

Moog Flight Simulator Visual Display

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Project Overview

- The purpose of this project is to design and build a system for displaying the flight simulator program.
- The visualization technology and mounting system are the main requirements.
- It will important to analyze the system, taking into account the effect that the motion table will have on the components.

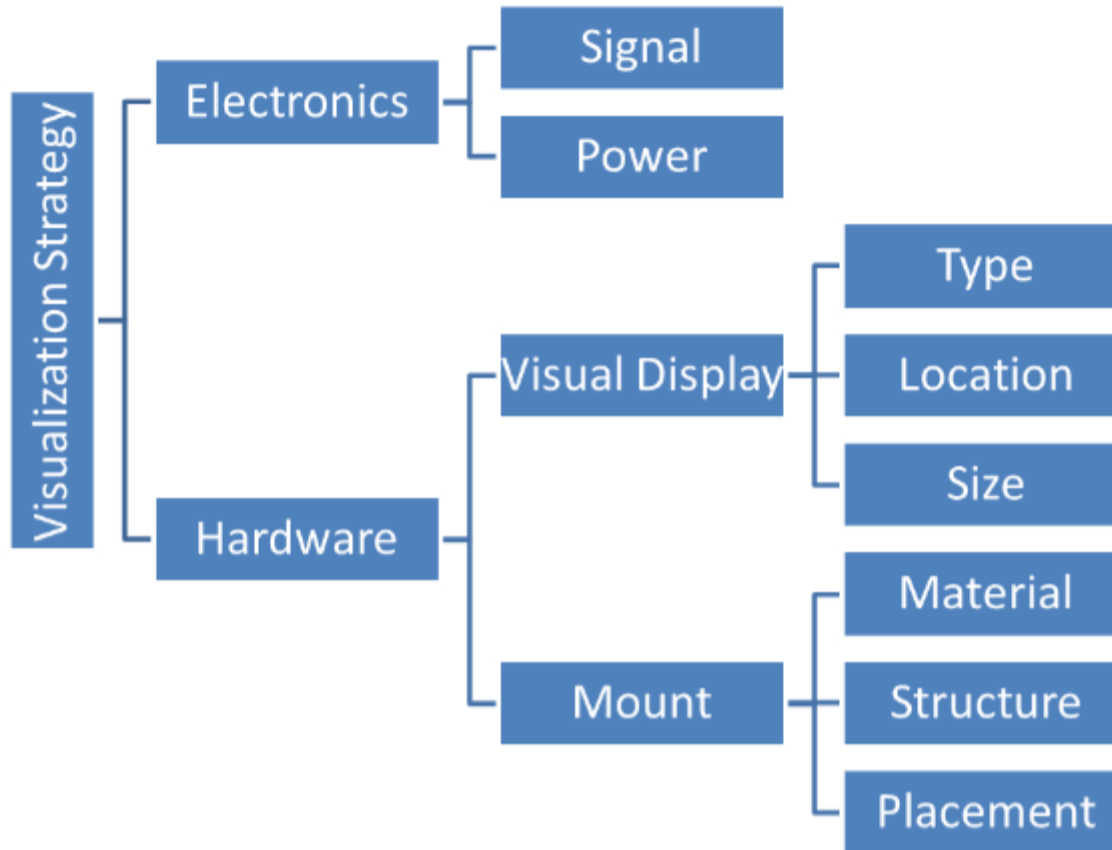
Customer Needs

- Immersive Visual Environment
 - Robust Mounting Strategy
- Interface with Flight Simulation Software

