Treating Disease

Exhibit Description:

"Treating Disease" is a stand-alone interactive component of the Nanomedicine exhibition. Visitors read about cutting-edge medical treatments that are being developed with nanotechnology. The flat screen to the right of the exhibit contains slides that highlight nonmedical treatments that are being used or are currently under development.

The tabletop interactive, Gold Nanoshells, demonstrates how tiny nanoparticles (gold nanoshells) are being used to destroy cancerous tumors. Visitors inject gold nanoshell marbles into the bloodstream and watch as the gold nanoshells are absorbed by cancerous cells. The visitor then activates an infrared laser and watches as the laser heats up and kills the tumor cells while leaving the healthy tissues unharmed.

This multimedia static exhibit consists of one copy panel, the tabletop Gold Nanoshells interactive, and a flat-screen monitor slideshow that can be updated to keep the exhibit content current and relevant. Like all of the exhibit components in the Nanomedicine package, headphone listening stations with both English and Spanish audio description labels are included. These audio labels serve two functions—to explain the "Big Idea" content of the exhibit and to provide illustrative descriptions of the interactive experience.

Exhibit Interface:

Interactive

Visitor approaches exhibit and notices "START" below a syringe and Steps 1, 2, and 3 to the right.

- Visitor slides knob on syringe to left.
  - Bloodstream ring starts to rotate.
  - The first LED in the Tissue and Tumor
  - Temperatures turn on.
  - The balls are released.
  - Step 1 area lights up.
- Balls are carried along ring and start to fall into Tumor.
- After a set period of time (TBD), Step 1 goes dark.
  - Step 2 lights up.
  - Laser button blinks.
- Return trap door opens to catch any remaining balls.
- Visitor presses Laser button.
  - If laser button is not pressed, unit will time out and reset.
  - Tumor disk rotates 1/4 turn to reveal Return Hole to allow balls to empty into starting chute.
  - Step 2 and Laser button go dark.
  - Bloodstream ring stops.
  - Tissue and Tumor LED's go dark.
- Laser light comes on.
  - Laser button stays lit but no longer blinks.
- The Tumor temp LED's steadily climbs until reaches 130 degrees.
  - Only the first Tissue temp LED is lit.
- Once 130 degree LED is lit, Laser light turns off.
  - Laser button turns off.
  - Step 2 goes dark.
- Step 3 lights up.
  - Tumor temp LED's steadily drops to 98.6 degrees.
  - Tumor disk rotates 1/4 turn to show Dead Tumor.
- After a pause, Tumor disk rotates 1/4 turn to show Healthy tissue.
- After a pause, Step 3 goes dark
  - Tumor disk rotates 1/4 turn to reveal Return Hole to allow balls to empty into starting chute.
  - Bloodstream ring stops.
  - Tissue and Tumor LED's go dark.

Side Monitor

The monitor, on the right side of the interactive, displays images of nanotechnology.

- Images self scroll.
- Visitors can press the “Next” button to scroll to the next image.

Audio

Audio station

- Visitor wares the headphones.
- Visitor chooses to listen to English or Spanish by pressing the “English” or “Espanola” button.
    - Audio starts.
        - Audio explains the content of the exhibit
        - Audio provides instructions of the interactive.
- Visitors can adjust the volume of the audio.

Exhibit Components:

The following lists of components combine to make the exhibit.

Base Cabinet:

- Weighing, 100 lbs.
- Dimension, 57” H x 66” W x 32”D

Graphic Panel:

