San Diego State University

Instructional Technology Services ITS

Learning Glass

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Learning Glass

SDSU Physics professor Matt Anderson turns things around to make teaching a more engaging experience for his live and online presentations. *Learning Glass* is designed by Dr. Anderson and built by Dr. James Frazee's group at Instructional Technology Services, San Diego State University.

The presentation system uses LED side lighting on low-iron shower glass to create a see-through white board. In addition, the *Frosted Glass* attachment allows the ability to include Powerpoint lecture slides, which may also be annotated on the *Learning Glass* system.

Students are able to observe the nuances of problem solving while their professor teaches facing them. The instructor is not required to write backwards! The writing becomes forward with a simple horizontal "flip" of the image. It's that easy!

This manual will guide you through the necessary steps to build your own *Learning Glass*.

Studio Setup Information

Lighting: Fluorescent lights and diffusers to give a soft, even light and reduce the heat on the presenters. There is also an incandescent backlight. We intend to replace it with an LED version.

The glass is attached to an adjustable height table made by Steelcase. This allows us to change the height to accommodate different presenter's heights. The weight of the glass is more than the 150 lb capacity of the table support mechanism. It takes two people to adjust the height safely.

Video camera: Sony PMW-200.

Audio: Wired lavalier microphone connected to the camera.

Video display (not pictured): Used by the presenter to confirm their head location on the glass.

Teleprompter (not pictured): Displays content to the presenter. This option has been tested but not used by our faculty yet. When used, the glass needs to be angled to avoid reflecting the prompter image.

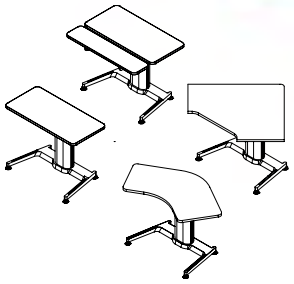
Airtouch Table Information

SteelCase Airtouch Table

Airtouch® Height-Adjustable Worksurfaces

Customer Needs:

Height-adjustable worksurfaces that are usable in both seated and standing postures. Ideal solution for power-free height adjustability and for ergonomic support in c:scape, panel or freestanding environments.



Additional worksurface shapes available.

Performance & Specification

- 26” to 43” height adjustability range
- Travel speed is approximately 1.2” seconds for entire 17” of adjustability
- Lifting column controlled manually; no power required
- 150 lbs. load capacity (including worksurface)
- Ergonomic lift handle activates smooth, effortless height adjustments
- More than just a worksurface; add the right worktools and it becomes a fully adjustable workstation

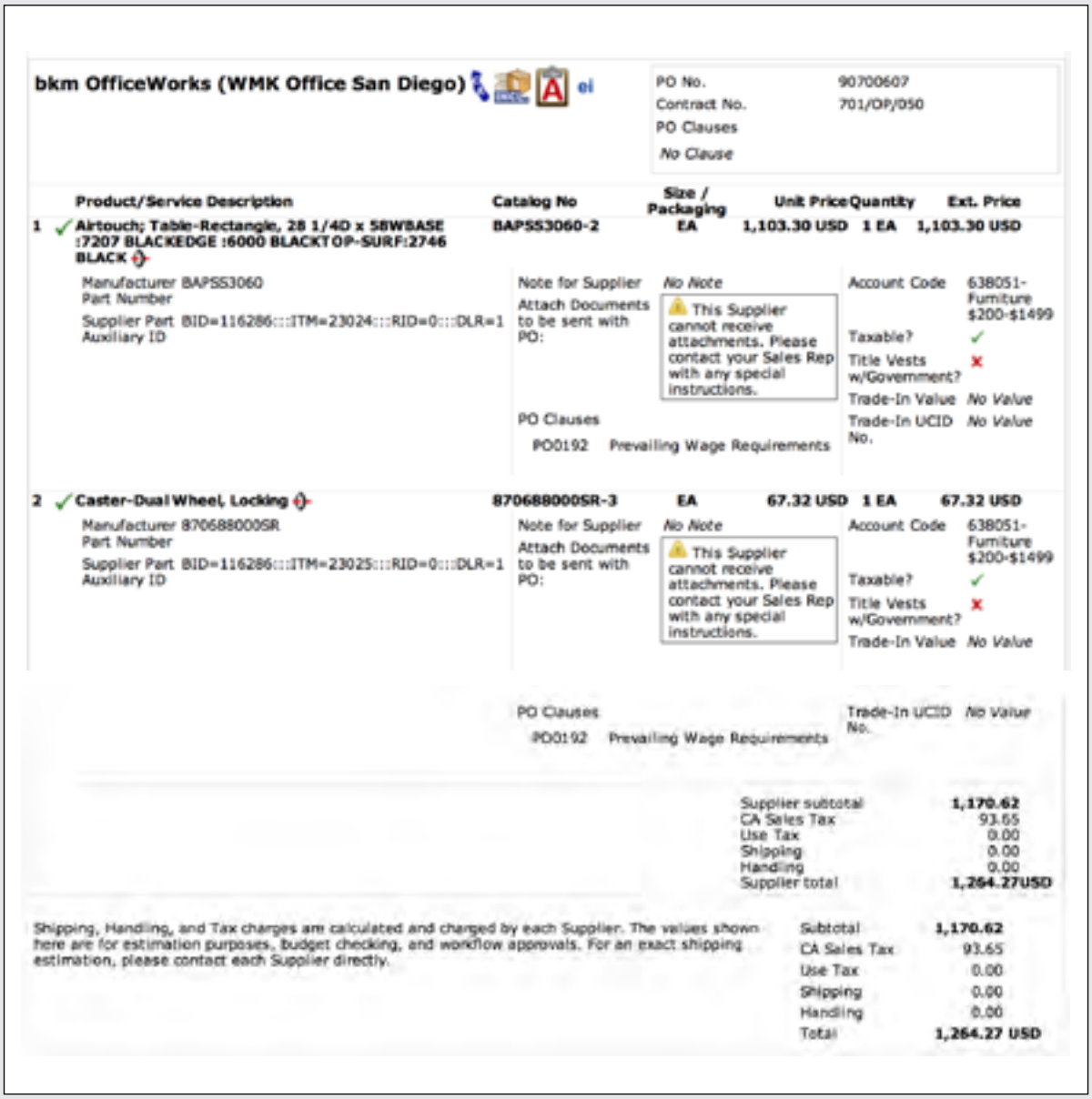
Adjustment:

- Infinite height adjustment within the 17” vertical range
- Keyboard worksurface on dual worksurfaces adjusts up to 6” higher or 5” lower than the monitor worksurface
- Keyboard on dual worksurface tilts 15°/-10°
- Shipped at minimum load bearing capacity (approximately 30 lbs.)
- Lift gauge on the column allows the amount of lift assist to be set for various cargo loads
- Lift assist mechanism needs to be adjusted properly - clockwise for heavier loads and counterclockwise for lighter loads - for the table to move smoothly
- Lift gauge tool is shipped with each table for finite adjustments

Worksurface Construction:

- Core is medium-density mat-formed particleboard.
- Manufactured with a high-pressure decorative laminate.
- Worksurfaces are available in the Universal Tables, Universal Systems and Series 9000® Systems style options
- Universal Tables have radius corners with a continuous edge profile around all edges of the worksurface. Available in 3mm or P-edge profile options.
- Universal Systems and Series 9000® worksurfaces have 90° corners. Front (user’s) edge is available in 3mm or P-edge. Back and side edges are 1mm.
- Edge finish is specified separately from laminate color
- PVC-free, 3mm edge profiles are proprietary polyolefin blend for all solid colors and seven woodgrain finishes. Matching 1 mm side and back edges are also PVC-free
- Available in Straight, Corner and 120° configurations. Straight and Corner are also available with dual worksurfaces
- Worksurfaces have pre-drilled mounting holes for the base and paddle installation
- Worksurfaces are specified in nominal dimensions to provide a 1” gap to adjacent furniture. This eliminates any pinch points between a height-adjustable worksurface and a fixed object
- All standard Steelcase laminates supported; open line laminates (OLL) are also available
- Universal worksurfaces are SCS Indoor Advantage™ certified for indoor air quality

Airtouch Table Pricing



bkm OfficeWorks (WMK Office San Diego)

PO No.	90700607
Contract No.	701/OP/050
PO Clauses	
No Clause	

	Product/Service Description	Catalog No	Size / Packaging	Unit Price	Quantity	Ext. Price
1	✓ **Airtouch; Table-Rectangle, 28 1/4D x 58WBASE :7207 BLACKEDGE :6000 BLACKTOP-SURF:2746 BLACK**	BAPSS3060-2	EA	1,103.30 USD	1 EA	1,103.30 USD

Manufacturer Part Number: BAPSS3060
Supplier Part Auxiliary ID: BID=116286:::ITM=23024:::RID=0:::DLR=1

Note for Supplier: *No Note*
Attach Documents to be sent with PO: ⚠ This Supplier cannot receive attachments. Please contact your Sales Rep with any special instructions.

PO Clauses
PO0192 Prevailing Wage Requirements

Account Code: 638051-Furniture $200-$1499
Taxable? ✓
Title Vests w/Government? ✗
Trade-In Value: *No Value*
Trade-In UCID No.: *No Value*

2	✓ **Caster-Dual Wheel, Locking**	870688000SR-3	EA	67.32 USD	1 EA	67.32 USD

Manufacturer Part Number: 870688000SR
Supplier Part Auxiliary ID: BID=116286:::ITM=23025:::RID=0:::DLR=1

Note for Supplier: *No Note*
Attach Documents to be sent with PO: ⚠ This Supplier cannot receive attachments. Please contact your Sales Rep with any special instructions.