Engineering Specs

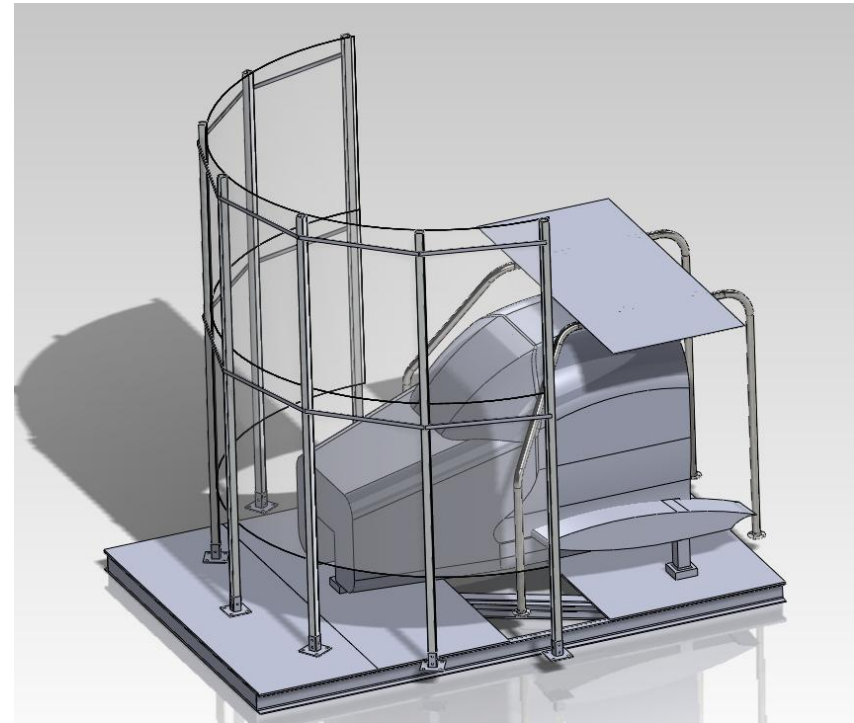
· Cost · Weight · Screen Size · Resolution ·
Brightness · Acceleration Tolerance · Vibration
Tolerance · Material Strength

System Architecture

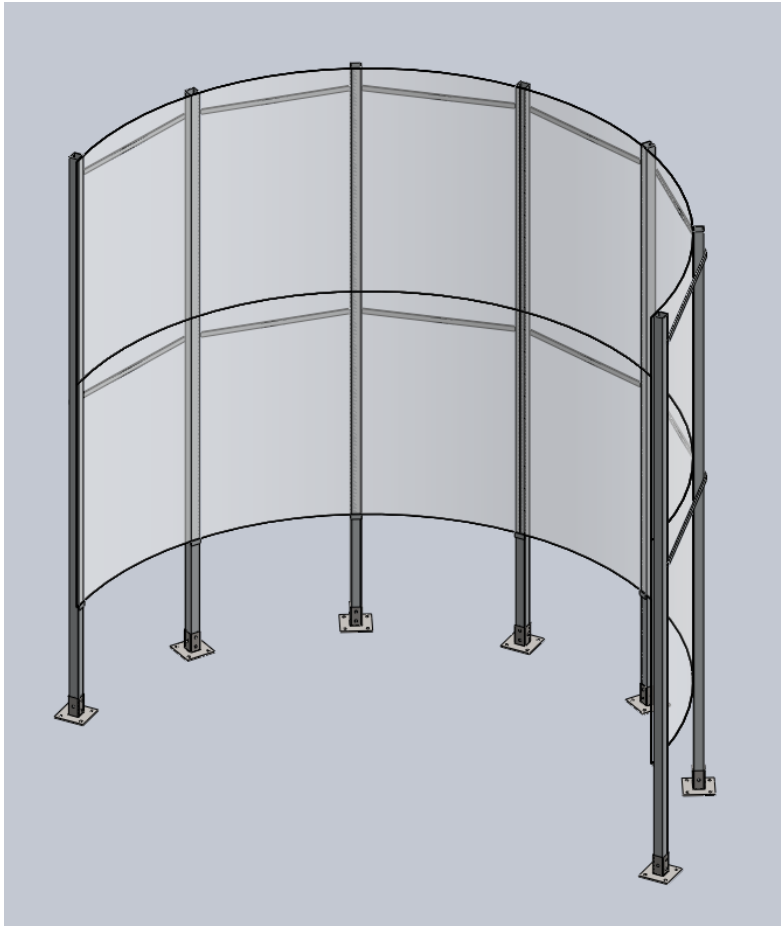


Design Summary - Projectors

Two short throw projectors from InFocus, will be connected to the computer through a Matrox DualHead2Go, and PixelWix Warping software will be used to correct for the curve. They will be mounted on a steel plate and frame above the cockpit.



