drop calculations – 2014 NEC Handbook, Table 9, and SKM Power Tools DAPPER software.
3) Lighting foot-candle calculations – per Illuminating Engineering Society, utilizing Lite-Pro version 2.025.

NORMAL POWER - LOAD SUMMARY

LIGHTING:		SF	VA/SF				
	Bus. Occup.	15,409	3.5	=	53,932		
	Conference Rooms:	1,065	1.0	=	1,065		
	Stor.	540	0.25	=	135		
	Corridors/Stairs:	6,029	0.5	=	3,015		
			Sub-Total	=	58,146		
			Total	=	ST x 1.25	=	72,683
RECEPTACLES:							
		418 total					
		418 x 180VA		=	75,240		
		1st 10KW		=	10,000		
		remaining @ 50%		=	32,620		
			Sub-Total	=	42,620		
			Total			=	42,620
HVAC:							
	Admin AHU SF:	30 HP	(460V/3P)	=	40A x 460V x 1.732 =		21,511
	BSL-2 AHU SF:	40 HP	(460V/3P)	=	52A x 460V x 1.73 =		41,429
	BSL-3 AHU SF:	25 HP	(460V/3P)	=	34A x 460V x 1.73 =		16,732
	General EF:	10 HP	(460V/3P)	=	14 x 460V x 1.73 =		2,550
	BSL-2 EF:	50 HP	(460V/3P)	=	65 x 460V x 1.73 =		50,195
	BSL-3 EF:	20 HP	(460V/3P)	=	27A x 460V x 1.73 =		17,528
	DDC Panel:	5 x 5A	120V/1P	=	5A x 120V =		600
			Total			=	150,544
FUME HOODS: (Remote blower)							
	(general receptacle & lt. fixture)			1A x 8 Hoods x 120V		=	960
GLASS WASH UNITS:							
	Qty of 1 x 2200VA EA					=	2,200
FREEZERS/COOLERS (WALK-IN):							
	Qty of 2 x 15A EA x 208V					=	6,240
LAB FREEZER/COOLERS:							
	Qty of 6 x 15A x 120V					=	10,800

AUTOCLAVE:					
Elect. steam generator				=	45,000
Vac. Pump				=	2,493
Ctrls					240
		Total		=	47,733
REFRIGERATORS/VENDING:					
Qty of 5 x 5A x 120V				=	3,000
MISC. LAB EQUIPMENT:				=	6,000
ELEVATORS:					
(2) Elev. Mtrs.	20HP EA	(460V/3P)	= 2 x 27A x 460V x 1.73	=	43,023
STANDBY GEN SET ACCESSORIES:					
Recepts/battery charger/lighting				=	1,200
Jacket Heaters		2 x 1500VA		=	3,000
			Project Total:	=	390,003
			+ 20% Spare Capacity	=	468,003

AMPS @ 480V/3P = 563

STANDBY POWER - LOAD SUMMARY

LIGHTING:		SF	VA/SF				
	BSL3 Lab:	1,624	3.5	=	5,684		
			Sub-Total	=	5,684		
			Total	=	ST x 1.25	=	7,105
RECEPTACLES:							
		81 total					
		81 x 180VA x 0.5				=	14,580
HVAC:							
	BSL-2 AHU SF:	40 HP	(460V/3P)	=	52A x 460V x 1.73 =		41,431
	BSL-3 AHU SF:	25 HP	(460V/3P)	=	34A x 460V x 1.73 =		27,089
	Fume Hood EF:	7.5 HP	(460V/3P)	=	11A x 460V x 1.73 =		8,764
	BSL-2 EF:	50 HP	(460V/3P)	=	65A x 460V x 1.73 =		51,788
	BSL-3 EF:	20 HP	(460V/3P)	=	27A x 460V x 1.73 =		21,512
	DDC Panel:	5 x 5A	120V/1P	=	5A x 120V =		600
			Total			=	151,184
FUME HOODS: (Remote blower)							
	(general receptacle & lt. fixture)				1A x 7 Hoods x 120V	=	840
FREEZERS/COOLERS (WALK-IN):							
	Qty of 2 x 15A EA x 208V					=	6,240
LAB FREEZER/COOLERS:							
	Qty of 6 x 15A x 120V					=	10,800
REFRIGERATORS/VENDING:							
	Qty of 5 x 5A x 120V					=	3,000
MISC. LAB EQUIPMENT:						=	6,000
ELEVATORS:							
	(2) Elev. Mtrs.	20HP EA	(460V/3P)		= 2x27A x 460V x 1.73	=	43,024
STANDBY GEN SET ACCESSORIES:							
	Recepts/battery charger/lighting					=	1,200
					Project Total:	=	243,974
	AMPS @ 480V/3P (250kW Gen Set)			=	293		