Account Code: 638051-Furniture $200-$1499
Taxable? ✓
Title Vests w/Government? ✗
Trade-In Value: *No Value*

PO Clauses
PO0192 Prevailing Wage Requirements

Trade-In UCID No.: *No Value*

Supplier subtotal	1,170.62
CA Sales Tax	93.65
Use Tax	0.00
Shipping	0.00
Handling	0.00
Supplier total	1,264.27USD

Shipping, Handling, and Tax charges are calculated and charged by each Supplier. The values shown here are for estimation purposes, budget checking, and workflow approvals. For an exact shipping estimation, please contact each Supplier directly.

Subtotal	1,170.62
CA Sales Tax	93.65
Use Tax	0.00
Shipping	0.00
Handling	0.00
Total	1,264.27 USD

Glass Information

The glass was purchased from Comprehensive Glass Works. Any local supplier of industrial glass products will likely be able to provide comparable material. Comprehensive Glass Works provided four mounting brackets (instead of three as seen in the CAD drawing shown later) to attach the glass to the table. They held the glass but did not provide enough stability. So side supports brackets were needed. Comprehensive Glass Works suggested that 3/8" thick glass could be used instead of ½" thick glass. We opted for the ½" glass due to its added strength, despite the added weight. We selected low-iron glass, which provides better light transmission. Standard or soda-lime glass has an inherent green tint that would add a color bias to the videos.

Glass Invoice

Zuheir Inc. Dba Lic # 643139

COMPREHENSIVE GLASS WORKS *we build with glass*

6950 El Cajon Blvd., San Diego CA 92115
www.comprehensiveglassworks.com
sales@comprehensiveglassworks.com
Phone: 619-589-8858
Fax: 619-589-7426

Qty	Part / Description
1	36" X 60" #GLASS TEMPERED 1/2 LOW IRON POLISHED AND MOUNTED WITH SM12GM SLOT STANDOFFS
1	MEASURED, DELIVERED AND INSTALLED

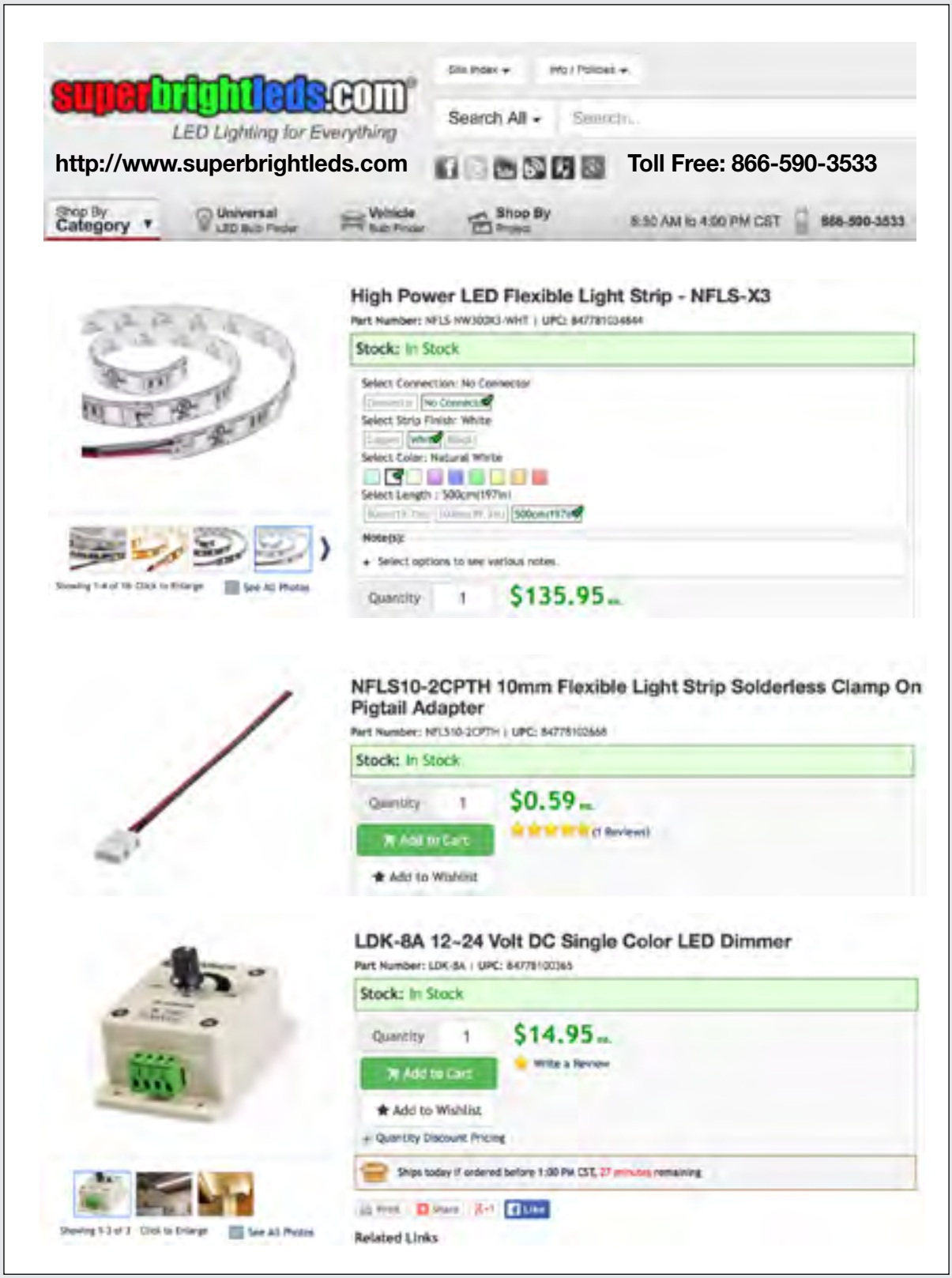
Pmt Info:	Total	Payments	Balance
VS -2026	682.86	682.86	0.00
VS -2026			

