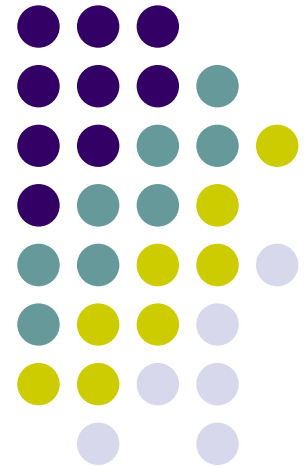
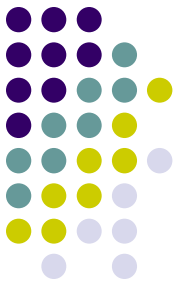


Presentation

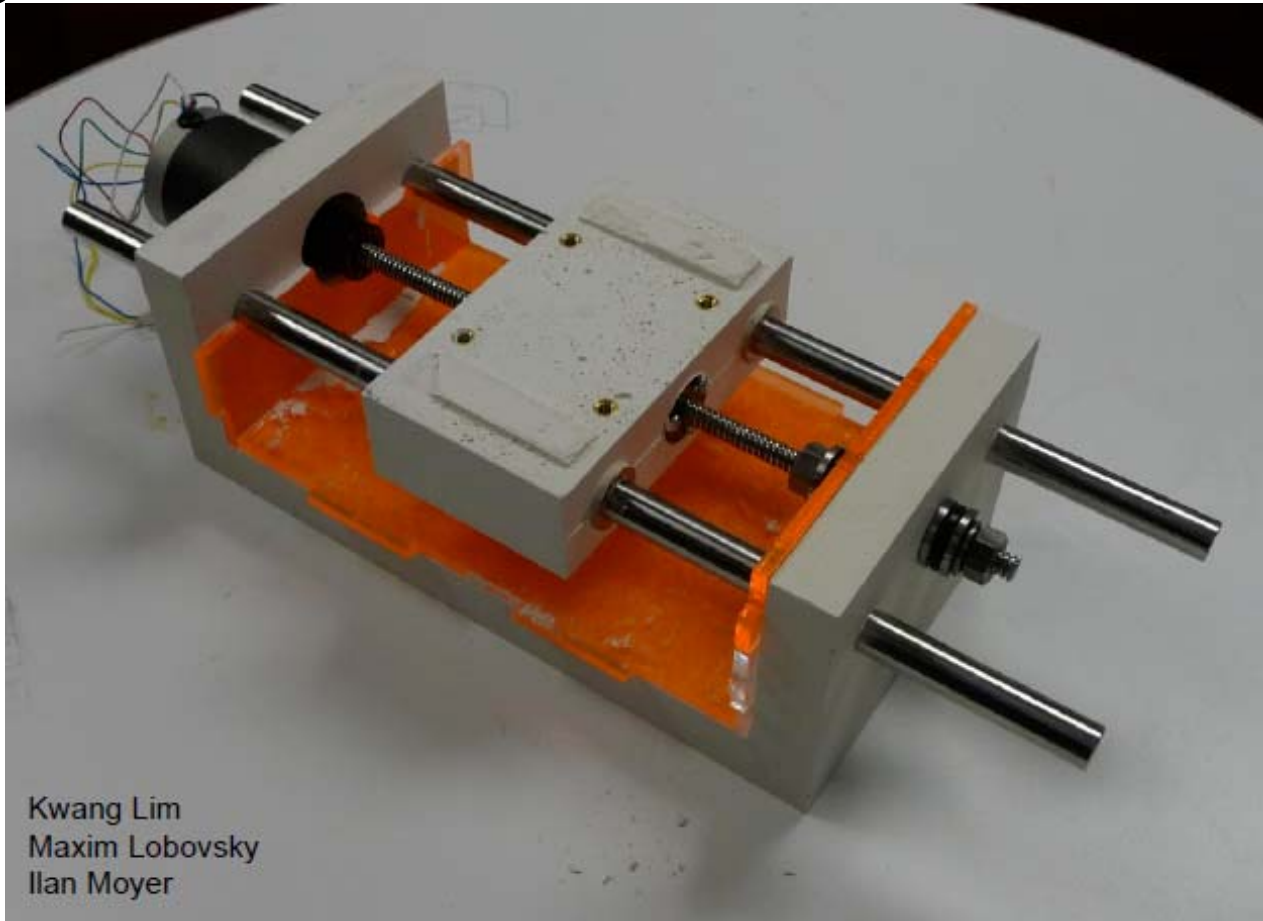
