Overview

- What is a lightboard?
 - A see through whiteboard that is an effective online teaching tool
- How does it work?
 - Total internal reflection
 - Frustrated total internal reflection to illuminate the ink in contact with the glass
- Why is it useful?
 - Provides a more engaging and personal experience to the typical online class
 - Stimulates the viewer and engages learning in new ways





Problem Statement

- The Center for Excellence in Teaching and Learning (CETL) at the University of Idaho requested we manufacture a low cost lightboard.
- MSRP ≈\$3000
- Our Budget \$2000
- Goal: create a financially palatable lightboard that will be specially designed to gain faculty buy-in/interest via portability and user convenience.

Glass Problem





- Regular Plate Glass
 - Window Glass
 - Cheaper (≈\$4/ft^2)
 - Poor Light Penetration
- Starphire Glass
 - Low Iron Glass
 - Expensive (≈\$12/ft^2)
 - Better Light Penetration

Final Design

• Portable

- Fits through doorways
- Locking caster wheels
- Easy to Use
 - Simple plug and play
 - Easy adjust lighting
 - Adjustable shelf
- Accommodating
 - Ergonomic for users



Final Design Details

- Height: 6' 5.65"
- Width: 4' 6"
- Length: 6' 5.7"
- Weight: 146 lb
- Frame Matl.: Aluminum T-Slot
- Glass Sheet: 4' x 6'



Final Design Details

• Power Brick Holder



• Light Dimmer



Final Design Details

• Rubber Wheel Dampers



• LED/Glass Fit



Safety Calculations

- Tipping
 - Can withstand 42.26 lb force at top before tipping at current width.

Variables						
Status	Input	Name	Name Output			
	140	F_1				
L	23.44	width				
	77.65	h_max				
	29.12	h_bot				
L		F_2_bot	112.692308			
L		F_2_max	42.2614295			
					•	
4				•	1	





Safety Calculations

- Bending
 - Support leg beam deflects 0.1292 in from a 215 lb load
 - Deflection of vertical beam is 0.205 in from 50 lb force







Safety Calculations

- Wind Force
 - Can withstand 20.81 mph wind before tipping at current width

Status	Input	Name	Output	Unit _
	2	C_D		
		Α	26.3530625	
	.00237	ρ		
L		V	30.5180856	
	4.1775	h		
	6.30833333	b		
	4.36541667	h_c		
	130	W		
L	1.95333333	width		
L		F_D	58.1693233	
	0	М		
L		V_mph	20.8077856	
L		width_tot	3.90666667	
				•





Budget

- Regular Aluminum Frame
 - Cost \$414.78
- Anodized Black Aluminum Frame
 - Cost \$645.15

Part	Length Quanitity		Black Price (\$/Item)	Clear Price (\$/Item)	Diffrence per Item	
1x1 Beam	71.2"	1	\$ 36.37	\$ 18.44	\$ 17.93	
2x1 Beam	71.2"	2	\$ 47.84	\$ 29.91	\$ 17.93	
2x2 Beam	54"	2	\$ 60.37	\$ 32.83	\$ 27.54	
2x2 Beam	71.2"	2	\$ 78.95	\$ 42.63	\$ 36.32	
8 hole flat bracket	N/A	4	\$ 7.66	\$ 5.95	\$ 1.71	
12 hole flat bracket	N/A	2	\$ 11.78	\$ 10.80	\$ 0.98	
8 hole corner bracket	N/A	4	\$ 6.51	\$ 5.35	\$ 1.16	
6 hole flat bracket	N/A	2	\$ 7.31	\$ 6.40	\$ 0.91	
6 hole corner bracket	N/A	4	\$ 6.56	\$ 5.40	\$ 1.16	
2x1 Beam (45 degree conect	26"	4	\$ 18.59	\$ 12.90	\$ 5.69	
45 degree connector beam	12"	2	\$ 19.50	\$ 16.40	\$ 3.10	
					0	
	Total Co	sts	\$ 645.15	\$ 414.78	\$ 230.37	

Capstone Project Bud	get Tem	plate - S	ummer	Fall						
Project:	CETL Lig	htBoard								
Last Updated	9/28/2018									
				2018				Item		
Expense Items	June	July	Aug	Sept	Oct	Nov	Dec	Total		
Equipment/Tools:					1					
								\$ -		
								-		
Supplies / Parts / Services:										
Glass board					X			\$ 460.00)	
	Extrude	d Aluminu	m Frame (Clear Price	2)					
1x1 Beam					X			\$ 18.44	ţ	
2x1 Beam					X			\$ 59.82	2	
2x2 Beam					x			\$ 65.66	;	
2x2 Beam					X			\$ 85.72	2	
8 hole flat bracket					х			\$ 23.80)	
12 hole flat bracket					х			\$ 21.60)	
8 hole corner bracket					х			\$ 21.40)	
6 hole flat bracket					x			\$ 12.80)	
6 hole corner bracket					×			\$ 21.60)	
45 degree connector					1 _X			\$ 32.80)	
2x1 Beam for connectors					1 _X			\$ 51.60)	
Shelf Material					1	X		\$ 150.00)	
Shelf Brackets					1	X		\$ 42.40)	
Caulk Gun				x	1			\$ 2.00)	
Silicon Sealant				X				\$ 3.00	1	
Loctite				~		x		\$ 10.00)	
Under Glass Rubber					LX.	~		\$ 18.00)	
LED Dimmer		x						\$ 7.97	7	
LED Lights (X2)		X						\$ 73.94	1	
12V Power Supply 60W		X			-			\$ 24.97	7	
Neon Expo Markers		X						\$ 740	1	
Caster Wheels						x		\$ 69.72	,	
Wheel Rubber						X		\$ 12.59	•	
Prototype Glass		x				~		\$ 105.49	•	
Shinning		~					X	\$ 75.00		
Prototype Frame		x					0	\$ 50.00)	Expenses
Building Material		~					X	<i>v</i>		Lapenses
					-				\$ 1,528	Subtotal
ME Shop Usage (est. Hrs):				1				Hours		
Aluminum Frame (Board)				1	1	×		10	•	
Aluminum Supports				1	-	X		10		
Wood Shelf				1	1	X		4		
Prototype		×		1	1	^		5		
Metal base plate		~		1	1	-		2		
metal base plate				1	1	-		0		
					1					
					Grad	Graduate Student Support		\$ -	including	fringe
						Sho	p Overhead	\$ -		
							Totals	\$ 1,528	\$ 1,500	\$ (28)
								-	Budget	Excess