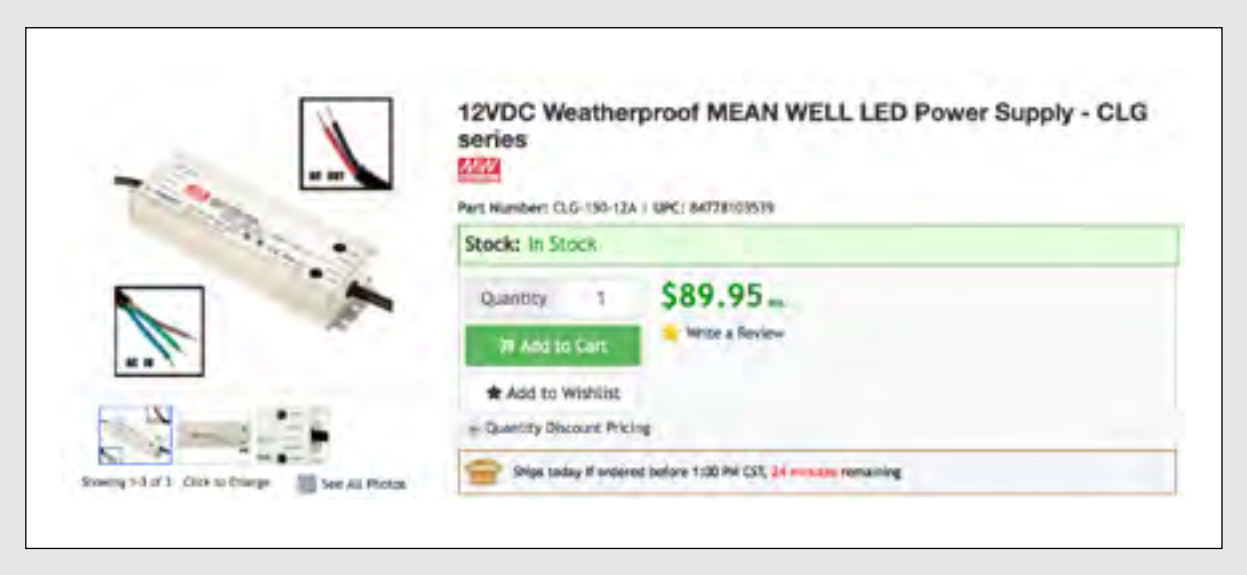
Lighting System

LED display parts were purchased from SuperBrightLeds.com. Many options were available to serve as a lighting solution. Part numbers are provided for the system we created. A power cord is required to complete the wiring setup. The dimmer and power supply modules are mounted on the underside of the table near the height adjustment handle. Changing the intensity of the LED light can affect the amount of color captured in the video.

Electrical Component Connections

Power Cord → **Power Supply** → **Light Dimmer** → **LED Light Strip**


superbrightleds.com
LED Lighting for Everything
Search All
http://www.superbrightleds.com
Toll Free: 866-590-3533
Shop By Category
Universal
Vehicle
Shop By
8:30 AM to 4:00 PM CST
866-590-3533
High Power LED Flexible Light Strip - NFLS-X3
Stock: In Stock
Select Connection: No Connector
Select Strip Finish: White
Select Color: Natural White
Select Length : 500cm(197in)
Quantity 1
$135.95
NFLS10-2CPTH 10mm Flexible Light Strip Solderless Clamp On Pigtail Adapter
Stock: In Stock
Quantity 1
$0.59
Add to Cart
Add to Wishlist
LDK-8A 12~24 Volt DC Single Color LED Dimmer
Stock: In Stock
Quantity 1
$14.95
Add to Cart
Add to Wishlist
Quantity Discount Pricing
Related Links



Specifications

We created a CAD drawing to provide our campus machine shop with details to enable them to create the support pieces. After installing the system we realized we omitted the thickness of the LED strips from the planned dimensions.