- Weighing, 20lbs.
- Dimension, 34”H x 38” W x 2”D

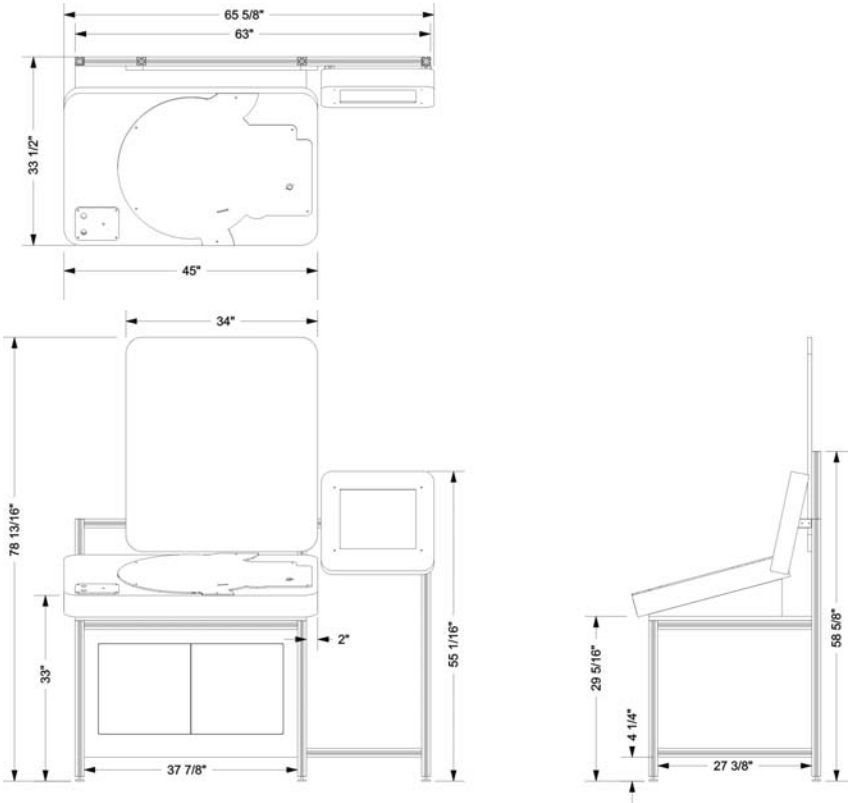
Exhibit Specifications

Dimensions:

- Exhibit Dimensions:
  - 79”H x 66”W x 31”D
- Exhibit Foot Print:
  - 66”W x 31”D
- Recommended Exhibit Floor Space:
  - 72”W x 62.5”D

Power Requirements

- 110-volt, 15-amp.
  - Accessed through base cabinet of component.



Tools and Hardware:

Tools and Hardware needed for installation, maintenance and repairs to the exhibits.

Key

- 415-A.
  - To open base cabinet.

Cam Wrench

- Cam locks
  - Securing Side Monitor to exhibit frame.
  - Securing exhibit frame.

9/64" Allen Wrench

- All ¼ x 20 button head bolts.
  - Securing the exhibit monitor to interactive cabinet
  - Securing the Graphic Panel to the exhibit frame.

5/32" Allen Wrench

- Security screws
  - Securing all second surface graphic panels

3/32" Allen Wrench

- Machine screws that secure Side Monitor shroud.

#2 Phillips Screwdriver

- Machine screws
  - Securing Side Monitor shroud back panel.

6" Crescent Wrench

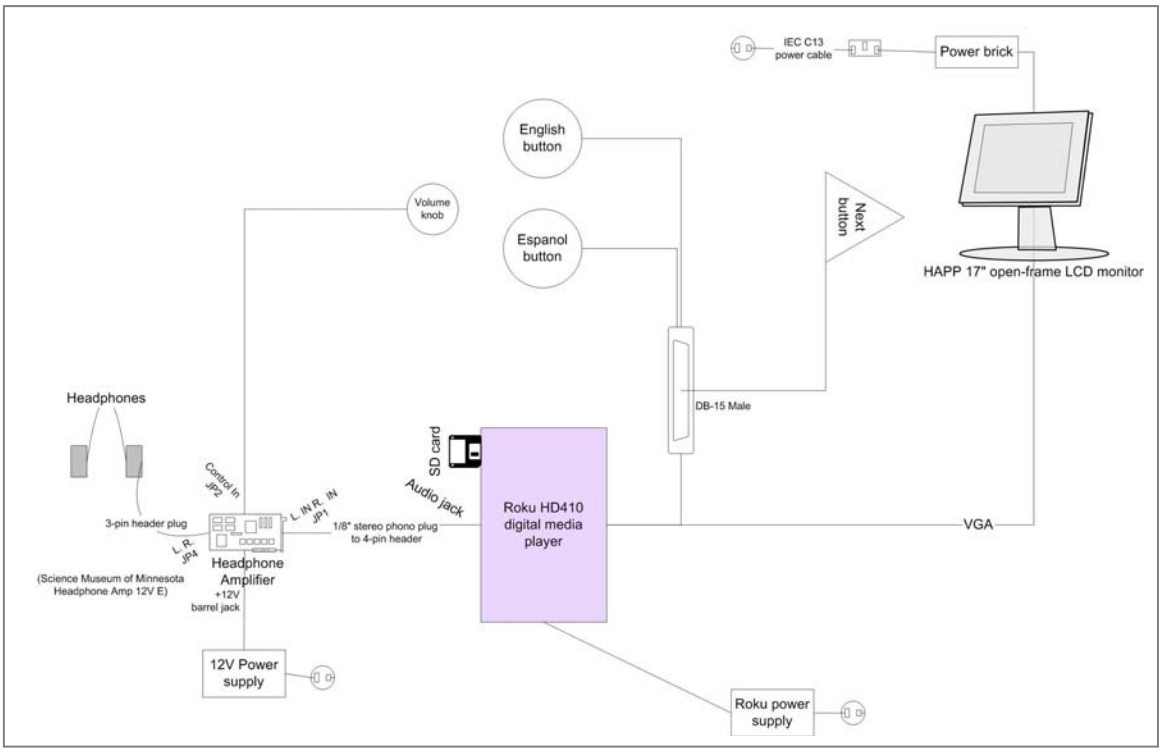
- To adjust leveling feet.

