Hive13 Laser

About the Laser

- Specs
  - 60W Laser tube
  - Cutting Area: 12”x20”
  - Beam combiner merges the red dot sighting laser and the cutting laser.
  - Final Cost: ~$5,600
- Materials
  - Can material up to 3/4” depending on material density
  - Can cut wood, acrylic, and other materials
  - Can't cut any metal or materials with chlorine. More info about chlorine later in document.

Optics

- This machine uses “flying” optics – just means the mirrors / lens moves and not the laser itself.
- The beam bounces off 3 mirrors before passing through the lens made from ZnSe
- Normal glass is opaque to CO2 laser light so it won't work for lenses.
- The lens this machine has ~2” focal length lens (the point of focus is 2” below the lens).
  - We also have a 5” focal length lens to allow cutting materials w/ the front doors open.

Potential Uses

- Laser cutter is good for cutting & engraving
- Engraving: Wood, Plastic, Leather, Glass, Stone, Metal (with coating)
  - Rubber for stamps
  - Coated PCB's to make circuitboards
  - Creating solder masks for SMT soldering.
  - Plastic to make signs
  - Wood blackens for good contrast
  - Etch the coating off anodized metal

Potential Uses

- Cutting: Wood, plastic, rubber, cork, cloth, paper, cardboard, etc... No metal.
  - Cut wood to make a makerbot
  - Cut plastic to make robots
  - Cut templates to make sandblasting masks and paint masks.
  - Cut paper to make pepakura (paper craft)

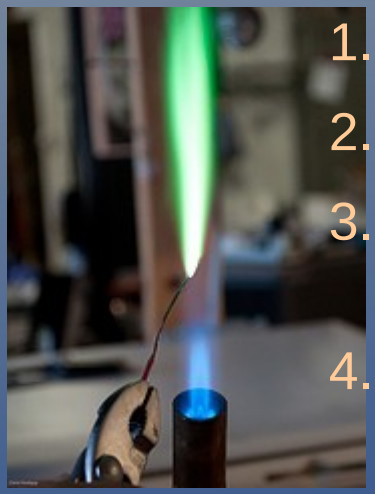
Safety

- The laser can burn/cut skin and blind you.
- The laser beam is invisible.
- There is a safety interlock that disables the cutting laser when the lid is opened.
- The top viewing window has an IR filter on it to prevent harmful light from escaping. The front air slots have no such protection, don't look into them.
- Fires WILL occur at times inside the laser. Most self-extinguish, if they don't use the CO2 duster. If that fails, use the fire extinguisher.
- There is an E-Stop button. Love the button.

Chlorine in Plastics

Test Procedure:

1. If you know the type of plastic, google it. If it is a device, still google it but your chances of finding a definite result are slimmer.
2. Did not find the result on google? Want to burn things anyway?

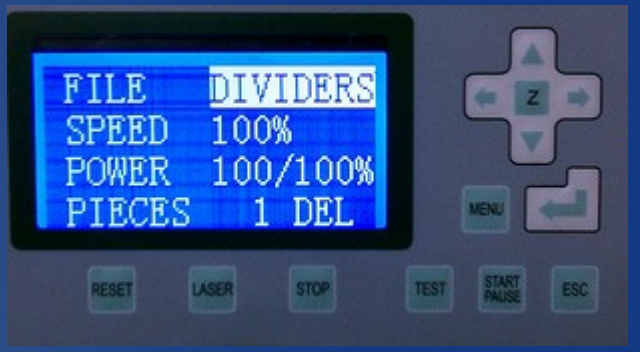


    1. Cut off a small sliver of plastic.
    2. Find a solid core copper wire, strip off the casing.
    3. Start the blowtorch and stick the exposed copper wire into the flame until it glows orange.
    4. Press the glowing orange copper into the plastic sliver so some melts onto the copper.
    5. Put the copper with the melted plastic into the flame.
    6. Is the flame green? If no, then there is not chlorine gas, you should be safe. This does not eliminated Hydrochloric Acid.
3. Do a small test cut. Materials with chlorine tend to produce lots of yellowish smoke and / or yellowish dust on the material being cut.

