

# Army National Guard Readiness Center

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## Thesis Proposal

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# Executive Summary

The following proposal contains a summary of work to be completed during the Spring 2011 semester for AE 482. Two depth and two breadth topics are required to be researched. A MAE focus will also be completed for the spring semester. The first depth deals with lighting design and covers a redesign of the lighting and controls of four different spaces within the Army National Guard Readiness Center Addition. The second depth focuses on electrical design. It will include a protective device coordination study, calculations for short circuiting, and two depth studies. The depth studies chosen are panel consolidation and a comprehensive short circuit analysis using SKM software.

Architectural and acoustical studies will be completed to satisfy the breadth topic requirements. For the architectural breadth, a study on lowering the ceiling heights and its effect on the installation of mechanical equipment within the plenum space will be conducted. The acoustical breadth will focus on the effects on the acoustics of lowering the ceiling heights in the auditorium.

To satisfy the MAE requirements, a study on replacing all fluorescent luminaires with similar LED luminaires within the proposed design will be conducted. Luminaire placement will remain the same and several categories of changes will be analyzed and compared.

## Background Information

The Army National Guard Readiness Center Addition is a 251,444 ft<sup>2</sup> office building that will function as a stand-alone building. Its contract value is \$100 million and is a Design-Bid-Build with Tompkins Builders Inc. with the general contractor holding lump sum contracts with all subcontractors. This new addition will have three levels below grade consisting of open office space, an auditorium, fitness facilities, locker rooms, and a telecommunication center. Above grade, there is a five story triangular tower of smaller footprint that consists of open office space, a library, and mechanical penthouse. Where the below grade levels transition to the tower, there is an outdoor plaza consisting of seating and walkways and doubles as a green roof. A unique architectural feature of the building is the steel tricorn that is meant to represent an eyebrow.

The Army National Guard Readiness Center houses administrative and resource functions that provide support to the National Guard. The 2005 Base Realignment and Closure Act (BRAC) required the realignment of Jefferson Plaza 1 in Crystal City by relocating National Guard Bureau Headquarters and Air Force Headquarters to the Army National Guard Readiness Center in Arlington Virginia and to Andrews Air Force Base, in Maryland. Over 1,200 National Guard Bureau Joint Staff and Army National Guard Bureau Joint Staff and Army National Guard Staff were required to relocate to the Readiness Center. A need for additional space was created.

## Lighting Depth

### *Problem Statement*

The Army National Guard is a large office building with the majority of the lighting design comprising of either recessed or pendant mounted fluorescent fixtures. This ensures uniform lighting at efficient energy costs. However, a more aesthetic and interesting lighting scheme can be implemented that is still appropriate for the function of the building. The scope of the lighting depth is to redesign three indoor spaces and one outdoor. These include an open office, prefunction area, auditorium, and outdoor plaza. A preliminary schematic design for each space was completed in the Tech 3 report. The designs were presented in front of a panel of professional lighting designers on December 8<sup>th</sup>, 2010 and their comments will be taken into consideration in the revisions for the spring semester.