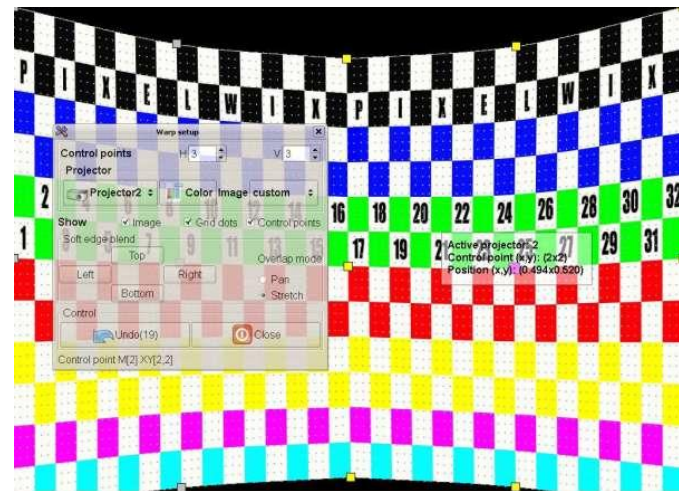
Design Summary - Screen



The screen was designed to be a 180 cylinder with a diameter of 9 ft. 7 Aluminum poles support the screen with the shape held by 1/8" thick Lexan sheet. A fabric sheet covers this as the projection surface.

System Testing Results

Testing for this project was done qualitatively. The screen needed to be structural sound and hold its shape. The projection also needed to be fit to the curved screen and tested, and corrected several times.



Budget Comparison

| | Part | Description | Supplier | Price | |
|-----------|---------------------------------|--------------------------------------|-----------------|------------|------------|
| Frame | Plate | 8' x 4' x 1/8" | Steel work | \$ 283.00 | |
| | Pipe | 1 1/2" x 10 ft LNG | Home Depot | \$ 156.25 | |
| | Flange | 1 1/2" (for pipe) | Home Depot | \$ 50.00 | |
| | Tee | 1 1/2" connecting tee | Home Depot | \$ 31.96 | |
| | Sticky Foam | 1-1/4 gry camper | Lowe's | \$ 0.72 | |
| | Ubolt | 536 U bolt | Lowe's | \$ 8.04 | |
| | Spray Paint | Flat Black Spray | Home Depot | \$ 11.94 | |
| Projector | Projector | InFocus IN1503 Portable Projector | InFocus | \$2,098.00 | |
| | PixelWix | PixelWix Warping Software | PixelWix | \$ 629.00 | |
| | Matrox | Matrox Box DualHead2Go | NewEgg | \$ 202.00 | |
| | bolt | 5/16-18"x6" Hex Bolt | Home Depot | \$ 1.46 | |
| | Nuts | Hex nut 5/16 | Home Depot | \$ 0.88 | |
| | screw | 6-32 x1 Alum | Home Depot | \$ 2.10 | |
| | Cord | PowerColor Active Displayport to DVI | NewEgg | \$ 24.99 | |
| | Cord | Statech Displayport to HDMI | NewEgg | \$ 31.98 | |
| | | For cords special shipping | | \$ 24.82 | |
| | cable | Rocketfish 6ft usb | BestBuy | \$ 29.99 | |
| | Joystick | Attack 3 joystick | BestBuy | \$ 24.99 | |
| | Graphics Card | AMD Card | BestBuy | \$ 129.50 | |
| | Tube | 2" sq x 1/8 Wall Alum Tube 10 ft LNG | Rochester Steel | \$ 249.45 | |
| | Support | 1/4 x 1 x 33" 6061 Alum Flat | Rochester Steel | \$ 42.00 | |
| | Flange Tube | 2 1/2 sq x 5" LNG Steel Tube | Rochester Steel | \$ 43.80 | |
| | Flange Plate | 1/4 x 6" sq Flat | Rochester Steel | \$ 12.06 | |
| | Support | 1/4x1 aluminum flat suport (2" pcs) | Rochester Steel | \$ 6.02 | |
| | Rochester Steel Delivery Charge | | \$ 25.00 | | |
| Screen | Panels | 8' x 4' x 1/8" Ploycarbonate Panles | Curbell | \$ 312.16 | |
| | Bolt | Elevator Bolts 1/4 20 | MSC | \$ 50.00 | |
| | Bolt | 3/8 16 Hex Head 2 3/4 | MSC | \$ 15.00 | |
| | Bolt | 3/8 16 Hex Head 1 3/4 | MSC | \$ 35.00 | |
| | Nut | 1/4 20 Hex Nut | MSC | \$ 5.00 | |
| | Nut | 3/8 16 Hex Nut | MSC | \$ 8.00 | |
| | bolt | 3/8 x 3 1/2 hex bolt | Home Depot | \$ 9.98 | |
| | bolt | 3/8 x 3 1/2 hex bolt | Home Depot | \$ 4.50 | |
| | bolt | 3/8 x 3 hex bolt | Home Depot | \$ 5.60 | |
| | washers | pack bag 3/8" cut washer | Home Depot | \$ 6.28 | |
| | Cloth | 108IN Black | Joann fabric | \$ 39.96 | |
| | Screen | cotton sheet | Fabric.com | \$ 50.00 | |
| | 2x4 | 2 x 4 x 10 ft | Lowe's | \$ 15.68 | |
| | plywood | 15/32" x 4x8 ft | Lowe's | \$ 95.82 | |
| | Angle Iron | 1/4"x2"x4' weld steel angle | lowes | \$ 26.49 | |
| | Washers | flat washers | lowes | \$ 11.00 | |
| | drill bit | Ryobi 1/4" hex shank drill bit | Home Depot | \$ 3.97 | |
| | TOTAL | | | | \$4,814.39 |