NORMAL POWER - LOAD SUMMARY

LIGHTING:

General Lab:	10,585 SF x 4VA/SF	=	42,340		
Conference Rooms:	1065 SF x 1VA/SF	=	1065		
Bus. Occup/Offices:	6620 SF x 3.5VA/SF	=	23170		
Corridors:	3781 SF x 0.5VA/SF	=	1891		
	Sub-Total	=	68,466		
	Total	=	ST x 1.25	=	85582.5

RECEPTACLES:

Overall:	22051 GSF x 1VA/SF	=	22051		
Fixed Multioutlet:	730 LF/5 FT = 146 FT				
	146 FT x 180VA/FT	=	26280		
	Sub-Total	=	48331		
	Total			=	48331

HVAC:

Admin AHU SF:	20 HP	(460V/3P)	=	27A x 460x1.732 =	21511
Lab AHU SF:	40 HP	(460V/3P)	=	52A x 460V x 1.73 =	41429
BSL AHU SF:	7.5 HP	(460V/3P)	=	11A x 460V x 1.73 =	8764
General EF:	2.5 EF	(460V/3P)	=	4.2A x 460V x 1.73=	3346
Radio Isotope EF:	1.5 HP	(460V/3P)	=	3A x 460V x 1.73 =	2390
Lab EF:	2 x 15 HP	(460V/3P)	=	2x21A x 460V x 1.73 =	33462
BSL EF:	5 HP	(460V/3P)	=	7.6A x 460V x 1.73 =	6055
DDC Panel:	2 x 5A.	120V/1P	=	10A x 120V =	1200
Lab ATU Controllers:	40 x 1A.	120V/1P	=	40A x 120V =	4800
	Total			=	122957

FUME HOODS: (Remote blower)

(general receptacle & lt. fixture) 1A x 8 Hoods x 120V = 960

GLASS WASH UNITS:

Qty of 4 x 2200VA EA = 8800

FREEZERS/COOLERS:

Qty of 5 x 12A EA x 120V = 7200

REFRIGERATORS:					
Qty of 5 x 2A x 120V				=	1200
MISC. LAB EQUIPMENT:				=	6000
ELEVATORS:					
(3) Elev. Mtrs.	20HP EA	(460V/3P)	= 3 x 27A x 460V x 1.73	=	64460
STANDBY GEN SET ACCESSORIES:					
Recepts/battery charger/lighting				=	1200
Jacket Heaters		2 x 1500VA		=	3000
			Project Total:	=	349690.5
			+ 20% Spare Capacity	=	419628.6

and 419,628.6 VA @ 480V/3P = 505A

STANDBY POWER - LOAD SUMMARY

LIGHTING:						
General Lab:	10,585 SF x 1VA/SF		=	10,585		
Corridors:	3781 SF x 0.5VA/SF		=	1891		
		Sub-Total	=	12,476		
		Total	=	ST x 1.25	=	15595
RECEPTACLES:						
Fixed Multioutlet:	730 LF/5 FT = 146 FT 0.5 (146 FT x 180VA/FT)				=	13140
HVAC:						
Lab AHU SF:	40 HP	(460V/3P)	=	52A x 460V x 1.73 =		41429
BSL AHU SF:	7.5 HP	(460V/3P)	=	11A x 460V x 1.73 =		8764
Radio Isotope EF:	1.5 HP	(460V/3P)	=	3A x 460V x 1.73 =		2390
Lab EF:	2 x 15 HP	(460V/3P)	=	2x21A x 460V x 1.73 =		33462
BSL EF:	5 HP	(460V/3P)	=	7.6A x 460V x 1.73 =		6055
DDC Panel:	2 x 5A.	120V/1P	=	10A x 120V =		1200
Lab ATU Controllers:	40 x 1A.	120V/1P	=	40A x 120V =		4800
		Total			=	98100
FUME HOODS: (Remote blower)						
(general receptacle & lt. fixture)				1A x 8 Hoods x 120V	=	960
GLASS WASH UNITS:						
Qty of 1 x 2200VA EA					=	2200
FREEZERS/COOLERS:						
Qty of 5 x 12A EA x 120V					=	7200
REFRIGERATORS:						
Qty of 5 x 2A x 120V					=	1200
MISC. LAB EQUIPMENT:					=	6000

