Project Number: 48 – DMO – 5277 – 48

COMPUTER AIDED LIGHTING DESIGN

An Interactive Qualifying Project Report

submitted to the Faculty

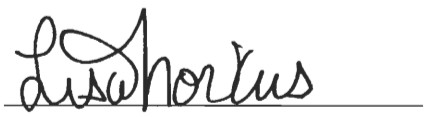
of the

WORCESTER POLYTECHNIC INSTITUTE

in partial fulfillment of the degree requirements for the

Degree of Bachelor of Science

by



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Date: April 25, 2002

Approved:

Dean M. O'Donnell, Major Advisor

Abstract

The goals of this project are two-fold: First it offers an aid for a lighting designer in the theatre. The project offers a test facility for the lighting designer to use, implementing a design of their own, as well as a sample design that a designer can adjust to experiment with desired effect. Second it offers a basic tutorial to understand the basics of the software, VectorWorks Spotlight.

Contents

Computer Aided Lighting Design

[1]Nemetschek N. A. Incorporated, VectorWorks SpotLight Users Manual (Maryland, Nemetschek N. A. Inc, 2001), 4.
[2]Nemetschek N. A. Incorporated, VectorWorks SpotLight Users Manual (Maryland, Nemetschek N. A. Inc, 2001), 9.

The Purpose of Computer Aided Lighting Design

Computer aided lighting design allows a designer to create light plots, visualize your lighting design, and keep track of your progress. It also allows for a more clear concise plan, so that the plan can be followed more accurately. Computer aided lighting design also allows a lighting designer to show the director ideas before the design gets implemented. This allows the show's director to see it and make changes before the design is actually up in the theatre. It also aides in the visualization of the performance. There are many programs available for this, one of these being VectorWorks SpotLight. There are two parts of the final result of this program. First there is a visual representation of what the theatre will look like given the particular lighting design. This goes back to the ability of the designer to show the director his or her ideas and how it might play out. The second result is a light plot with position and attributes of each light. This information is crucial for the Master Electrician and the other technical designers because each designer can put forth their design and allow them all to be put together to make sure they all work with each other.

[1]Nemetschek N. A. Incorporated, VectorWorks SpotLight Users Manual (Maryland, Nemetschek N. A. Inc, 2001), 4.
[2]Nemetschek N. A. Incorporated, VectorWorks SpotLight Users Manual (Maryland, Nemetschek N. A. Inc, 2001), 9.

The Benefits of Computer Aided Lighting Design

The benefits of computer aided lighting design are many. All paper work for budgets, schedule, and inventory can be generated and all information can be arranged in an organized concise way. You can also easily modify the instruments and the overall design, rather than having to re-write and draw a design. The design can allow you to view what effect you may obtain due to position, color and placement of the light. You can also easily calculate throw distances for beams. It allows you to see what you create and alter it according to your vision. It also lets you learn lighting design before actually doing it with a show. You can experiment without the time constraints of show deadlines. For example. You could use a PAR 64 light shining on a specific object at a certain angle and using computer aided lighting design you can see the effect it will have without the difficulty of hanging a light only to find that it doesn't create the effect you were looking for.

[1]Nemetschek N. A. Incorporated, VectorWorks SpotLight Users Manual (Maryland, Nemetschek N. A. Inc, 2001), 4.
[2]Nemetschek N. A. Incorporated, VectorWorks SpotLight Users Manual (Maryland, Nemetschek N. A. Inc, 2001), 9.

Challenges of Computer Aided Lighting Design

The main challenge of computer aided lighting design is allowing for imperfections. The nature of external forces is that they will either positively or negatively affect the results of the lighting design. It is close to impossible to predict all external factors when creating a design. The learning curve plays into this. Your degree of experience with the program and your degree of experience with lighting design will vary the results of your design. The set designer should also ideally use the same program to provide consistency. Also a factor to consider, is the time spent working at the computer worth it in terms of the final design?

[1]Nemetschek N. A. Incorporated, VectorWorks SpotLight Users Manual (Maryland, Nemetschek N. A. Inc, 2001), 4.
[2]Nemetschek N. A. Incorporated, VectorWorks SpotLight Users Manual (Maryland, Nemetschek N. A. Inc, 2001), 9.

VectorWorks SpotLight

[1]Nemetschek N. A. Incorporated, VectorWorks SpotLight Users Manual (Maryland, Nemetschek N. A. Inc, 2001), 4.
[2]Nemetschek N. A. Incorporated, VectorWorks SpotLight Users Manual (Maryland, Nemetschek N. A. Inc, 2001), 9.