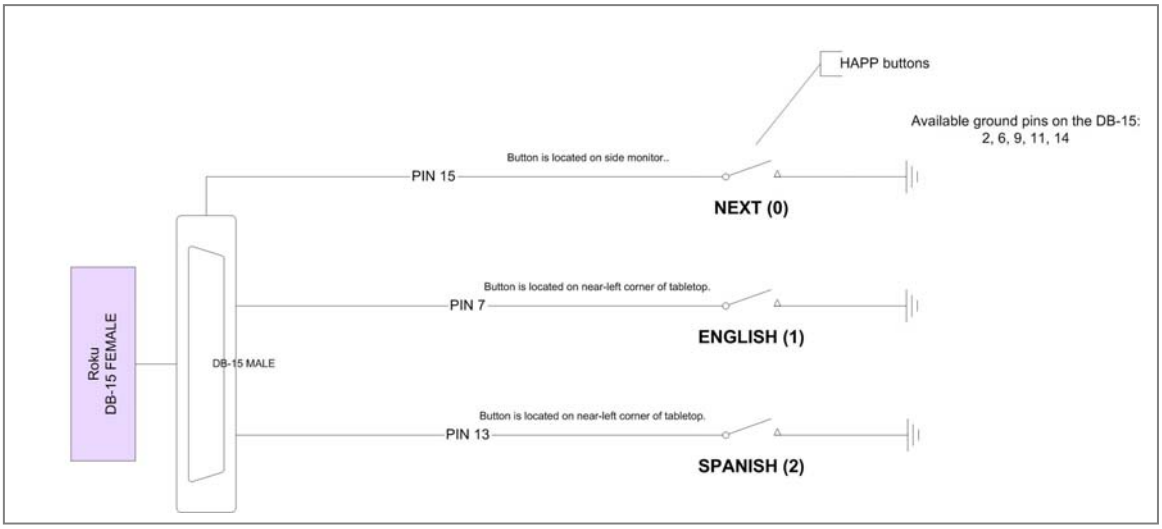
Parts:

Parts needed for installation, maintenance and repairs to the exhibit.

- Headphones
  - AKG K77
- Monitor
  - 17" Happ, 49-2603-30
- Media Player
  - Roku HD410
- Amplifier
  - Produced by The Science Museum of Minnesota (SMM).