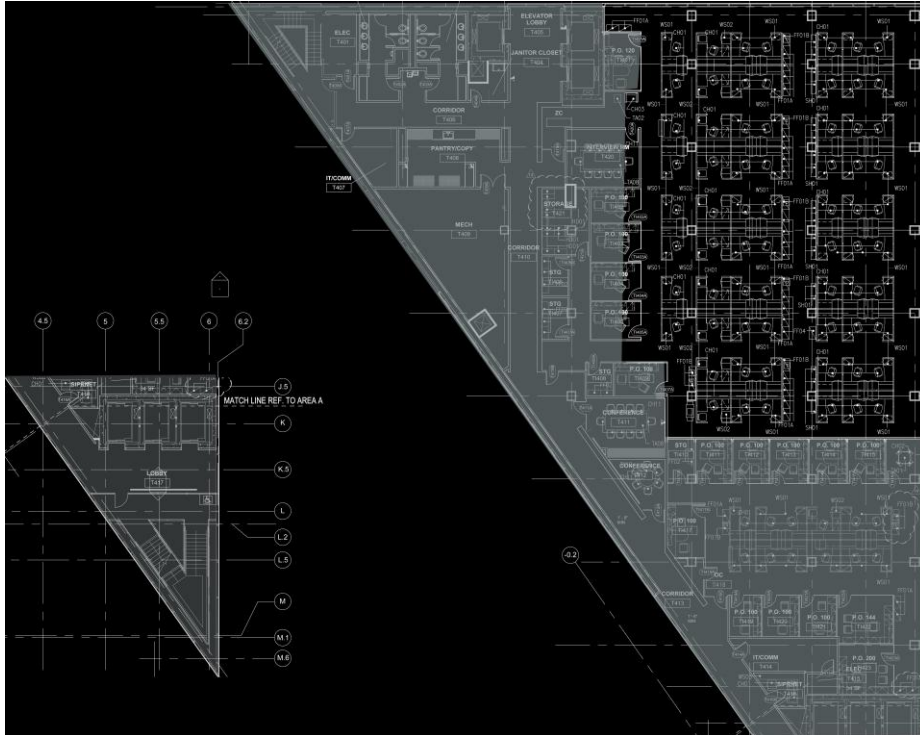


Figure 1: Open Office Floor Plan

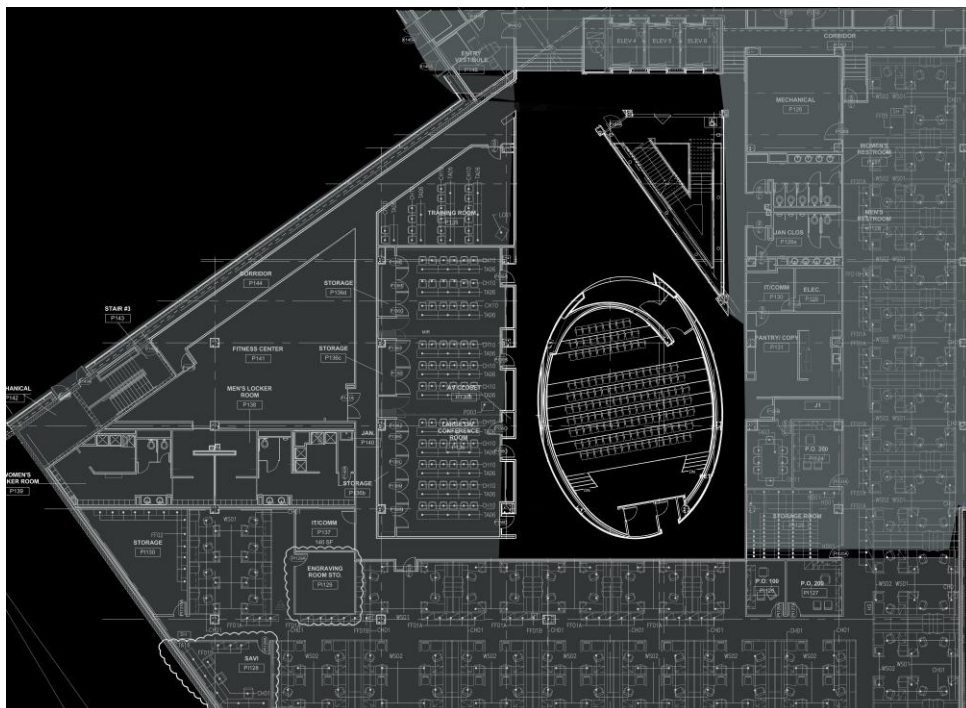
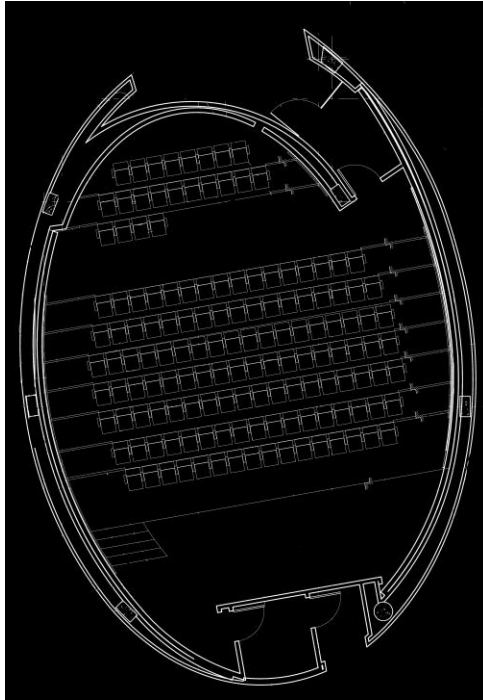
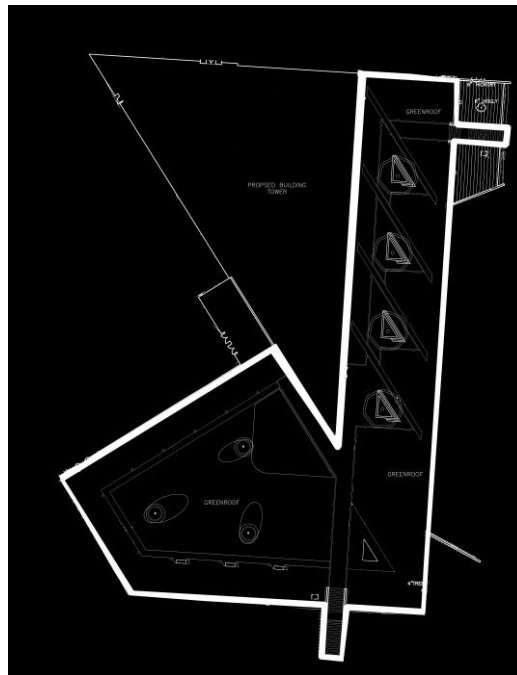