The Purpose of VectorWorks SpotLight

VectorWorks SpotLight is a professional lighting design program that is of the series of add-on products for VectorWorks. VectorWorks is a CAD based design program that allows for 2 and 3-D models to be created. It is used as an aide to civil and mechanical engineers as well as theatre professionals and many more. SpotLight provides the lighting designer with a comprehensive set of tools for planning and creating a light plot and its associated paperwork. VectorWorks SpotLight combines 2D drafting and powerful 3D modeling with advanced lighting design and production tools. According to their website it's easy to create light plots, place set and scenic elements on stage, automate reports and schedules, and visualize design concepts in 3D.

[1]Nemetschek N. A. Incorporated, VectorWorks SpotLight Users Manual (Maryland, Nemetschek N. A. Inc, 2001), 4.
[2]Nemetschek N. A. Incorporated, VectorWorks SpotLight Users Manual (Maryland, Nemetschek N. A. Inc, 2001), 9.

The Challenges of VectorWorks SpotLight

There were four challenges I found in using VectorWorks SpotLight. Three of which are challenges I base solely on my own abilities and experience. The first however was problems with the copy protection and I was unable to access the SpotLight tools. This problem was fixed after the technical support was contacted and we were given a code to allow us to access what we needed to. The second challenge I ran into was the minor differences in this CAD based program and the one that I am most familiar with, Cadkey 7. I found it difficult to adjust. Another designer likely would not have the same difficulty. The third difficulty I ran into was my lack of technical theatre knowledge. Though this was a learning experience for me and I believe I have a lot of technical knowledge specific to CAD modeling and lighting in general, as will be shown later in the report. The final difficulty I faced was having little to no lighting experience and knowledge starting off. Even the research done left me feeling as though I was on shaky ground. Again, these were all difficulties specific to myself and would not necessarily occur with another designer.

[1]Nemetschek N. A. Incorporated, VectorWorks SpotLight Users Manual (Maryland, Nemetschek N. A. Inc, 2001), 4.
[2]Nemetschek N. A. Incorporated, VectorWorks SpotLight Users Manual (Maryland, Nemetschek N. A. Inc, 2001), 9.

The Model

[1]Nemetschek N. A. Incorporated, VectorWorks SpotLight Users Manual (Maryland, Nemetschek N. A. Inc, 2001), 4.
[2]Nemetschek N. A. Incorporated, VectorWorks SpotLight Users Manual (Maryland, Nemetschek N. A. Inc, 2001), 9.

Alden Hall

The original plan was to create a computer model of Alden Hall. Then create a sample lighting design for it. There are a couple factors as to why this didn't work. I believe one was my inexperience, another the learning curve of the program itself. When I tried to create Alden Hall I ended up not getting the result I attempt to achieve. Fig 1. shows a dashed line version of the model I was attempting to create.

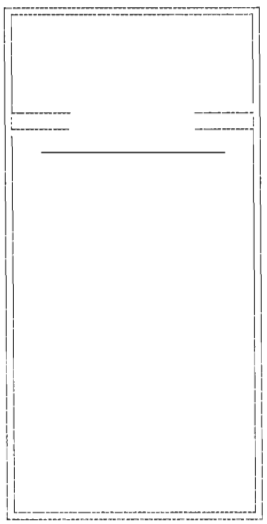

Fig 1

I was not able to create solid walls or a raised stage. My difficulties could partially be due to the project specific tutorials rather than them teaching larger concepts or ideas and also could be partially due to my inexperience with the program at the time. As a compromise, a black box test lab was suggested and created.

[1]Nemetschek N. A. Incorporated, VectorWorks SpotLight Users Manual (Maryland, Nemetschek N. A. Inc, 2001), 4.
[2]Nemetschek N. A. Incorporated, VectorWorks SpotLight Users Manual (Maryland, Nemetschek N. A. Inc, 2001), 9.

Black Box Test Lab

This was suggested to enable anyone involved in the theatre to be able to play around with lights to try to figure out how to create certain effects. This would provide a tool for lighting designers to access. However, because of the difficulties encountered with the program this may not end up being a viable option. The benefits of the black box are that it creates a neutral space which one can allow for experimentation of different lighting combinations.

[1]Nemetschek N. A. Incorporated, VectorWorks SpotLight Users Manual (Maryland, Nemetschek N. A. Inc, 2001), 4.
[2]Nemetschek N. A. Incorporated, VectorWorks SpotLight Users Manual (Maryland, Nemetschek N. A. Inc, 2001), 9.