ELEVATORS:					
(1) Elev. Mtrs.	20HP EA	(460V/3P)	= 27A x 460V x 1.73	=	21511
STANDBY GEN SET ACCESSORIES:					
Recepts/battery charger/lighting				=	1200
			Project Total:	=	167106
			+ 20% Spare Capacity	=	200527.2

and 200527 VA @ 480V/3P = 241A
(250kW Gen Set)

NORMAL POWER - LOAD SUMMARY

LIGHTING:		SF	VA/SF				
	General Lab:	7,060	4	=	28,240		
	Conference Rooms:	1,360	1	=	1,360		
	Bus. Occup/Offices:	5,130	4	=	17,955		
	Corridors:	7,120	1	=	3,560		
			Sub-Total	=	51,115		
			Total	=	ST x 1.25	=	63,894
RECEPTACLES:		SF	VA/SF				
	Overall:	20,670	1	=	20,670		
	Fixed Multioutlet:	690 LF/5 FT = 138					
		138 x 180VA		=	24,840		
			Sub-Total	=	45,510		
			Total			=	45,510
HVAC:							
	Admin AHU SF:	20 HP	(460V/3P)	=	27A x 460V x 1.732 =		21,511
	BSL-2 AHU SF:	40 HP	(460V/3P)	=	52A x 460V x 1.73 =		41,429
	BSL-3 AHU SF:	15 HP	(460V/3P)	=	21A x 460V x 1.73 =		16,732
	General EF:	2 x .75 HP	(460V/3P)	=	2 x 1.6A x 460V x 1.73 =		2,550
	Radio Isotope EF:	.75 HP	(460V/3P)	=	1.6A x 460V x 1.73 =		1,275
	BSL-2 EF:	3 x 15 HP	(460V/3P)	=	3 x 21A x 460V x 1.73 =		50,195
	BSL-3 EF:	2 X 7.5 HP	(460V/3P)	=	2 x 11A x 460V x 1.73 =		17,528
	DDC Panel:	5 x 5A	120V/1P	=	5A x 120V =		600
			Total			=	151,819
FUME HOODS: (Remote blower)							
	(general receptacle & lt. fixture)		1A x 7 Hoods x 120V			=	840
GLASS WASH UNITS:							
	Qty of 1 x 2200VA EA					=	2,200
FREEZERS/COOLERS (WALK-IN):							
	Qty of 2 x 15A EA x 208V					=	6,240
LAB FREEZER/COOLERS:							
	Qty of 6 x 15A x 120V					=	10,800

AUTOCLAVE:					
	Elect. steam generator			=	45,000
	Vac. Pump			=	2,493
	Ctrls				240
			Total	=	47,733
REFRIGERATORS/VENDING:					
	Qty of 5 x 5A x 120V			=	3,000
MISC. LAB EQUIPMENT:				=	6,000
ELEVATORS:					
	(3) Elev. Mtrs.	20HP EA	(460V/3P) = 3 x 27A x 460V x 1.73	=	64,460
STANDBY GEN SET ACCESSORIES:					
	Recepts/battery charger/lighting			=	1,200
	Jacket Heaters		2 x 1500VA	=	3,000
			Project Total:	=	406,696
			+ 20% Spare Capacity	=	488,035

AMPS @ 480V/3P = 587

STANDBY POWER - LOAD SUMMARY

LIGHTING:		SF	VA/SF				
	General Lab:	7,060	1	=	7,060		
	Corridors:	7,120	0.5	=	3,560		
			Sub-Total	=	10,620		
			Total	=	ST x 1.25	=	13,275
RECEPTACLES:							
	Fixed Multioutlet:	690 LF/5 FT = 138					
		138 x 180VA x 0.5				=	12,420
HVAC:							
	BSL-2 AHU SF:	40 HP	(460V/3P)	=	52A x 460V x 1.73 =		41,429
	BSL-3 AHU SF:	15 HP	(460V/3P)	=	21A x 460V x 1.73 =		16,732
	Radio Isotope EF:	.75 HP	(460V/3P)	=	1.6A x 460V x 1.73 =		1,275
	BSL-2 EF:	3 x 15 HP	(460V/3P)	=	3 x 21A x 460V x 1.73 =		50,195
	BSL-3 EF:	2 X 7.5 HP	(460V/3P)	=	2 x 11A x 460V x 1.73 =		17,528
	DDC Panel:	5 x 5A	120V/1P	=	5A x 120V =		600
			Total			=	127,759
FUME HOODS: (Remote blower)							
	(general receptacle & lt. fixture)			1A x 7 Hoods x 120V		=	840
FREEZERS/COOLERS (WALK-IN):							
	Qty of 2 x 15A EA x 208V					=	6,240
LAB FREEZER/COOLERS:							
	Qty of 6 x 15A x 120V					=	10,800
REFRIGERATORS/VENDING:							
	Qty of 5 x 5A x 120V					=	3,000
MISC. LAB EQUIPMENT:						=	6,000
ELEVATORS:							
	(1) Elev. Mtrs.	20HP EA	(460V/3P)	= 27A x 460V x 1.73		=	21,511
STANDBY GEN SET ACCESSORIES:							
	Recepts/battery charger/lighting					=	1,200
				Project Total:		=	203,045
				+ 20% Spare Capacity		=	243,654
	AMPS @ 480V/3P			=	293		
	(250kW Gen Set)						