Media:


IEC C13
power cable
Power brick
English
button
Volume
knob
Espanol
button
Next
button
HAPP 17" open-frame LCD monitor
DB-15 Male
Headphones
SD card
Audio jack
Roku HD410
digital media
player
VGA
Control in
JP2
L IN R IN
JP1
3-pin header plug
1/8" stereo phono plug
to 4-pin header
L R
JP4
Headphone
Amplifier
(Science Museum of Minnesota
Headphone Amp 12V E)
+12V
barrel jack
12V Power
supply
Roku power
supply


HAPP buttons
Available ground pins on the DB-15:
2, 6, 9, 11, 14
Button is located on side monitor..
PIN 15
NEXT (0)
Button is located on near-left corner of tabletop.
PIN 7
ENGLISH (1)
Button is located on near-left corner of tabletop.
PIN 13
SPANISH (2)
Roku
DB-15 FEMALE
DB-15 MALE

Electronics:

The electronics in the Gold Nanoshells exhibit consist of:

- A microcontroller board
- A syringe switch which starts the exhibit
- A lighted laser pushbutton
- An mr16 LED “laser”
- A 120VAC to 12VAC transformer for the laser
- An AC gear motor which turns the bloodstream ring
- A stepper motor which turns the central disc
- Two solenoids driven gates which route balls
- Three backlit graphics
- Two thermometer displays
- A 12VDC power supply
- Four relays for the solenoids, laser and ring motor

Program flow:
At power-up the central disc rotates to drain any balls that may be in the tumor cavity and then turns to the red tumor position.

In the exhibit’s resting state the red tumor is visible and both thermometers are lit at the 98.6 position. Nothing else is lit or moving. All of the balls are in a hidden sump, below the bloodstream ring.

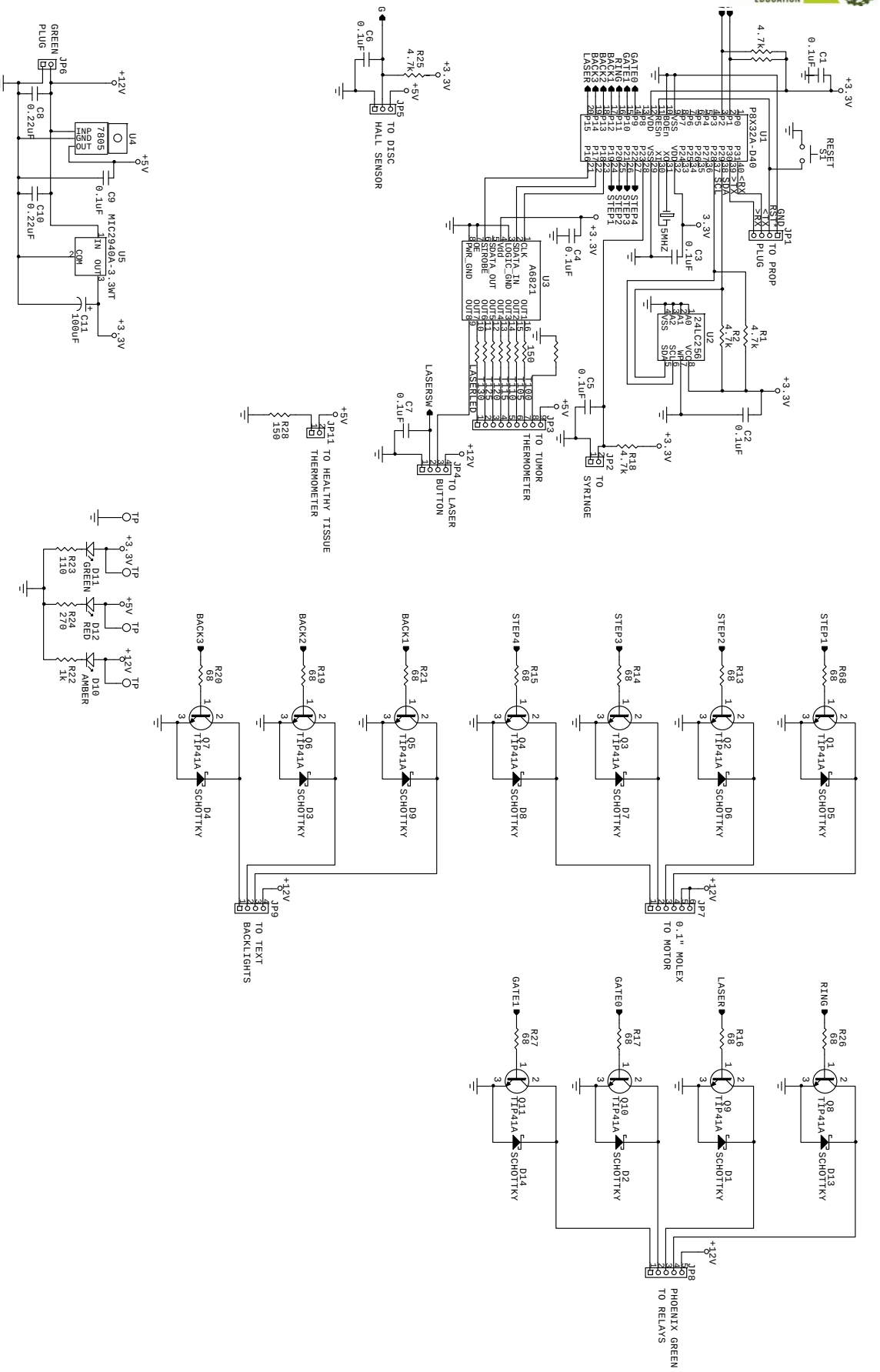
When the syringe lever is moved to the left the activity starts.