Lighting Design

[1]Nemetschek N. A. Incorporated, VectorWorks SpotLight Users Manual (Maryland, Nemetschek N. A. Inc, 2001), 4.
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Design Manual

This is a step by step manual on how to use SpotLight to create a lighting design. This is meant to aide lighting designers in their work. This is not a tutorial on how to do lighting design in general. Just specifically how to use SpotLight to do what a lighting designer needs to do. This is assuming you have already created an actual 3-D model of the theatre space in VectorWorks

1. Create a new file using the theatrical lighting template.
2. In the file menu select the SPOTLIGHT workspace. This gives you the same resources as the other workspaces and also the SPOTLIGHT specific tools.
3. Go to your original model or pull up the test room created with this project.
4. Select the model using the 2-D selection tool, in the edit menu select cut. This cuts the model from the page you are in.
5. Go back to the spotlight workspace and paste in place (from the file menu).
6. Define the layers and classes for the plot.
    a. A layer is a sheet that holds the items. The items in that layer belong to that layer.
        1. From the organize menu use the layer function to create layers.
        2. After the layers are created, be sure to align them by using the align layers option from the view menu. This ensures consistency through the whole job.
    b. A class is an attribute of an object. This allows you to change an attribute, let's say the color of a set piece, and it will be changed through out the layers. To do this simply use the class option in the organize menu.

[1]Nemetschek N. A. Incorporated, VectorWorks SpotLight Users Manual (Maryland, Nemetschek N. A. Inc, 2001), 4.
[2]Nemetschek N. A. Incorporated, VectorWorks SpotLight Users Manual (Maryland, Nemetschek N. A. Inc, 2001), 9.

7. Create and define lighting positions.
    a. The lighting positions should be created with the regular VectorWorks tools and then converted to VectorWorks symbols. This can be done in two ways.
        1. If you are using a lighting position only once, **Define/Convert > Convert to Lighting Position** from the Spotlight menu. That will create the symbol and place the symbol on the plot.
        2. If you are creating a unique lighting position, create the object (if it is multi-part then after creating it select group from the organize menu). Then repeat above. When prompted, enter the name and click ok.
    b. Once the lighting position classes and layers have been created and defined select one from the resources palette. *Be sure you are in top/plan view.* Then using the light position object tool to insert the lighting positions.
8. Create label legends.
    a. From the Spotlight menu select, **Instrument Processing > Label Legend Manager**.
    b. Select Add in the manager and give the legend a name.
    c. Select the items to be labeled and click ok.
    d. To edit label legends:
        1. In the Label Legends Manager click choose fields.

[1]Nemetschek N. A. Incorporated, VectorWorks SpotLight Users Manual (Maryland, Nemetschek N. A. Inc, 2001), 4.
[2]Nemetschek N. A. Incorporated, VectorWorks SpotLight Users Manual (Maryland, Nemetschek N. A. Inc, 2001), 9.

2. Then change the labels that you want, whether it be which symbols are being used or the locations of the labels.

9. Add lighting instruments.
    a. A lighting instrument to get placed must be in symbol format, so either one provided from Spotlight, or one created by you but converted to a symbol.
    b. To place the lighting instruments first you must select active symbol definition from the resources palette and they must all be imported.
    c. Then using the instrument insertion tool from the Spotlight palette place the instruments in the desired location. *You can then number and refresh instruments by using the instrument processing option in the Spotlight menu*

Example: First create a truss using one of the two truss tools. Then change the view to front view. Once in the front view you can change the Y value of the truss, which is now the height the truss will be off the ground. When creating each like you must first create it and then follow the same instructions to change the height in which the light is off the ground.

10. Define and place accessories and equipment. Accessories and equipment can be placed by using the accessory insertion tool.
11. Define focus points.
12. Implement design visualization.
    a. First you need to attach a Gobo projector to each light. This allows the light to project and then you will see the effects that it has on the scenery.

[1]Nemetschek N. A. Incorporated, VectorWorks SpotLight Users Manual (Maryland, Nemetschek N. A. Inc, 2001), 4.
[2]Nemetschek N. A. Incorporated, VectorWorks SpotLight Users Manual (Maryland, Nemetschek N. A. Inc, 2001), 9.

b. To change the color of the lights you need to be in the 3-D view mode. With the 2-D selection tool click on a white point protruding from the light, this is the gobo projector. Then in the object info palette change the color to the color that you desire.