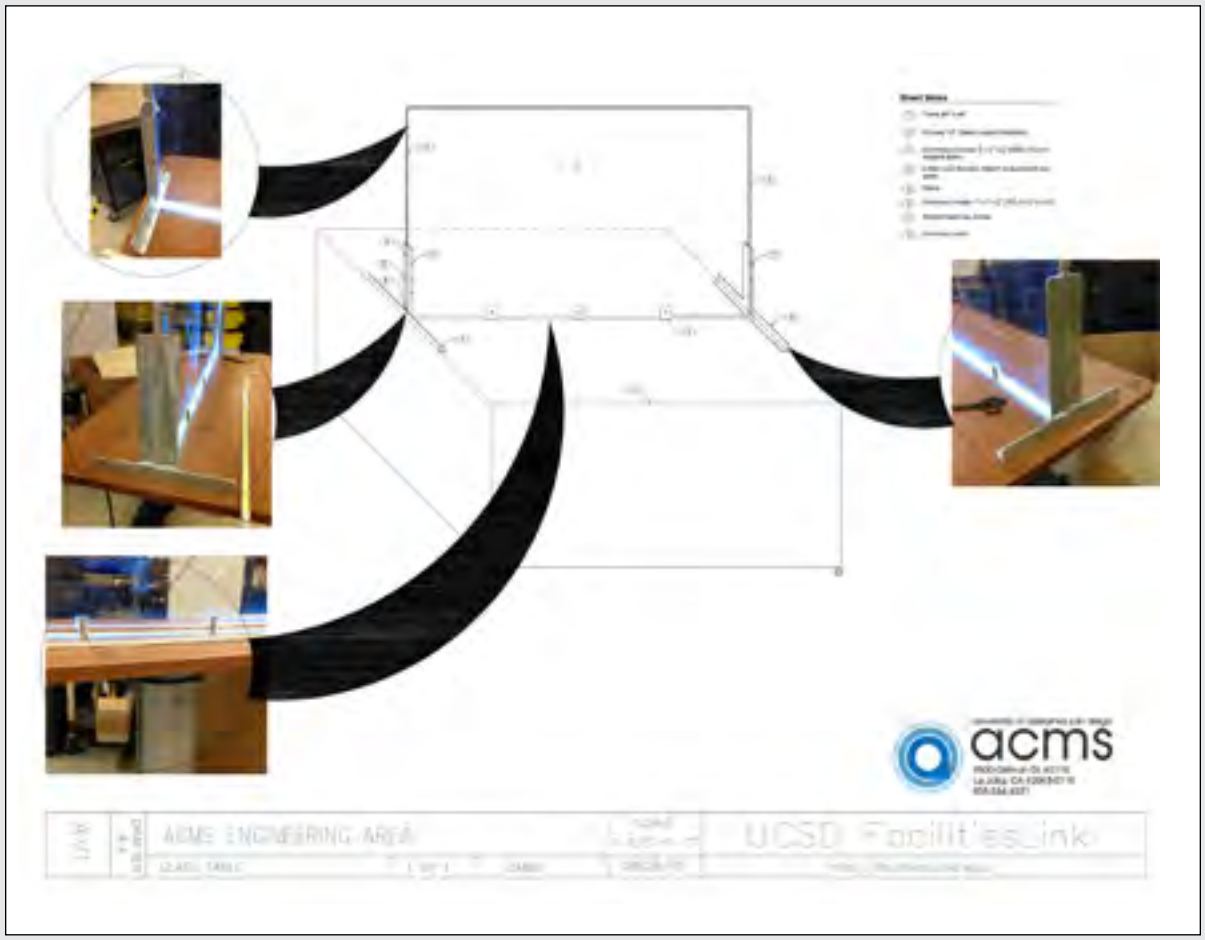
- All the “U” channel is ¾” x ¾” with a 1/8” wall thickness and ½” interior opening
- Top “U” channel: 60 ½” long.
- Side “U” channels: 36 ¾” to the length of the top channel
- Bottom pieces with mounting holes: 1 ½” x 1 ½” x 3/16” wall thickness 12” long
- The mounting holes: 6” apart, 3” in from the ends, centered
- Upright pieces: 1 ¼” x 1 ½” x 3/16” wall thickness 12” long
- Three threaded holes in each upright to allow 1/8” set screws to hold the uprights in place.

The aluminum channel pieces were black-anodized to reduce reflections.

Four ½” x 2 ½” long hex head black oxide treated steel bolts, washers, and nuts attach the support system to the table.

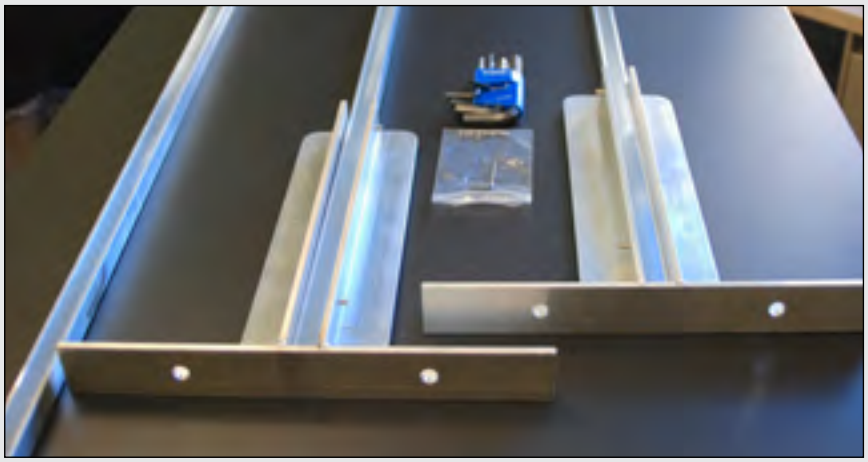
The LED strip was cut to length and wrapped around the glass. Neither the LED strip nor the “U” channel are attached to the glass. This was done to make it easy to replace any parts that might fail. The “U” channel holds the LED strip in place. The top channel sits over the LED strip and the glass.