Plumbing Narrative

Prepared by:
José Lizasoain, P.E., CxA
GRAEF

The Plumbing design will consist of the addition of a second floor to an existing research facility. The existing first floor facility will be occupied during the construction of the second floor therefore the new design will consider the least amount of interruptions as possible. Within this narrative you will find a general description of the systems that are been design and their point of connections to the existing facility.

CODES & STANDARDS

The latest edition of the following codes and standards are applicable to this project:

- VA Directives, Design Manuals, Master Specifications, VA National CAD Standard Application Guide, and other Guidance on the Technical Information Library (TIL) (http://www.cfm.va.gov/til/)
- International Building Code
- International Plumbing Code
- International Mechanical Code
- National Electrical Code (NEC)
- Safety Code for Elevators and Escalators, American Society of Mechanical Engineers (ASME) A17.1
- ASME code for Pressure Piping
- Architectural Barriers Act Accessibility Standards (ABAAS) including VA supplement, Barrier Free Design Guide (PG-18-3)
- NFPA 101 Life Safety Code
- NFPA 54 National Fuel Gas Code
- ASHRAE 90.1 Energy Standard for Buildings Except Low-Rise Residential Buildings

DOMESTIC WATER

The domestic cold water service will connect to an existing an existing 4” cold water stub out located in room 1C120 MECHANICAL. An isolation valve will be provided and a new 4” water service will connect to it and will run to the second floor. The domestic hot water service to connect to an existing 2-1/2” stub out located downstream of the steam water heaters. A new thermostatic mixing valve and circulating pump will be provided for the second floor addition. All water distribution will be above the ceiling and non-combustible material for plenum rated installation. All domestic hot water and circulating hot water piping will be insulated.

The BSL3 laboratory domestic water supply will be separated from the rest of the building with a reduce pressure principal backflow preventer.

SANITARY SYSTEM

There are two locations where vertical stack have been provided for the future additions. All sanitary connections will have to be run to these locations. The sanitary stacks will be offset on the second floor and run to the roof for future use. All vents will be extended to the roof as needed. A new acid dilution tank will be provided at the exterior of the building. All sinks located in the BSL-3 and BSL-2 laboratories will discharge into the acid dilution tank. The BSL-3 laboratory will get an effluent contamination treatment system. All piping will be cast iron hubless.

PLUMBING FIXTURES

All plumbing fixture will comply with the requirements of applicable codes for barrier free access and water conservation.

SUMP PUMP

A sump pump will be provided for the elevator shaft and will connect to the existing force main stub out located inside the shaft.

STORM WATER SYSTEM

New roof drains and overflow drains will be provided for the new roof. The existing roof drains cannot be relocated because they need to remain active during construction until the second floor is weather tight and the new roof drains are operational. All new storm water pipe will be cast iron with insulation on the horizontal sections. Condensate disposal of HVAC equipment will be collected and dispose in the storm water system.

MEDICAL GAS

Medical gas and process gas will be provided to the necessary locations as required by the user. Existing stub out are located for future connections in room GAS STORAGE 1C104 & MECHANICAL 1C120. The following are available on site:

- Oxygen
- Medical vacuum
- Process air at 100 psi and low pressure
- Waste anesthetizing gas

NATURAL GAS

Natural gas will be provided to locations required by the user. Natural gas will connect to an existing stub out located south of the building.

Fire Protection Narrative

Prepared by:
José Lizasoain, P.E., CxA
GRAEF

The Fire Protection design will consist of the addition of a second floor to an existing research facility. The existing first floor facility will be occupied during the construction of the second floor therefore the new design will consider the least amount of interruptions as possible. Within this narrative you will find a general description of the systems that are been design and their point of connections to the existing facility.