- The controller switches on the ring motor and the bloodstream ring begins to rotate.
- Solenoid gate 0 opens to allow balls to enter the bloodstream. Solenoid gate 1 closes to allow any balls which miss the tumor cavity to return to the bloodstream. Both solenoids cycle a few time to help balls to flow from sump, through gate 0, into the bloodstream.
- Graphic 1 backlight comes on.
- The balls are picked up by magnets in the bloodstream ring and are released above the tumor. Most fall into the tumor cavity; some pass the tumor and return to the bloodstream ring.
- After about twelve seconds gate 0 closes, preventing any more balls entering the bloodstream for sump. Gate one opens, routing any balls which miss the tumor to a hidden sump.
- Graphic one backlight goes off and graphic two turns on.
- The laser pushbutton begins to blink.

-Continued next page-

When the laser pushbutton is pressed the button lamp and the LED ”laser” turn on.

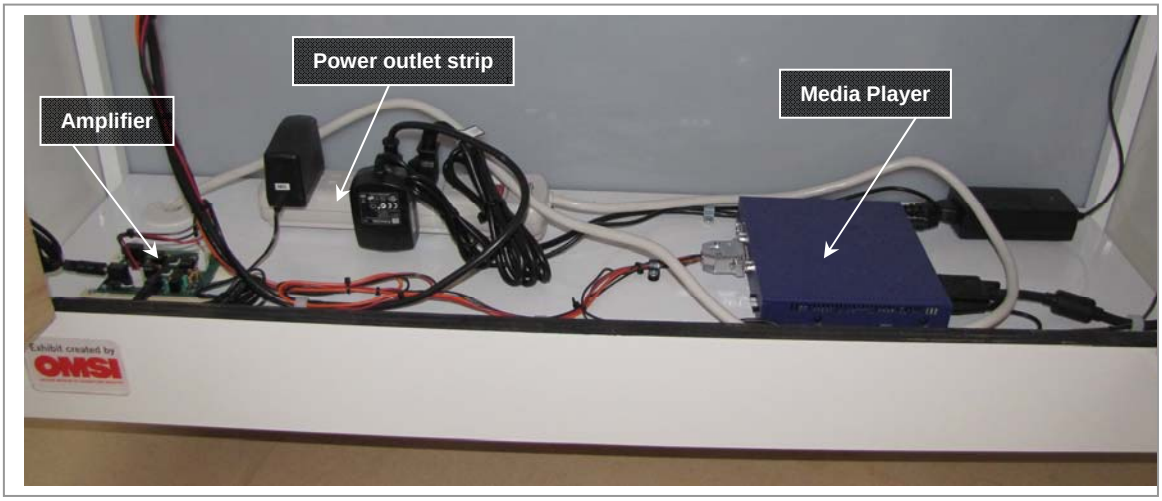
- The tissue thermometer continues to read 98.6 degrees, while the tumor thermometer rises to 130 degrees.
- The laser and laser button lamp turn off, graphic two goes off and graphic three comes on.
- The tumor thermometer returns to 98.6 degrees.
- The central disc rotates to show a dead tumor.
- After a delay the central disc rotates to show healthy tissue.
- After a delay the central disc rotates to drain balls from the tumor cavity to the hidden sump.
- After a delay the central disc rotates to show the red tumor, all graphics are off, the ring motor stops and the exhibit is back in its resting state.