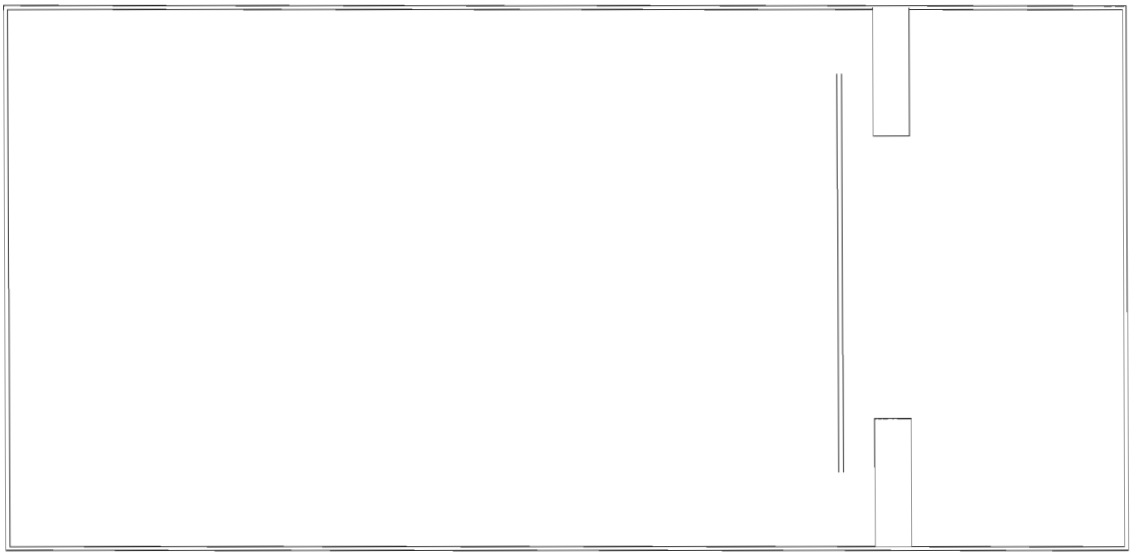
Note: See attached CD for the final lighting design. Which contains the black box, lights and the projection of those lights on the objects in the black box. Also run the Quicktime movies displaying the model.

13. Generate paperwork.

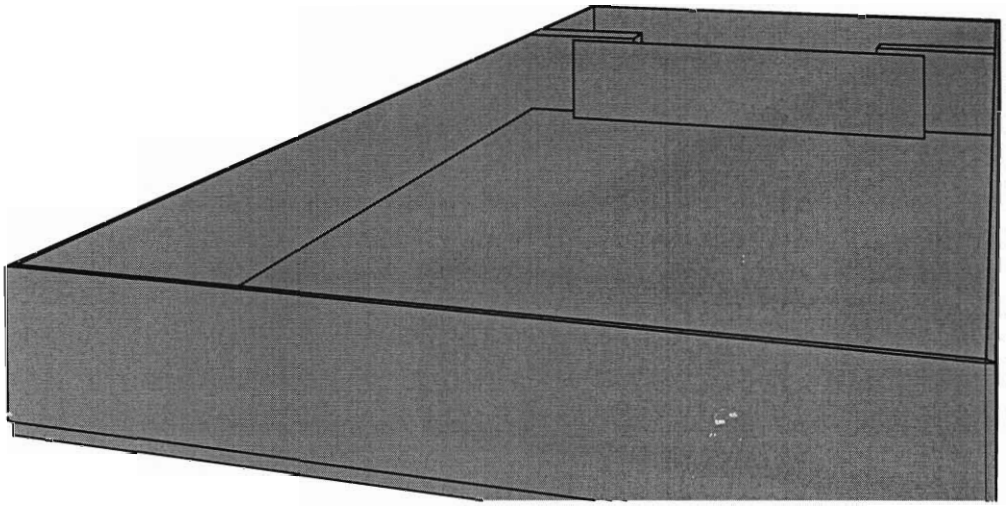
[1]Nemetschek N. A. Incorporated, VectorWorks SpotLight Users Manual (Maryland, Nemetschek N. A. Inc, 2001), 4.
[2]Nemetschek N. A. Incorporated, VectorWorks SpotLight Users Manual (Maryland, Nemetschek N. A. Inc, 2001), 9.

Project Failures

[1]Nemetschek N. A. Incorporated, VectorWorks SpotLight Users Manual (Maryland, Nemetschek N. A. Inc, 2001), 4.
[2]Nemetschek N. A. Incorporated, VectorWorks SpotLight Users Manual (Maryland, Nemetschek N. A. Inc, 2001), 9.