CAD Drawing

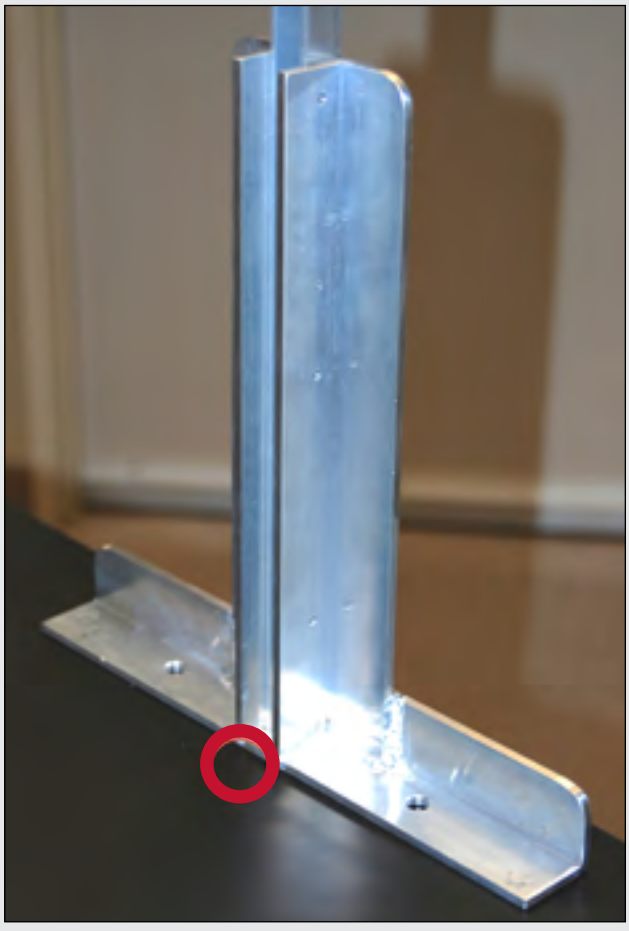


Welded Support Piece Details

This photo shows the hole locations.



The small holes on the uprights are for the 1/8" set screws. The larger holes are used to mount the supports to the table. To route the power lines from the dimmer to the light strip I drilled a ¼" hole through the table surface. See the red circle on the photo on right.



Marker Information

Expo Neon markers are used to write on the *Learning Glass*. The green, red, and blue markers have had the best results on the glass. We clean the glass after use with a cotton, lint-free cloth. Change to a clean part of the cloth as the color builds up. We tried other methods and this seems to work the best. Wet cleaners can be used but get messy and leave a film on the glass. Changing the intensity of the light can affect the amount of color captured in the video.

Frosted Glass Attachment

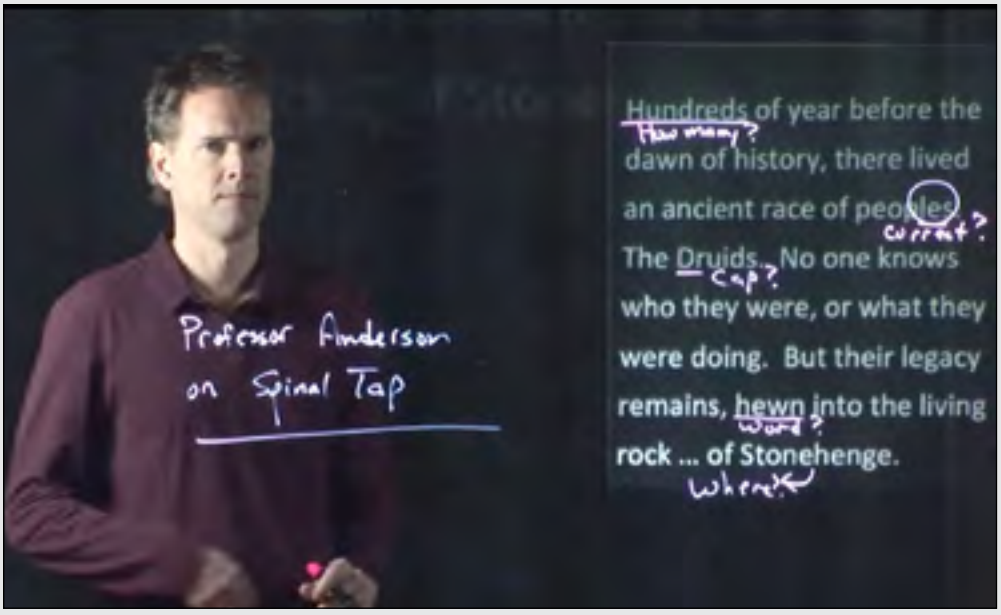
This new improvement to *Learning Glass* gives you the ability to include Powerpoint lecture slides in your presentation. Using a semi-transparent glass screen attachment and a standard video projector, you can image directly onto the *Learning Glass* system. The image is visible to the camera and/or your live studio audience for easy viewing. Since the screen is semi-transparent, you may also annotate the slides directly on the *Learning Glass* system.