U1
PBX32A-D40
U2
24LC256
U3
A6821
JP1
TO PROP PLUG
JP2
TO SYRINGE
JP3
TO TUMOR THERMOMETER
JP4
TO LASER BUTTON
JP5
TO DISC HALL SENSOR
JP6
GREEN PLUG
JP7
0.1" MOLEX TO MOTOR
JP8
PHOENIX GREEN TO RELAYS
JP9
TO TEXT BACKLIGHTS
JP11
TO HEALTHY TISSUE THERMOMETER
U4
7805
U5
MIC2940A-3.3WT
RESET
15MHZ
LASERLED
LASERSW
D1 SCHOTTKY
D2 SCHOTTKY
D3 SCHOTTKY
D4 SCHOTTKY
D5 SCHOTTKY
D6 SCHOTTKY
D7 SCHOTTKY
D8 SCHOTTKY
D9 SCHOTTKY
D10 AMBER
D11 TIP41A
D12 RED
D13 SCHOTTKY
D14 SCHOTTKY
D15 GREEN
Q1 TIP41A
Q2 TIP41A
Q3 TIP41A
Q4 TIP41A
Q5 TIP41A
Q6 TIP41A
Q7 TIP41A
Q8 TIP41A
Q9 TIP41A
Q10 TIP41A
Q11 TIP41A
R1 4.7k
R2 4.7k
R16 68
R17 68
R18 4.7k
R19 68
R20 68
R21 68
R22 1k
R23 110
R24 270
R25 4.7k
R26 68
R27 68
R28 150
R68 68
C1 0.1uF
C2 0.1uF
C3 0.1uF
C4 0.1uF
C5 0.1uF
C6 0.1uF
C7 0.1uF
C8 0.22uF
C9 0.1uF
C10 0.22uF
C11 100uF
+3.3V
+5V
+12V
GND
TP