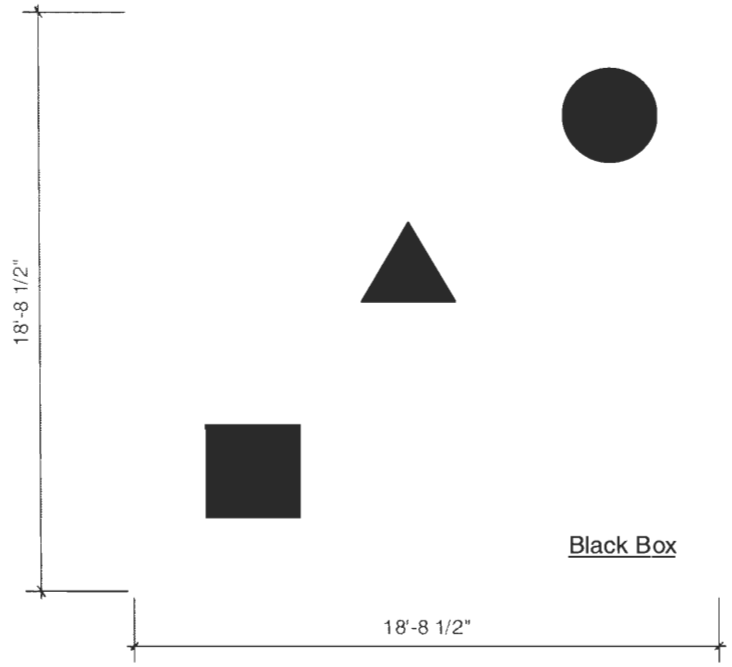


When this model of Alden was put into a 3-D view, the walls were not there, they were simply lines on the floor. Remedy: Re-adjust the Z coordinate.

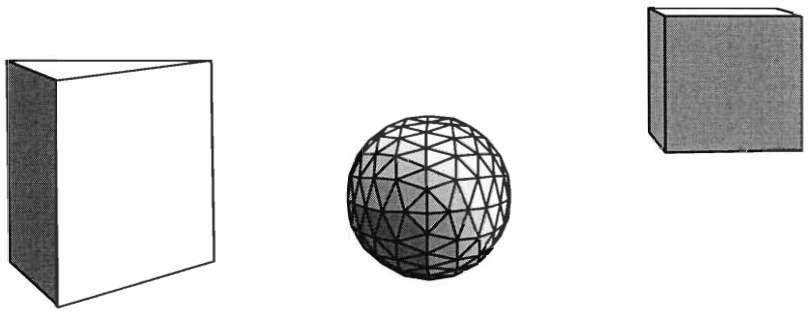


This is the next step in the Alden model. I was not able to create a stage with a different height as the walls. I was not able to remedy this problem.

[1]Nemetschek N. A. Incorporated, VectorWorks SpotLight Users Manual (Maryland, Nemetschek N. A. Inc, 2001), 4.
[2]Nemetschek N. A. Incorporated, VectorWorks SpotLight Users Manual (Maryland, Nemetschek N. A. Inc, 2001), 9.



Failed Black Box: When trying to create the 3-D objects inside the box I could not get the objects in the same layer as the walls. Remedy: Started from scratch and made a new room and objects.

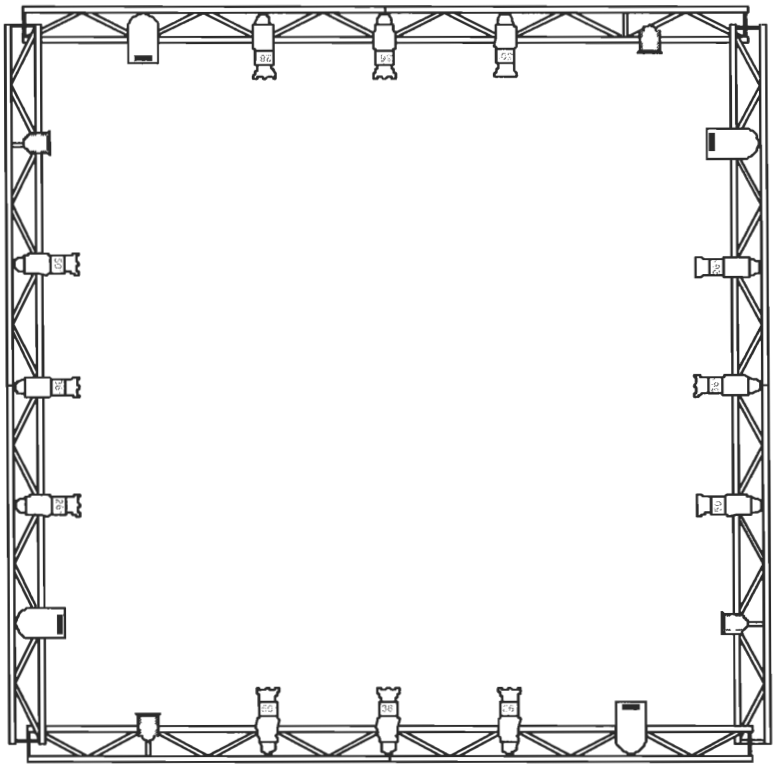


This is the 3-D version of the objects without the box.