Kwang Lim



XYZ Cell



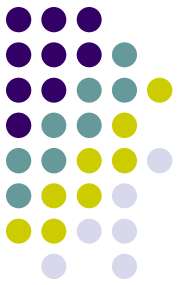
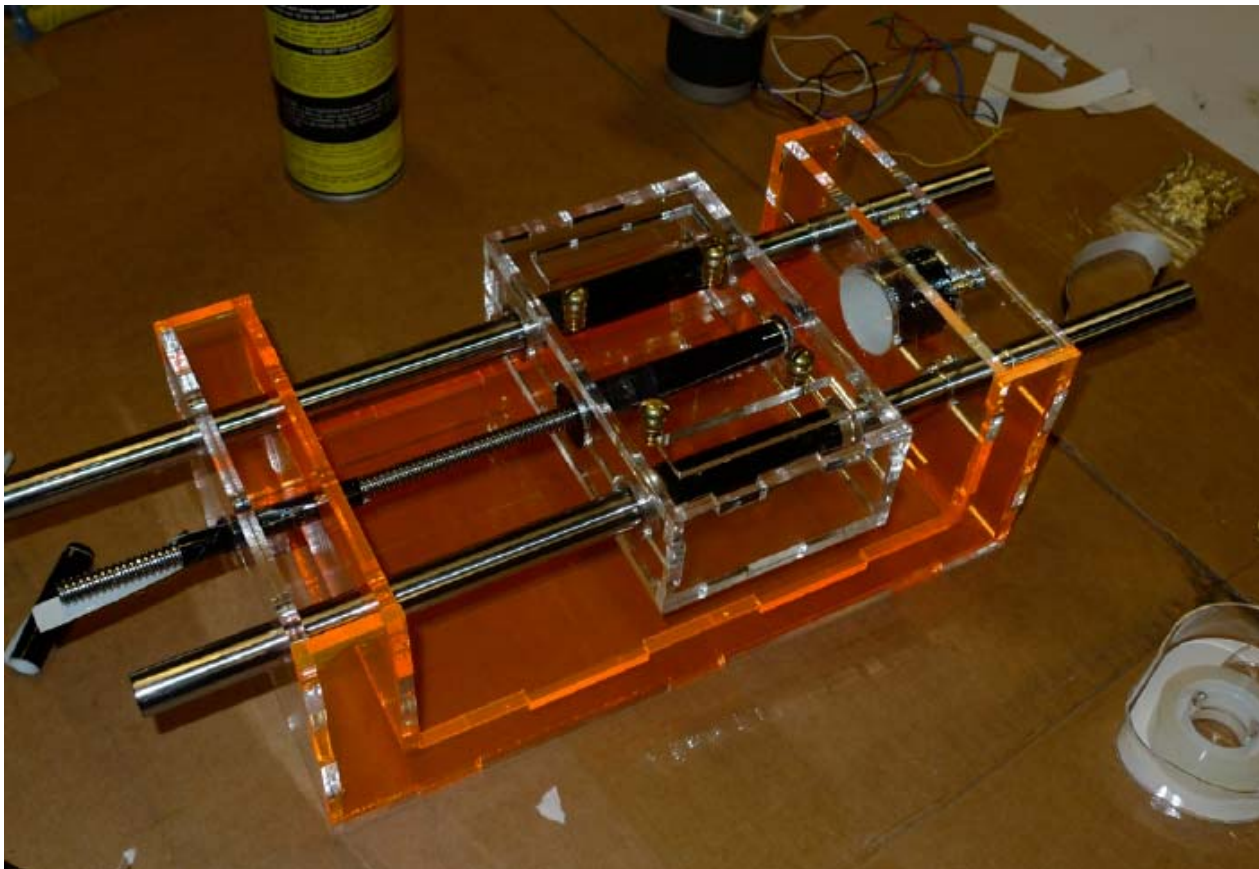
- Single Axis Bench Test