Figure 2: Prefunction Area Floor Plan



**Figure 3: Auditorium Floor Plan**



**Figure 4: Plaza Plan**

## ***Proposed Solutions***

### **Open Office**

The open office is a space where employees will be spending much of the day working with VDT's in cubicles. There is a double height ceiling, which is 10.5' above the work space and 9' above the perimeter of the space where circulation occurs. Use of indirect light with a direct component will be utilized to provide high ambient light while provide some contrast and modeling of objects. This will be done with linear fluorescent pendant fixtures over the work are. Where the ceiling is lower around the perimeter, the linear theme with the fixtures will be carried over. Wall washing will also be a technique considered around the perimeter of the space.

### **Prefunction Area**

The prefunction area serves as a place for gathering before events that may take place in the adjacent auditorium or conference rooms. Techniques to make the space feel more spacious will be utilized, which focus on illuminating the perimeter and ceiling. Because the space is a circulation space, the way light will be used to direct the occupants. Either random or guided circulation can be encouraged through the lighting design. The proposed design will implement guided circulation.

### **Auditorium**

The auditorium is an oval shape room that will be used for presentation and training purposes. At the southern end of the room is a stage that lies before a retractable projector screen. The lighting within the space will try to highlight three distinct areas within the space: seating, egress, and the stage. Because the room is shaped in an odd oval shape, the design will focus on complementing this architectural feature, making it unique for this space. Lighting for the stage should be the most flexible within the space to accommodate for either single speaker, use of projector screen, or panel discussion. Track lighting can be utilized to focus light on a single speaker or directional downlights can uniformly illuminate stage for other uses. Flexibility of lighting control will also be incorporated into the design. Different light levels will be required for different tasks that will take place.

### **Outdoor Plaza**

The plaza is a large outdoor area that provides seating and circulation around the exterior of the building. Because it is a government building, it is not desirable to draw public attention onto the site of the Army National Guard Readiness Center. Therefore the lighting design will be low

profile while providing adequate illumination for the employees to move about. In order to keep the space private, all the luminaires will be integrated within the site. The pathways will be illuminated by in-grade luminaires and luminaires integrated within the triangular planters. The stairs will be illuminated by LED handrails. To reinforce the idea of integrating the luminaires with the site, the trees within the planters will also be uplight. This will give the impression that the planters themselves are the light sources that light the paths.

## **MAE Focus: Replacing Fluorescent Fixtures with LEDs**

### ***Overview***

The majority of the luminaires used in the existing and proposed lighting designs will use fluorescent lamps. This is typical of most large commercial buildings because fluorescents often provide good quality light at exceptional efficacies. However, LEDs are making a big impact on the lighting market and becoming available in a larger variety of luminaires. For the MAE focus, a study of the effects of replacing all fluorescent luminaires used in the proposed lighting design with similar LED fixtures will be conducted. What this will include is a summary of changes in light levels, light distribution, long term costs, and lumen maintenance. In other words, the way the change to LEDs will affect the space will be studied. No changes in luminaire placement will be made to compensate for the LED luminaires during the study but suggestions for changes may be made depending on the data.

### **Solution Method**

The comments made by the panel of lighting professionals from the Tech 3 presentation will be taken into account when finalizing the design solutions. Computer software will be utilized to provide lighting calculations and renderings of each of the proposed spaces.

### **Tasks and Tools**

1. **Revise and Complete Schematic Design**  
Review and improve previously mentioned design concepts based around past semester's critiques.
2. **Model Spaces**



Computer programs such as AutoCAD, Revit Architecture, and AGI will be used to model each of the five spaces. Renderings and lighting calculations will be obtained from use of these programs.