Chlorine in Plastics

- Known Chlorinated Materials:
  - Drivers License Blanks (Kentucky)
  - Lexan (Hydrocholric Acid)
  - PVC
  - Vinyl (Notably vinyl sticker material)
  - Casing on copper wires
  - Moleskin device cases or journal covers
  - Sintra (PVC Foam board)

Hardware

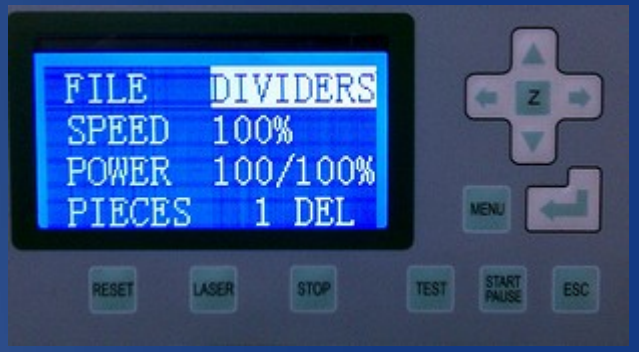


- Once a design is downloaded to the laser an operator can fully control the laser from the front panel.
  - Directional Arrows, Test, Reset, Stop, Start / Pause
- Emergency Stop button
  - Big Red, feel free to push it at the slightest indication of a problem. Gently twist to release.
- Focusing Cylinder
  - Small metal cylinder used for focusing the Z-Axis
- Laser tube & Electronics.
- Blower, Compressor, Water pump
- Lens

Hardware User Interface

Startup

- Turn the key to turn on the laser.
- Put the part to be cut into the laser.
- Focus the laser