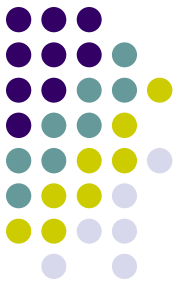
Kwang Lim
Maxim Lobovsky
Ilan Moyer

XYZ Cell

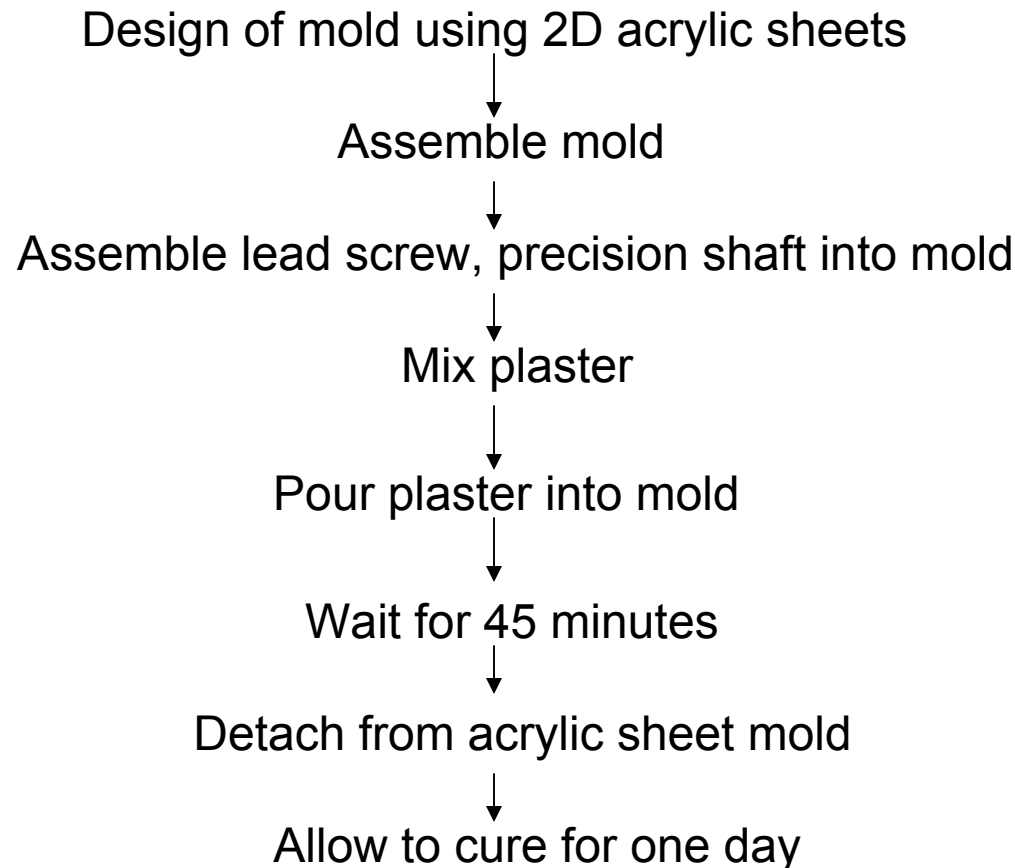
- Finished Mold

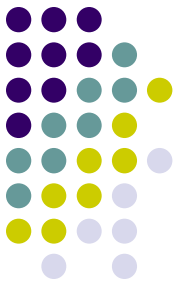


Require Development and Workflow



- Casting of machine structure

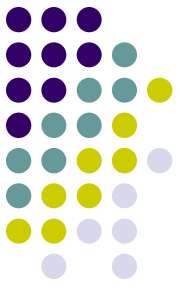




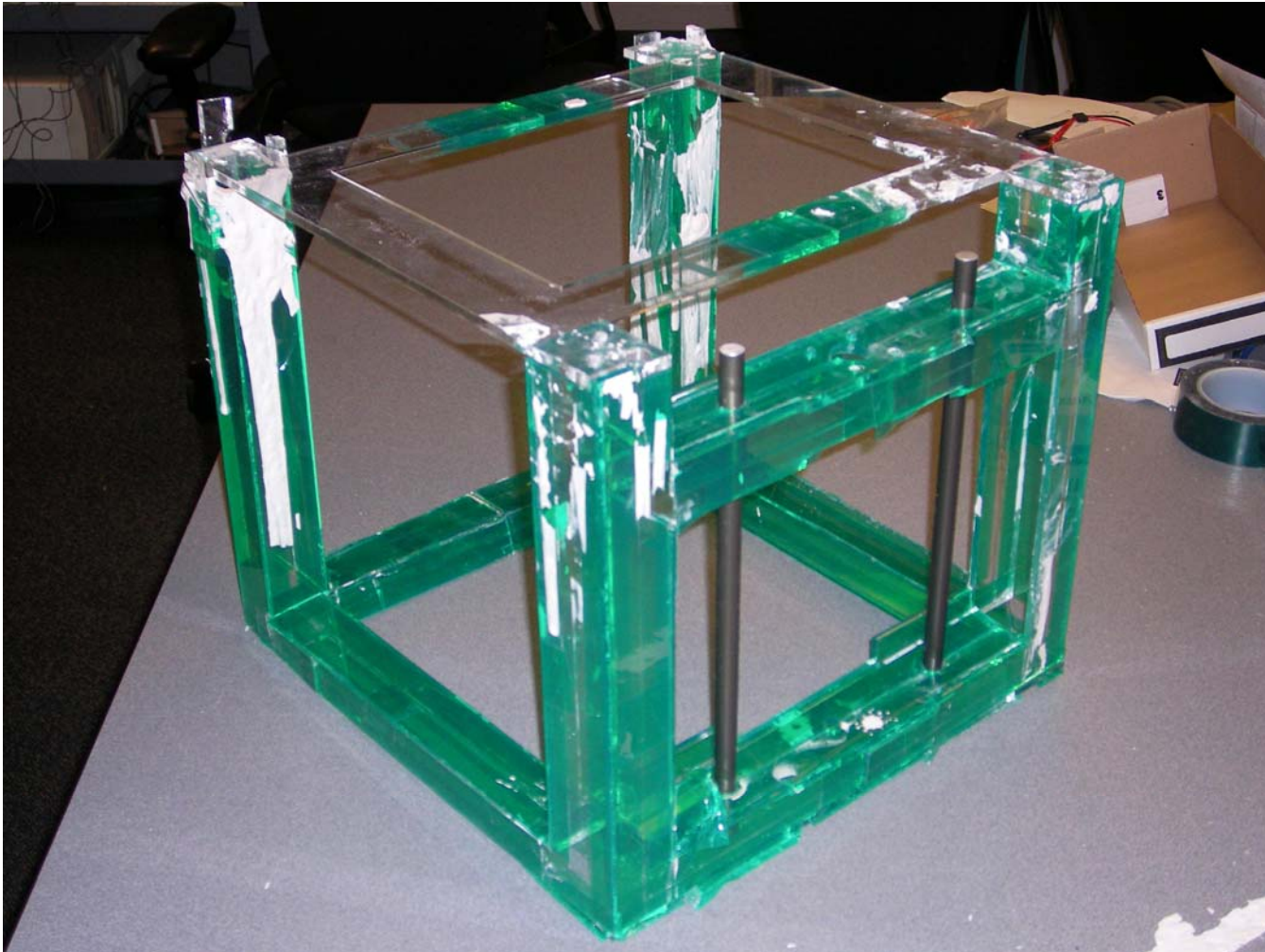
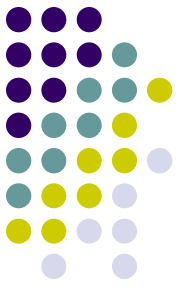
Cost and Benefits

- Machine Structure (~ \$60 for 3 axis)
- Structure is $\frac{1}{4}$ cost of entire XYZ cell (~ \$1000 for 3 axis)
- Low cost machine structure
 - < \$20 per axis
- Requires only 1 acrylic mold to produce many machine structures
- No oven drying