| | Part | Description | Supplier | Price |
|-----------|--------------|--------------------------------------|-----------------|------------|
| Frame | Plate | 8' x 4' x 1/8" | Rochester Steel | \$ 138.11 |
| | Pipe | 1 1/2" x 10 ft LNG | Home Depot | \$ 156.25 |
| | Flange | 1 1/2" (for pipe) | Home Depot | \$ 50.00 |
| | Tee | 1 1/2" connecting tee | Home Depot | \$ 31.96 |
| Projector | Projector | InFocus IN1503 Portable Projector | InFocus | \$2,098.00 |
| | PixelWix | PixelWix Warping Software | PixelWix | \$ 530.00 |
| | Matrox | Matrox Box DualHead2Go | NewEgg | \$ 202.00 |
| Screen | Tube | 2" sq x 1/8 Wall Alum Tube 10 ft LNG | Rochester Steel | \$ 300.00 |
| | Support | 1/4 x 1 x 32" 6061 Alum Flat | Rochester Steel | \$ 50.00 |
| | Flange Tube | 2 1/2 sq x 5" LNG Steel Tube | Rochester Steel | \$ 10.00 |
| | Flange Plate | 1/4 x 6" sq Flat | Rochester Steel | \$ 20.00 |
| | Panels | 8' x 4' x 1/8" Ploycarbonate Panles | Curbell | \$ 312.16 |
| | Bolt | Elevator Bolts 1/4 20 | MSC | \$ 50.00 |
| | Bolt | 3/8 16 Hex Head 2 3/4 | MSC | \$ 15.00 |
| | Bolt | 3/8 16 Hex Head 1 3/4 | MSC | \$ 35.00 |
| | Nut | 1/4 20 Hex Nut | MSC | \$ 5.00 |
| | Nut | 3/8 16 Hex Nut | MSC | \$ 8.00 |
| Screen | cotton sheet | Fabric.com | \$ 50.00 | |
| TOTAL | | | | \$4,061.48 |

We spent \$750 more than our presented budget at the design review.