3. Equipment Selection

Lamps, luminaires, and ballasts will be specified from manufactures' catalogues and be implemented into the lighting design.

4. Electric Lighting Calculations

Import 3D models of spaces into AGI and place selected luminaires within the model. Fill out all appropriate data. Run lighting calculations within program.

5. Renderings

Create accurate 3D renderings of spaces with the use of either AGI, Revit, or 3D Studio Max.

## Tasks and Tools

### *Overview*

The scope of the Electrical Depth includes a redesign of the branch circuit distribution for the four spaces that are being relighted, a protective device coordination study that addresses a single path through the distributions system, and two electrical depth topics. The depth topics that will be researched are panel consolidation and a short circuit analysis using SKM software.

### *Re-Lighted Spaces*

1. Open Office (Northeast area of the 7<sup>th</sup> floor)

The open office is a large area containing several cubicles, each containing its own computer. The lighting for both the existing and proposed lighting design consists of indirect and direct fluorescent fixtures running on 277 volts.

2. Prefunction Area (Center of the lower section of the third floor)

The prefunction area will be a place for gathering before events taking place within the adjacent auditorium and conference rooms. The existing and proposed lighting loads consist of recessed and wallwash fluorescent luminaires at 277 volts.

### 3. Auditorium (located with the foot print of the prefunction area)

The auditorium is a large, oval shaped room used for presentations and training purposes. The existing lighting design is consists mostly of recessed halogen luminaires with some cold cathode lighting around the perimeter. The proposed lighting design will attempt to use more energy efficient luminaires.

### 4. Outdoor Plaza

The outdoor plaza doubles as a green roof for the below grade levels. The existing lighting design uses halogen light sources to illuminate the pathways. The proposed design will try to utilize more efficient light sources.

## ***Short Circuit Analysis***

A short circuit analysis study will be conducted that addresses a single-path through the distribution system. The source will be from the utility transformer and the path will extend through the main switchgear MVS-1 to Unit Substation A, through feeder 23 to the motor control center MCC A.

## **Electrical Depth Topic 1 – Panel Consolidation**

There are several panelboards that are not fully utilized and have empty slots that can be filled in. A method of consolidating the loads into fewer panelboards will be conducted. The goal is to use each panel board at its max capacity to get the most use out of them. The excel spreadsheets will be used to create revised panelboards.

## **Electrical Depth Topic 2 – SKM Short Circuit Analysis**

A comprehensive short circuit analysis, coordination study and arc fault study will be conducted using SKM software. Spreadsheets will be used to list each piece of equipment in the system along with the actual AIC rating and the available SCC from SKM.

## **Breadth 1 – Architectural**

Upon visiting the Army National Guard Readiness Center Addition, I was informed that there was some trouble with the installation of the mechanical equipment due to the low plenum heights. This is due to the fact that the architect wanted high floor to ceiling heights. The architectural breadth will contain a study on the effects of lowering the ceiling levels and increasing the plenum space.

## **Breadth 2 – Acoustical**

Lowering the ceiling heights as mentioned in the Architectural Breadth will have an effect on the acoustical performance of the auditorium. For the Acoustical Breadth, a study will be conducted on the changes of acoustics within the auditorium and methods will be determined on how to adjust for the changes.

## Schedule

Preliminary Schedule for Spring 2011		
Week	Discipline	Activity
Winter Break	Lighting	Begin 3D modeling
		Start revisions on schematic design
January 10-15	Lighting	Finalize Schematic Designs
		Begin selecting luminaires
January 16-22	Lighting	Continue modeling
		Import spaces into AGI
January 23-29	Lighting	Import luminaires into AGI mode
		Begin lighting calculations
Jan. 30- Feb. 5	Lighting	Finalize Luminaire Selections
		Continue lighting calculations
February 6-12	Lighting	Continue lighting calculations
February 13-19	Lighting/	Continue lighting calculations
	Electrical	Begin renderings
		Begin redesign of branch circuits
February 20-26	Lighting/	Continue rendering
	Electrical	Continue redesign of branch circuits
Feb. 27- Mar. 5	Electrical	Begin SKM analysis
		Begin electrical depth #1
Spring break	Electrical/	Continue electrical depth #1
	Breadth	Begin Breadth studies
March 13-19	MAE/	Begin MAE focus
	Breadth	Complete breadth analysis
March 20-26	MAE/	Perform MAE Calcs and analysis
	Electric	Complete electrical breadths
Mar. 27- April 2	Lighting/	Complete electrical studies
	Electrical	Complete renderings
April 3-7	All	Report Due
April 11-15	All	Presentations