Service Access

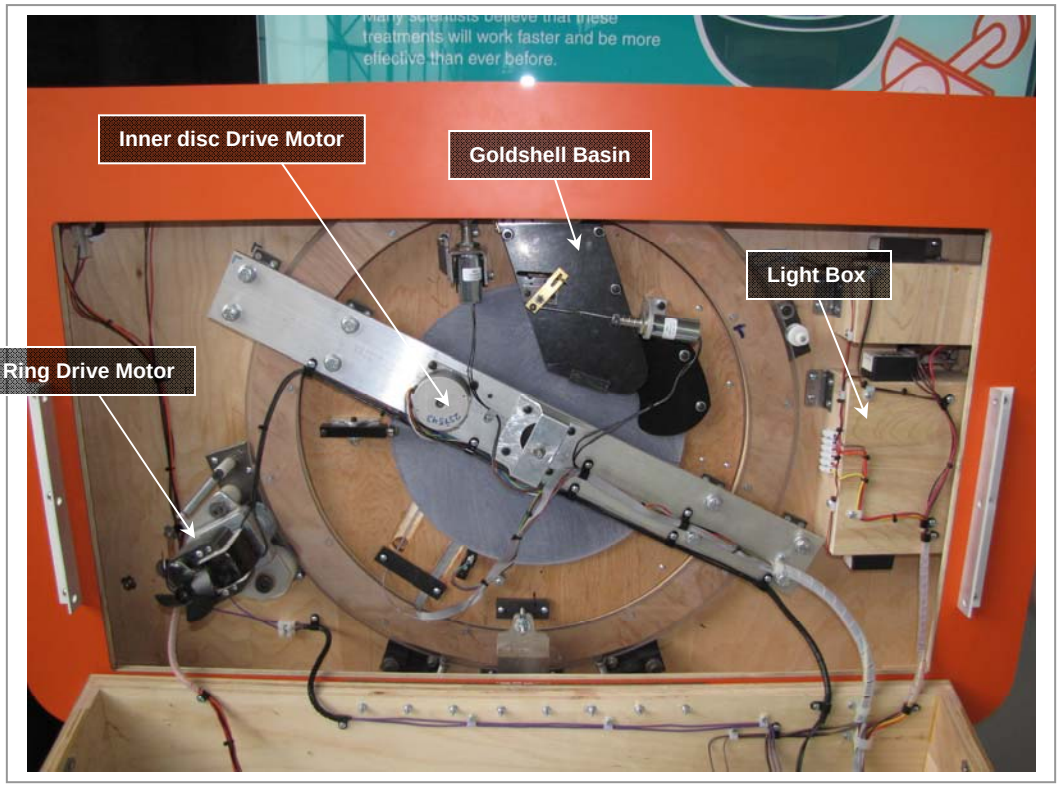
Base Cabinet Access

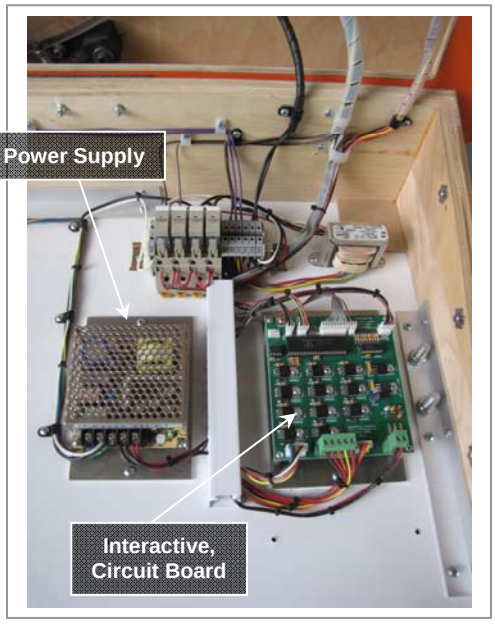
- Accessed with a 415-A key
- Contains
  - Power outlet strip
  - Media player
  - Audio amplifier



Interactive Access

- Accessed with 5/32” Allen Wrench, 6 bolts secure the top
- Contains
  - Circuit Boards
  - Interactive, Light Box
  - Interactive Mechanics
  - Interactive Power Supply
  - Drive Motors (2)





Trouble-Shooting

Interactive:

- Interactive does not respond when activated by slide switch.
  - Ensure there is power to the exhibit.
  - Ensure power strip is switched to the “ON” position.
  - Check to ensure all power plugs are connected to power strip.
  - Check to ensure all plugs are connected to the circuit board.
  - ➲ **If the above conditions are met the interactive power supply may be faulty, replace as needed.**

- Center Disk does not respond when activated by slide switch.
  - Ensure there is power to the exhibit.
  - Ensure power strip is switched to the “ON” position.
  - Check to ensure all power plugs are connected to power strip.
  - Check to ensure all plugs are connected to the circuit board.
  - Check for gear and belt alignment, or ware.
  - ➲ **If the above conditions are met the interactive drive motor or belt may be faulty, replace as needed.**

- “Goldshells” are not released when activated by slide switch.
  - Ensure there is power to the exhibit.
  - Ensure power strip is switched to the “ON” position.
  - Check to ensure all power plugs are connected to power strip.
  - Check to ensure all plugs are connected to the circuit board.
  - Ensure there is no obstruction at outlet.
  - ➲ **If the above conditions are met the interactive solenoid, may be faulty, replace as needed.**

Side Monitor:

- No Picture.
  - Ensure there is power to the exhibit.
  - Ensure power strip is switched to the “ON” position.
  - Check to ensure all power plugs are connected to power strip and to the back of the Monitor.
  - Check to ensure source plug is connected to the media player and to the back of the Monitor.
  - Check to ensure media card is securely inserted into the media player.
  - ➲ **If the above conditions are met the media card, media player, or side monitor may be faulty, replace as needed.**

- Pictures do not advance when prompted.
  - Check to ensure all plugs are securely connected to the “NEXT” and “HOME” buttons and the Signal cable is securely connected to the media player.
  - Check to ensure media card is securely inserted into the media player.
  - ➲ **If the above conditions are met the media card, media player, or buttons may be faulty, replace as needed.**

Audio:

- No Sound
  - Check to ensure all plugs are securely connected to the Amplifier.
  - Check to ensure plugs are securely connected to the “ENGLISH” and “ESPANOLA” buttons and the Signal cable is securely connected to the media player.
  - Check to ensure media card is securely inserted into the media player.
  - **If the above conditions are met the media card, or buttons may be faulty, replace as needed.**