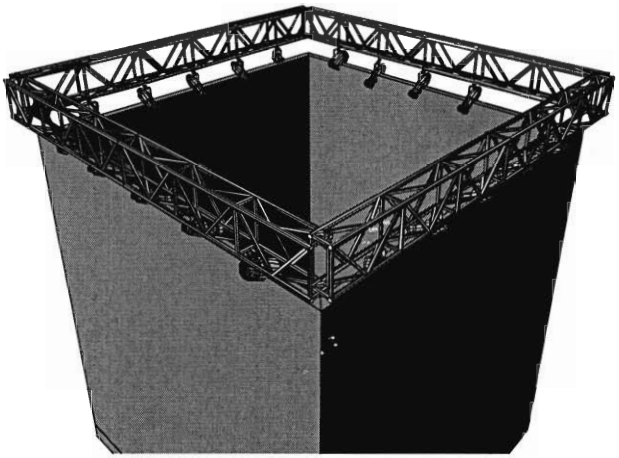
[1]Nemetschek N. A. Incorporated, VectorWorks SpotLight Users Manual (Maryland, Nemetschek N. A. Inc, 2001), 4.
[2]Nemetschek N. A. Incorporated, VectorWorks SpotLight Users Manual (Maryland, Nemetschek N. A. Inc, 2001), 9.

Project Success

[1]Nemetschek N. A. Incorporated, VectorWorks SpotLight Users Manual (Maryland, Nemetschek N. A. Inc, 2001), 4.
[2]Nemetschek N. A. Incorporated, VectorWorks SpotLight Users Manual (Maryland, Nemetschek N. A. Inc, 2001), 9.

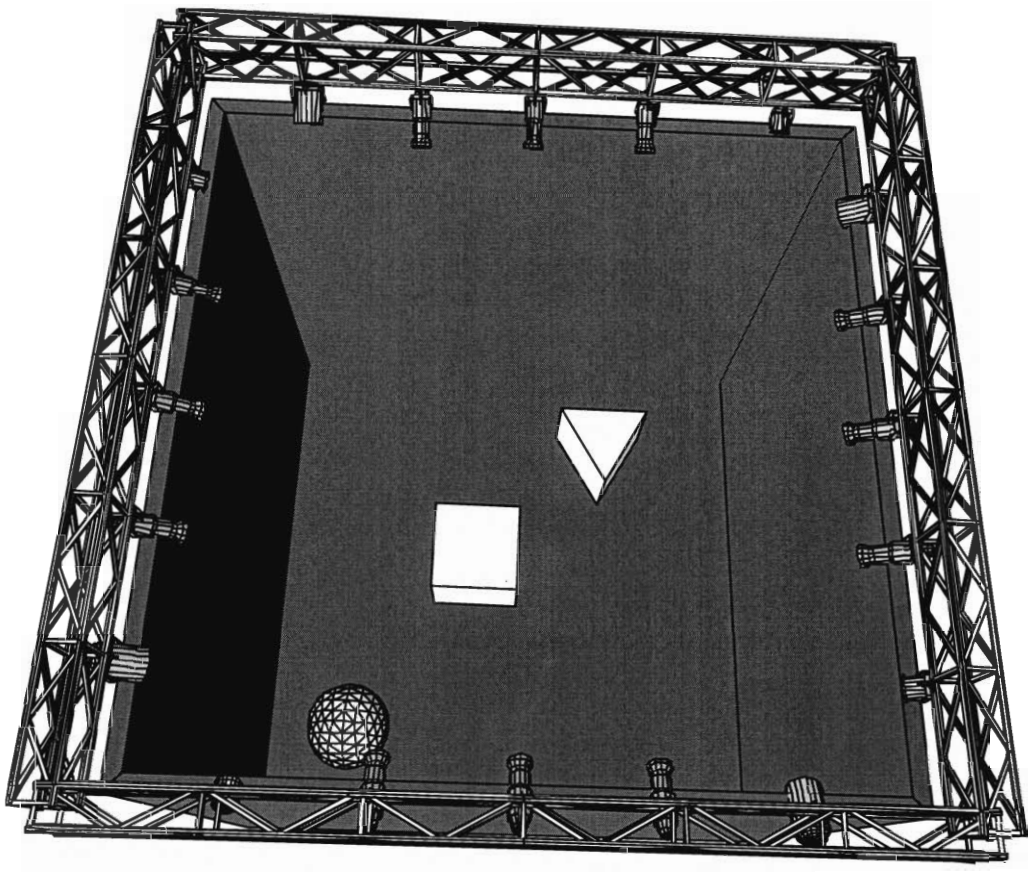


Top view of the truss with the lights hung.
Lights hung in order from left to right: (see terminology) PAR 64, ETC source 4 26°, ETC source 4 36°, ETC source 4 50°, and 165Q 6" Fresnal (all recommended to be used by Paul Messier).