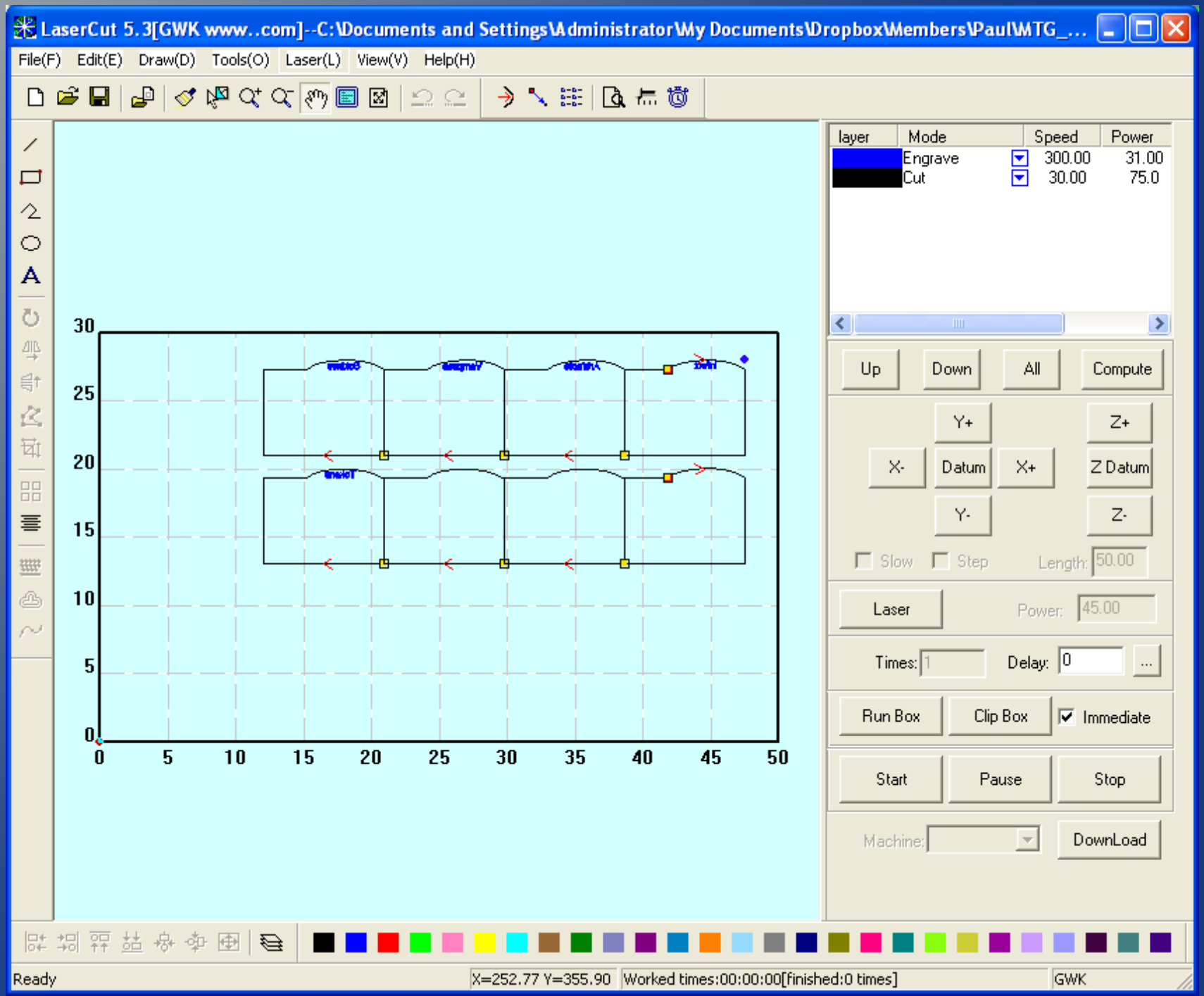


1. Put the metal focusing cylinder onto the surface of the part.
2. Press ESC, Move the laser head over the cylinder using the directional arrows.
3. Press ESC, Go into Z-Axis mode by pressing the center “Z” button.
4. Press “Reset” - The Z-Axis will raise up to the sensor, then drop back down to the focus height.
5. Leave Z-Axis mode by pressing the center “Z” button again.

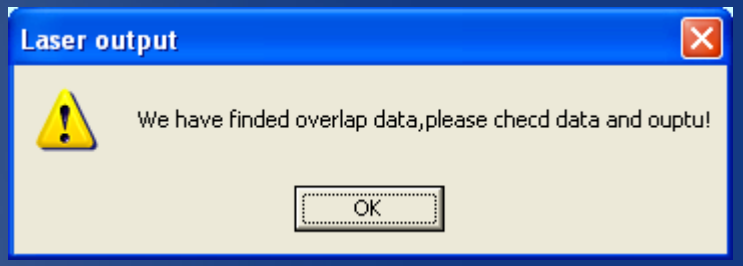
Startup

- Make absolutely certain you are no longer in Z-axis mode. Press Esc and then Reset to return the laser cut head to the top right corner.
  - **NOTE: If you are in Z-axis mode and hit Reset while the focusing cylinder is not under the cut head YOU WILL HEAD CRASH THE LASER.**
  - **If this happens immediately hit the E-Stop button.**
- Now on the PC start the LaserCut 5.3 software.
  - **NOTE:** Laser must be turned on before opening LaserCut 5.3 software. Also, if you get connection errors try shutting down both the laser and the software, then turn on the laser, then starting LaserCut 5.3

Software – LaserCut 5.3

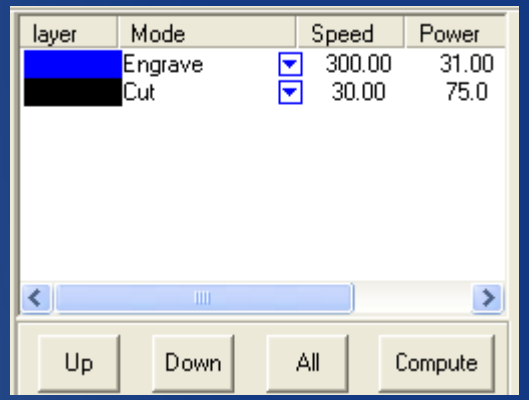


Software – LaserCut 5.3



- Chinese software, many quirks.
- Runs on XP and requires a dongle.
- Imports *.dxf files, Adobe Illustrator files, and HPGL files.
- Can also import BW BMP images, these images must be 1 bit BW images.
- Never, EVER, press the “Laser” button. It turns on the cutting laser beam immediately wherever the head is positioned.