CODES & STANDARDS

The latest edition of the following codes and standards are applicable to this project:

- VA Directives, Design Manuals, Master Specifications, VA National CAD Standard Application Guide, and other Guidance on the Technical Information Library (TIL) (http://www.cfm.va.gov/til/)
- International Building Code
- NFPA 13
- ASME code for Pressure Piping
- NFPA 101 Life Safety Code

OCCUPANCY CLASSIFICATION

The SimLEARN facility is classified as light Hard with exception of mechanical rooms, storage rooms, communication rooms and electrical rooms which are ordinary hazard, group 1.

SPRINKLER SYSTEM

A wet pipe sprinkler system will be provided for the second floor. The system will connect to an existing 6” stub out located in MECHANICA 1C120. The fire protection water supply is provided by a fire pump located in the central energy plant. The estimated available pressure is 165 psig at 2,000 GPM and a churn pressure of 178 psig.

Value Engineering

Prepared by:

AKEA, Inc.

GENERAL

Due to the challenges associated with providing a complex facility's design with a strict construction cost limitation (CCL) of $7.8M including a defined 20% deductive alternate, the design team had to execute a number of value engineering (VE) sessions to reduce the estimated construction cost to be within the CCL. To reach this cost, a number of design modifications were implemented. The following design modifications associated with those specific VE implementations are defined below.

MECHANICAL

BSL-3 ATUs: The biosafety level (BSL) 3 suite design normally includes air terminal units (ATUs) with shut-off capabilities so that the heating, ventilating, and air-conditioning (HVAC) system can be deactivated and isolated from the air handling unit (AHU) system during disinfection procedures involving a "fogger" machine. However, to help reduce the construction cost, standard, low-speed actuated air valves are being provided in lieu of the high-speed actuators with shut-off capabilities. Therefore, the disinfection procedures within the BSL3 suite shall be limited to a strict procedural wipe down of the suite's interior components. No "fogger" machine can be used without future isolation methods applied.

BSL-2/3 Lab Exhaust Systems: The BSL-2 and BSL-3 suites design normally includes exhaust fans as a mixed-flow, induced-dilution type such as MK Plastics or Strobic Air so that minimal rooftop equipment, ductwork, and components are required. This minimizes the impact on the level 2 research floor once the time comes to expand the facility vertically for additional levels. However, to help reduce the construction cost, utility sets with field-fabricated stacks and mixed-flow controls are being provided in lieu of the lab type exhaust systems. Therefore, additional ductwork exposed on the roof is required. Approximately 50% of additional outdoor airflow is mixed with the exhaust stream to help dilute the exhaust flow and to improve exhaust system performance.

BSL-2 Lab Fume Hoods Airflow: The BSL-2 suite currently includes six chemical fume hoods (plus one for radio-isotope) to serve as primary containment devices for the capture of hazardous vapors and chemicals. To help reduce energy consumption, these six chemical fume hoods are normally designed to vary the amount of exhaust removed depending upon the position of the vertical sash. A closed sash has minimal exhaust where an open sash has maximum exhaust. However, to help reduce the construction cost, these systems were changed to constant volume airflow without sash management controls and high-speed variable air valves. This results in a lower first cost but does require additional energy consumption regardless of hood occupancy.

BSL-2/3 Lab Thermal Control Zones: The BSL-2 and BSL-3 suites initially (25% design) had a number of thermal control zones to distribute environmental control of the suites to multiple (smaller area) locations. This provides for a more effective control of each of the suites' environmental conditions. However, to help reduce the construction cost, the number of thermal control zones was reduced such that their effective area of control has increased. Therefore, a single temperature or relative humidity control point will effectively manage the environmental conditions of an area some distance away. The zones still make sense but are larger to manage.

ELECTRICAL

Regarding power and telecom for the future lab casework in the BSL2 area:
Above the future utility columns, we will have junction/pull boxes for normal, emergency, and telecom conductors. Power cabling can be spliced; we will pull all branch circuit power conductors to the j-boxes and leave them capped for future splice and continued routing. The Category 6 horizontal cabling for voice and data must be installed without splices. We propose this cabling not be part of this contract. We would not know exact lengths for final connections, nor would we want that much coiled cabling hanging out of the boxes above. Current project savings can be had by providing an empty raceway system only (conduit and cable tray) for the BSL2 lab.