This is an outside view of the truss in place.

[1]Nemetschek N. A. Incorporated, VectorWorks SpotLight Users Manual (Maryland, Nemetschek N. A. Inc, 2001), 4.
[2]Nemetschek N. A. Incorporated, VectorWorks SpotLight Users Manual (Maryland, Nemetschek N. A. Inc, 2001), 9.

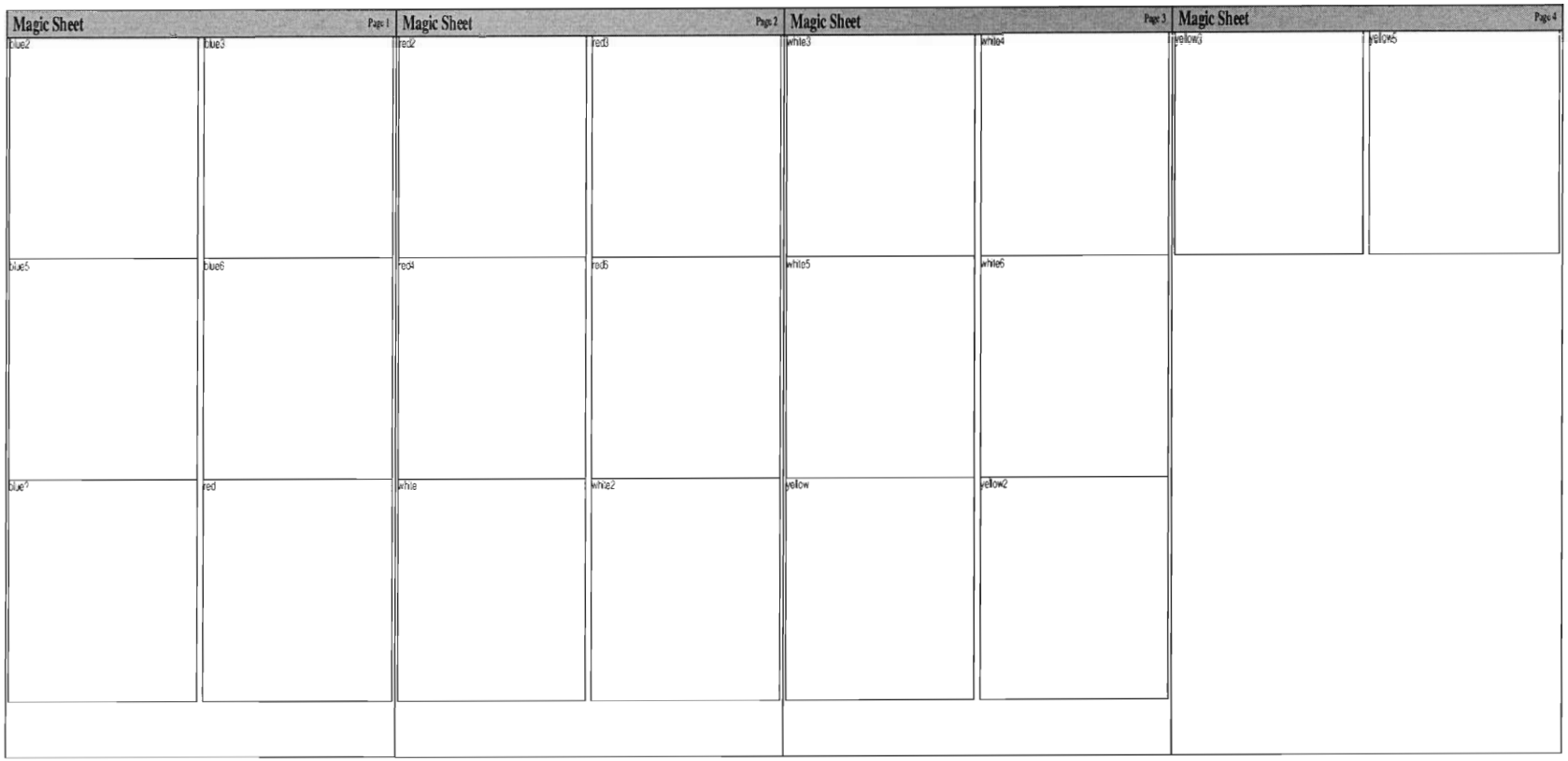


This is the complete model and lighting design.