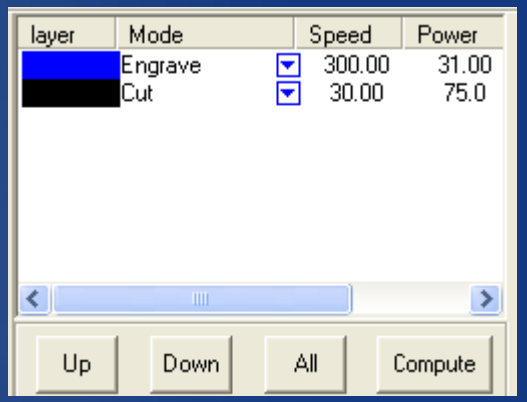
LaserCut 5.3 Info and Tips



- Engrave // Cut (Raster // Vector)
  - Defined in the top right section of the screen.
  - Engrave takes much longer, more like a printer than a cutter when in this mode. Creates filled in text or images.
  - Vector is typically much faster, but only works for vector based images or text. Create outlines or cuts through material.
  - LaserCut has 4 modes: Cut, Engrave, Graded Engrave, and Hole. We so far have only used Cut and Engrave.
- Cut Mode
  - 3 Variables: Speed, Power, Corner Power.
  - Speed: How fast the head will move while cutting. (0 - 300)
  - Power: Cut power when moving @ Speed
  - Corner Power: Cut power when changing directions.