Frosted Glass attachment build instructions:

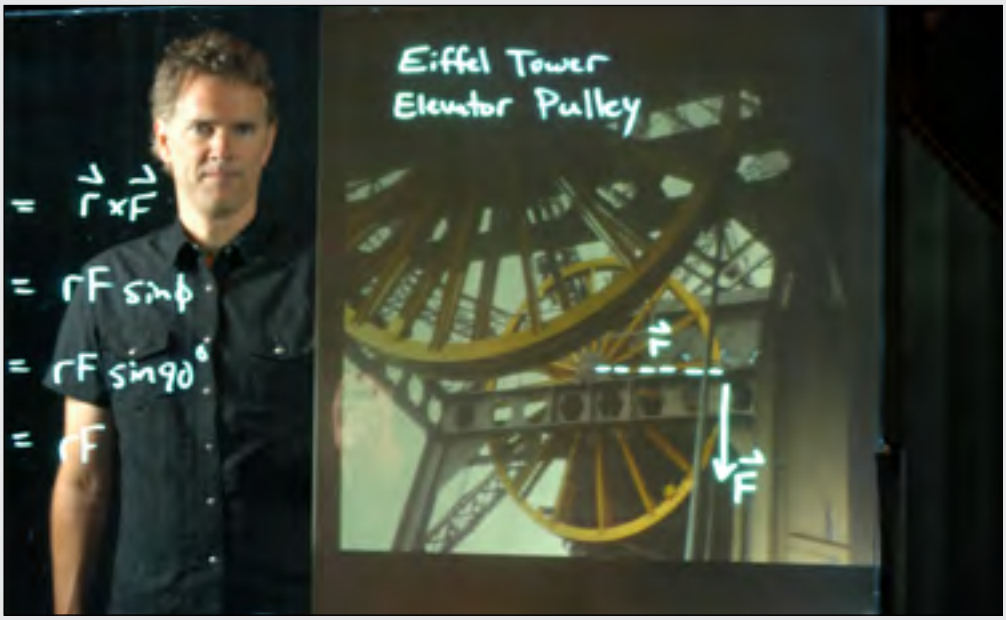
The attachment is a 29" x 34" x 1/4" piece of Starfire glass with polished edges, sandblasted (one side only) to a 50% opacity (called the "privacy factor"). The glass is attached directly in front of the *Learning Glass* with spring-loaded clips with the sandblasted side flush against the *Learning Glass*. A projector in front of the *Learning Glass* displays the desired image onto the *Frosted Glass*. The projector should be set up in "rear display" mode, such that the image appears in its correct orientation to the instructor. (When this image is subsequently flipped again for the viewer, it will now appear in its correct orientation).

Note on opacity: We have experimented with the opacity from 30% to 100%. Depending on how you plan to present your slides, you may want more or less opacity. For instance, with the presentation of text (white text on a black background), an opacity of 30% was used. The increased transparency means your hand written annotations are more clear.

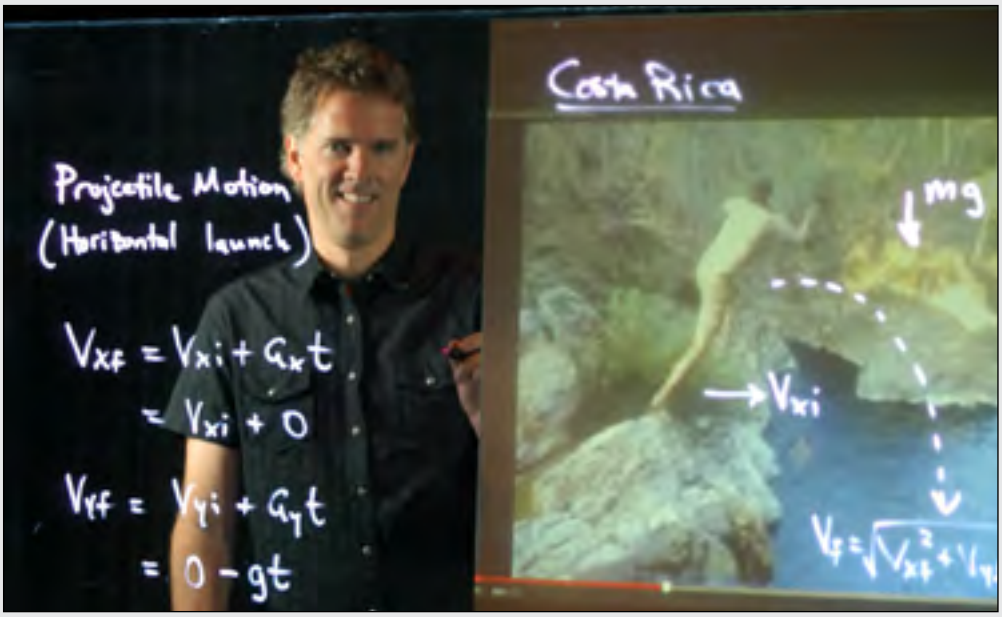
For better image quality, a higher opacity is used. This might preclude the instructor from annotating the image with perfectly legible writing, but will still allow the ability to "highlight" certain features on the image.