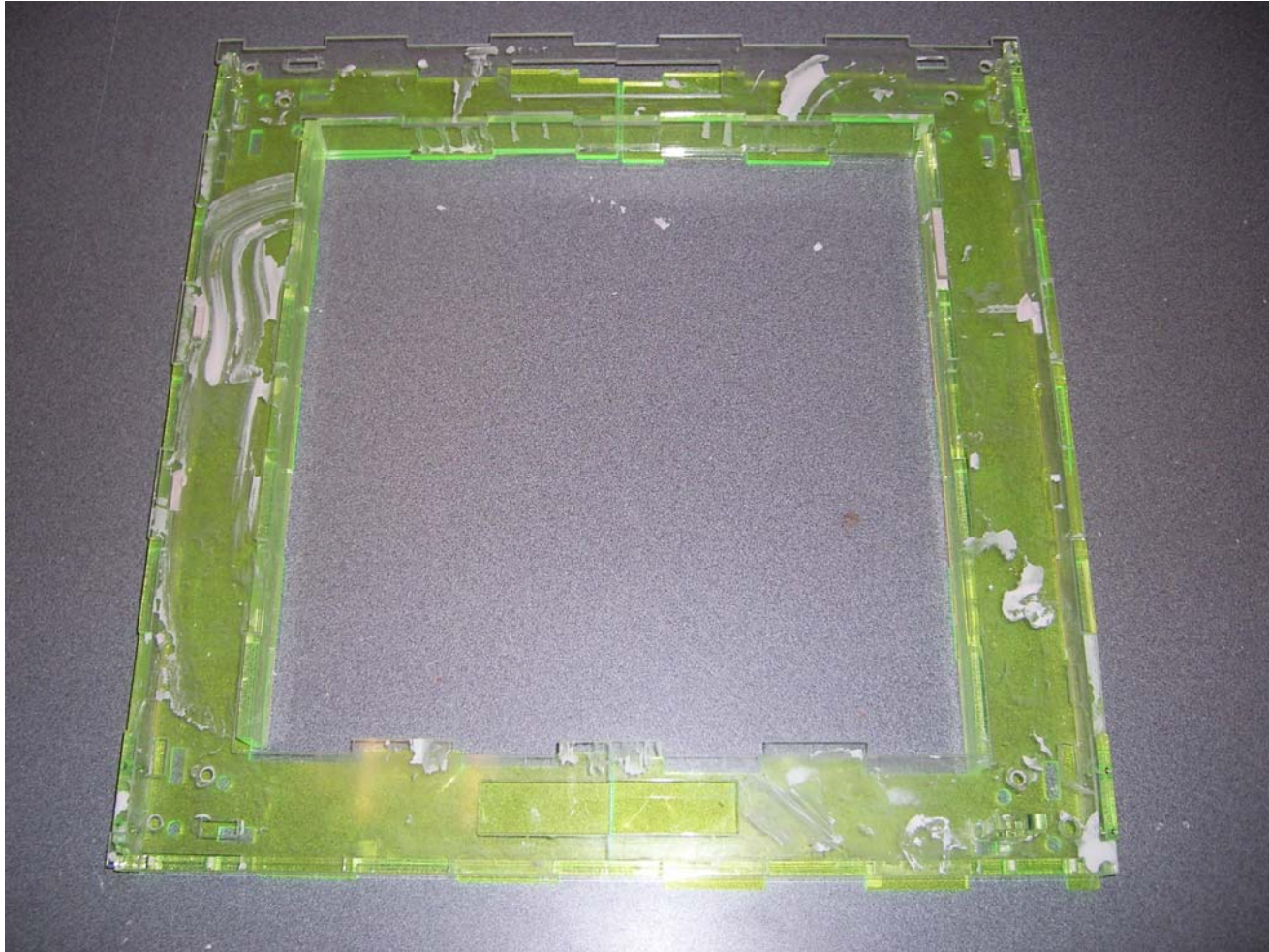
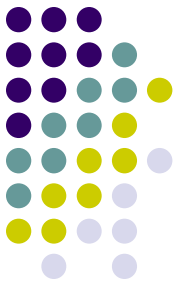
Plaster Disaster Development