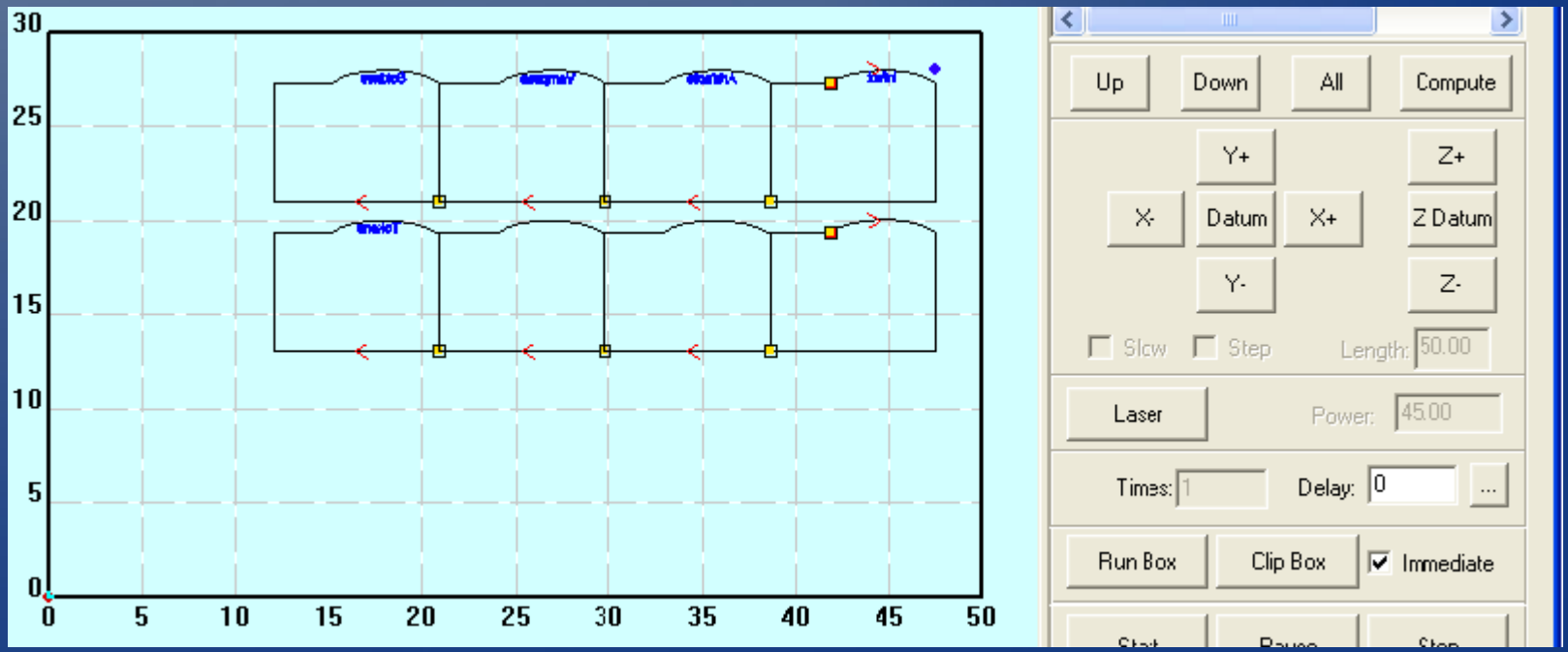
LaserCut 5.3 Info and Tips

- Engrave Mode
  - Used for rastering images or text.
  - Takes much, much longer than vector based cutting.
  - 2 variables: Speed, Power
  - Speed: How fast the laser head moves back & forth.
  - Power: How much power the laser uses when engraving.
- Layers
  - Defined via colors
  - Layers on top are cut or engraved first.
  - Typically it is best to engrave first, cut second.

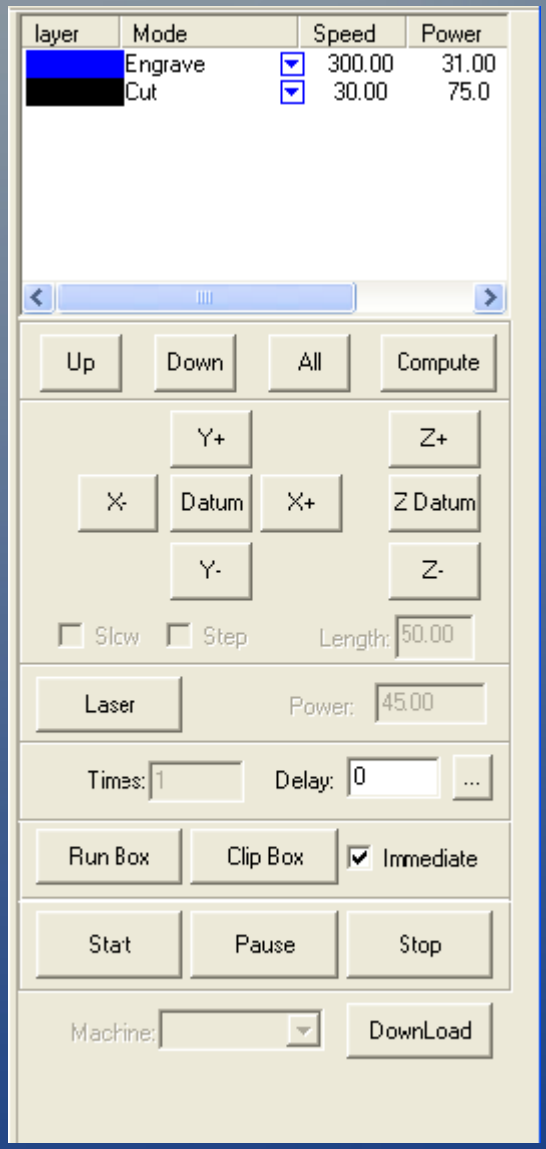


LaserCut 5.3 Info and Tips

- Positioning & Layout
  - If “Immediate” is *NOT* checked, the position on the layout grid is exactly where it laser will try to cut out the piece.
  - If “Immediate” is checked, the laser cutter will consider the “origin” to be wherever the laser head is positioned when it is started.