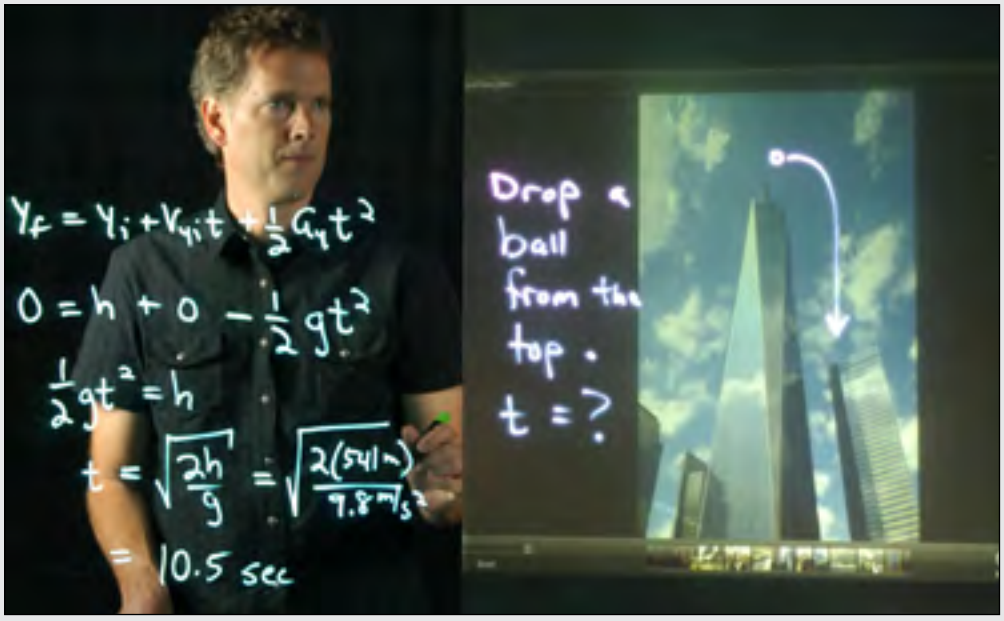
Powerpoint slide of white text on black background. **30% opacity.**



Digital color image. **50% opacity.**



Clip of a Dr. Anderson youtube video. **100% opacity.**



Digital color image of the Freedom Tower. **100% opacity.**

Recommendation: A good compromise is an opacity of 50%. With a suitably bright video projector, the image looks sharp, but the ability to annotate is still available.

Spring-loaded clip available at most hardware stores.

Frosted Glass attached to the *Learning Glass* system

6950 El Cajon Blvd., San Diego CA 92115
www.comprehensiveglassworks.com
sales@comprehensiveglassworks.com
Phone 619-589-6656
Fax 619-589-7426

COMPREHENSIVE GLASS WORKS

Quote: 3724
Date: 04/21/2014

Customer
MATT ANDERSON

Csr: AIMEE
Tech:
Terms:

Qty	Part / Description
2	34" X 29" #GLASS TEMPERED 1/4 LOW IRON POLISHED EDGES ALL AROUND. DELIVERED 1) AT 50% PRIVACY 1) AT 100% PRIVACY

Notes: *
PLEASE NOTE THERE IS NOT ENOUGH SQUARE FOOTAGE OF GLASS TO GUARANTEE AN EVEN 50% PRIVACY

Specifications for the *Frosted Glass* attachment

Contact information

To find out more about this exciting teaching method and how it may benefit you, please contact:

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San Diego, 92182-8114
Office Phone: 619-594-2893
Email: jfrazee@mail.sdsu.edu
Web: http://its.sdsu.edu/dept/staff.html

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Associate Professor
San Diego State University
Office: P-140
Office Phone: 619-594-2468
Office Fax: 619-594-5485
Email: manderson@mail.sdsu.edu
Web: http://www.physics.sdsu.edu/manderson/

Watch Matt Anderson demonstrate a sample lesson with his *Learning Glass* at http://tinyurl.com/learningglass

We would like to thank UC San Diego – Academic Computing Media Services, for the opportunity to collaborate with Don Olliff, Instructional Technologist. We appreciate his input, expertise and for providing us with some of the images in this manual.