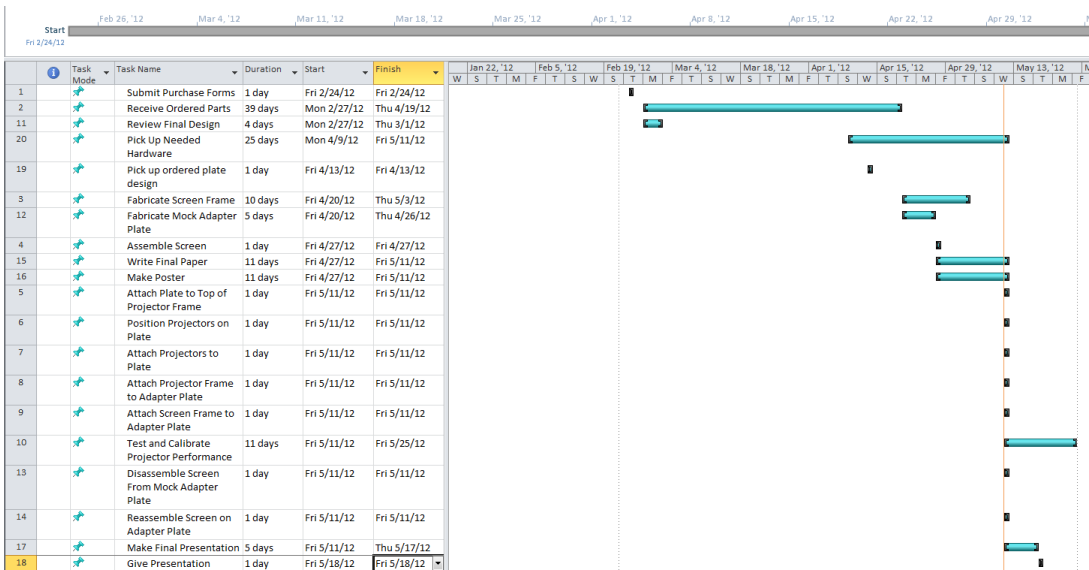
- New items that came as a result of the design review
- Unanticipated necessary expenses

Schedule Comparison

| | | | |
|--|---------|-------------|-------------|
| Submit Purchase Forms | 1 day | Fri 2/24/12 | Fri 2/24/12 |
| Receive Ordered Parts | 15 days | Mon 2/27/12 | Fri 3/16/12 |
| Review Final Design | 4 days | Mon 2/27/12 | Thu 3/1/12 |
| Attach Projectors to Plate | 2 days | Tue 2/28/12 | Wed 2/29/12 |
| Fabricate Screen Frame | 5 days | Mon 3/19/12 | Fri 3/23/12 |
| Attach Plate to Top of Projector Frame | 4 days | Mon 3/19/12 | Thu 3/22/12 |
| Position Projectors on Plate | 4 days | Fri 3/23/12 | Wed 3/28/12 |
| Assemble Screen | 3 days | Mon 3/26/12 | Wed 3/28/12 |
| Attach Projector Frame to Motion Table | 5 days | Mon 4/9/12 | Fri 4/13/12 |
| Attach Screen Frame to Motion Table | 5 days | Mon 4/9/12 | Fri 4/13/12 |
| Test and Calibrate Projector Performance | 25 days | Mon 4/16/12 | Fri 5/18/12 |

The schedule did not go quite as smoothly as we had planned. Many things contributed to this.

- Some things were out of our control.
 - The adapter plate did not come in on time which we needed.
- Some delays could have been prevented by better planning.
 - We did not order cables and adapter early enough.
- Other tasks just took longer than expected.
 - Machining the screen supports and drilling the holes.



Project Evaluation

Overall the project was a success. Unfortunately there was not an opportunity to observe the final set up on top of the 6 DOF motion table.



Suggestions for Future Work

- Due to space constraints during the build process, we were unable to mount the screen to the motion table.
 - This has caused some uncertainty about the behavior of the screen under those conditions
 - It is possible that there could be shaking of the screen during use
 - If this is the case, it is recommended that extra support poles be added.
 - Poles could connect the top corners of the screen to the much sturdier projector frame.
 - A pole could also be added across the top connect the top corners, above the image.
- Future improvements could also be made by improving the projectors.
 - Projectors that have improved brightness and resolution would improve quality.
 - Projectors that have built in geometric correction software would eliminate the need for the simulation to run through PixelWix



MOOG

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