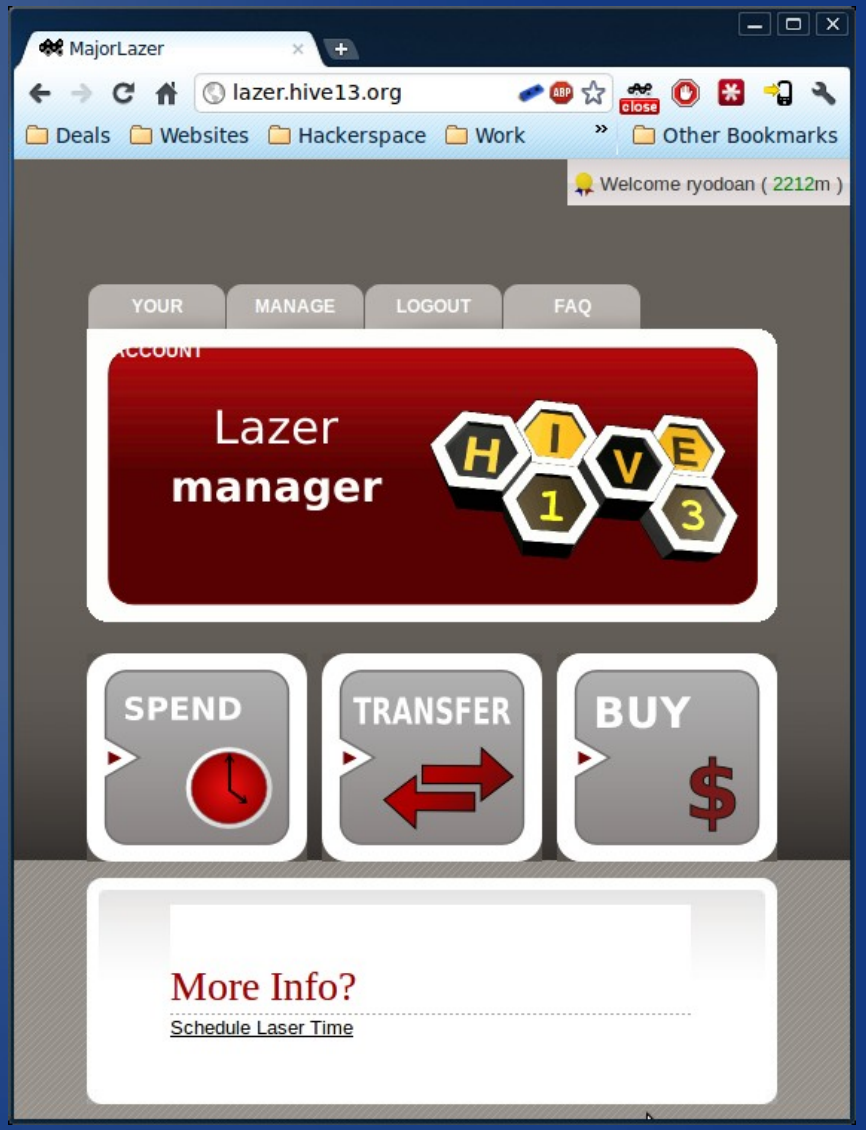
LaserCut 5.3 – Running the Laser



- If you change any layer settings (power, order, engrave // cut) you need to click “Compute” before downloading to the laser.
- Every time you make any change (Move the design, change power setting) you need to re-download your design to the laser cutter.
- Procedure:
    1. Click “Compute” if necessary
    2. Click “Download” to transfer design to the laser cutter.
    3. On the laser press “Test”, the laser should move in a box around the cut area. If this is not the desired area, move the part and go back to step #1.
    4. The “Test” box was acceptable, now click “Start”. The laser will begin to run your job.
    5. When the job is complete the laser will beep. Log the time on the display.

Laser Time & Tracking

- Student & Full members get 16 min / mo
- Cornerstone members get 32 min / mo
- Additional minutes for members $0.50/min
- Charges for non-members at operator discretion
- Honor system, if it is abused we have several ideas for making it required.
- Register at http://lazer.hive13.org
- Use the same address as your paypal account. This is how monthly and purchased points are assigned.



Do's & Don'ts

Do

- Focus the laser.
- Ask for help if unsure or confused.
- Check the troubleshooting page on the wiki.
- Check the Material Settings page on the wiki.
- Log your time (http://lazer.hive13.org)

Don't

- Ever leave the laser unattended (Fire danger)
- Cut any material with Chlorine in it. If you are unsure ask other operators. If tests or research is inconclusive find a different material.
- Try to cut metal. It will not work.
- Bump or touch the mirrors and lenses. (This will put the machine out of alignment or damage the optics)

Information and Troubleshooting

- Time tracking: http://lazer.hive13.org
- The wiki has many resources:
  - Known good material cut & engrave settings:
    http://wiki.hive13.org/Laser_Settings
  - Laser troubleshooting assistance:
    http://wiki.hive13.org/Laser_Troubleshooting
  - Design Software:
    http://wiki.hive13.org/Design_Resources
- Another good source of ideas or projects is Thingiverse:
  http://www.thingiverse.com/