[1]Nemetschek N. A. Incorporated, VectorWorks SpotLight Users Manual (Maryland, Nemetschek N. A. Inc, 2001), 4.
[2]Nemetschek N. A. Incorporated, VectorWorks SpotLight Users Manual (Maryland, Nemetschek N. A. Inc, 2001), 9.

Sample Paperwork

[1]Nemetschek N. A. Incorporated, VectorWorks SpotLight Users Manual (Maryland, Nemetschek N. A. Inc, 2001), 4.
[2]Nemetschek N. A. Incorporated, VectorWorks SpotLight Users Manual (Maryland, Nemetschek N. A. Inc, 2001), 9.



In the Magic Sheet each instrument has their own box, labeled with the name of the instrument.

Recommendations For Future Projects

[1]Nemetschek N. A. Incorporated, VectorWorks SpotLight Users Manual (Maryland, Nemetschek N. A. Inc, 2001), 4.
[2]Nemetschek N. A. Incorporated, VectorWorks SpotLight Users Manual (Maryland, Nemetschek N. A. Inc, 2001), 9.

My recommendations for future projects are two-fold, one being directly related to VectorWorks and the second being related to lighting design in general. Students undertaking a project in VectorWorks should research the program itself before beginning the project. A strong background in CAD is recommended. However, I found the best way to learn the program is to just use it and learn through trial and error.

Secondly students undertaking a project in computer aided lighting design should acclimate themselves to basic lighting design before attempting to do it with the aide of a computer. VectorWorks assumes the user has basic knowledge of theatrical lighting design. Without this knowledge the project will face many difficulties.

[1]Nemetschek N. A. Incorporated, VectorWorks SpotLight Users Manual (Maryland, Nemetschek N. A. Inc, 2001), 4.
[2]Nemetschek N. A. Incorporated, VectorWorks SpotLight Users Manual (Maryland, Nemetschek N. A. Inc, 2001), 9.

Terminology

Truss: a supporting structure or framework composed of beams, girders, or rods commonly of steel or wood lying in a single plane. A truss usually takes the form of a triangle or combination of triangles, since this design ensures the greatest rigidity. *(Encyclopedia.com)*

ETC source 4 26°: Electronic Theatre Controls (ETC) (manufacturer) light with a medium throw distance of (20° – 29°). (Munn, 630)

ETC source 4 36°: ETC light with a medium throw distance of (30° – 39°). (Munn, 630)

ETC source 4 50°:ETC light with a short throw distance of (50° – 59°). (Munn, 630)

[1]Nemetschek N. A. Incorporated, VectorWorks SpotLight Users Manual (Maryland, Nemetschek N. A. Inc, 2001), 4.
[2]Nemetschek N. A. Incorporated, VectorWorks SpotLight Users Manual (Maryland, Nemetschek N. A. Inc, 2001), 9.

Works Sited

Baer, Tom, VectorWorks 9 for Windows and Macintosh: Visual QuickStart Guide. Peachpit Press, 2001.

"Truss," Encyclopedia.com. http://encyclopedia.com/, 19 April 2002.

Izenour, George, C., *Theater Technology*. Yale University Press, Conneticutt, 1996.

Keller, Max, *Light Fantastic: The Art and Design of Stage Lighting*. Prestel Verlag, New York, 1999.

Mumm, Robert C., *Photometrics: 2nd Edition*. Broadway Press, Kentucky, 1997.

Pilbrow, Richard, *Stage Lighting*. Drama Book Specialists, New York, 1979.

Reid, Francis, *The ABC of Stage Lighting*. Drama Book Specialists, New York, 1992.

VectorWorks, *VectorWorks SpotLight User's Guide*. Nemetschek N.A., Incorporated, Maryland, 2001.

VectorWorks, *Learning Exercises Manual*. Nemetschek N.A., Incorporated, Maryland, 2001.

VectorWorks, *Theatrical Lighting Manual*. Nemetschek N.A., Incorporated, Maryland, 2001.

Warfel, William, *The New Handbook of Stage Lighting*. Drama Book Publishers, New York, 1990.

[1]Nemetschek N. A. Incorporated, VectorWorks SpotLight Users Manual (Maryland, Nemetschek N. A. Inc, 2001), 4.
[2]Nemetschek N. A. Incorporated, VectorWorks SpotLight Users Manual (Maryland, Nemetschek N. A. Inc, 2001), 9.