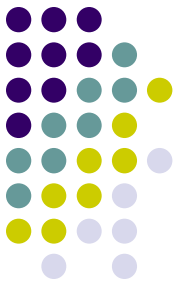
Plaster Disaster Mold



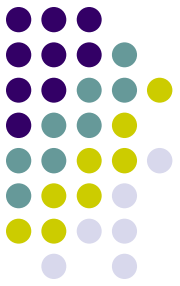
Plaster Disaster XY axis Top Mold



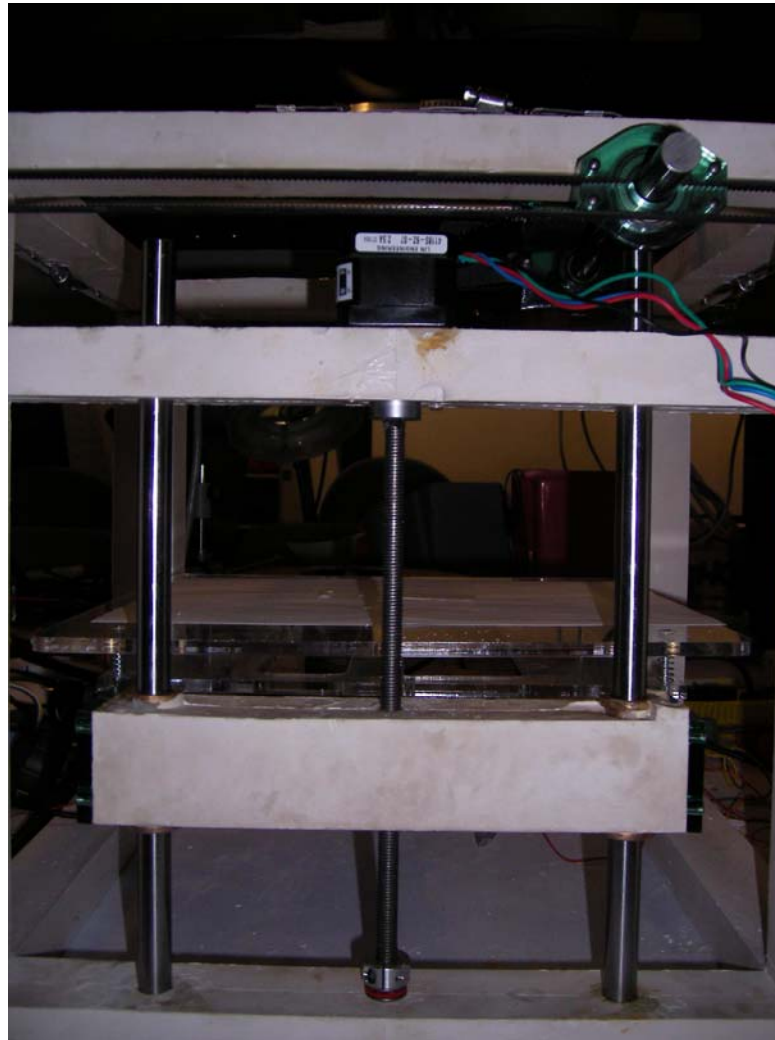
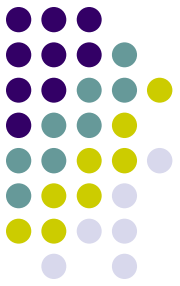
Plaster Disaster XY axis Details



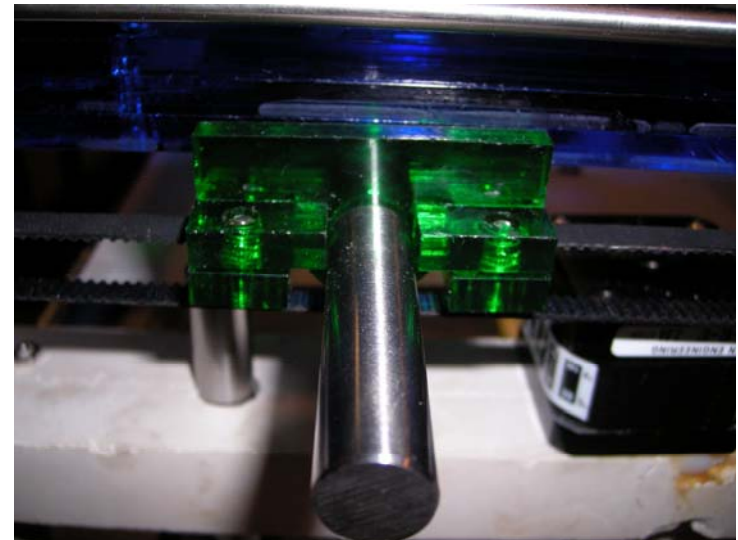
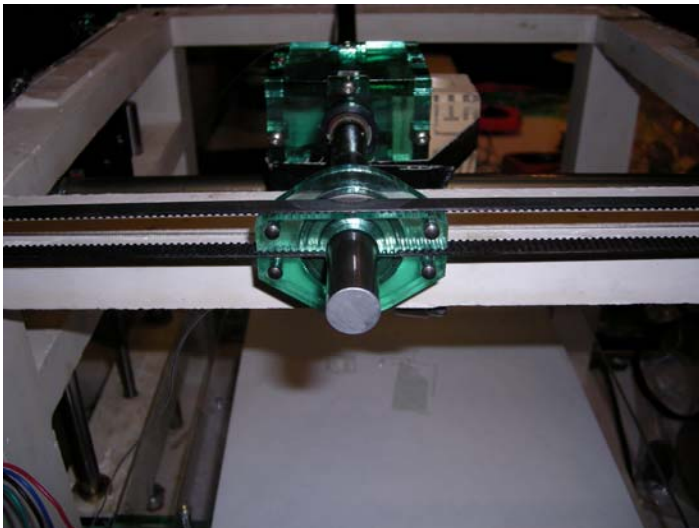
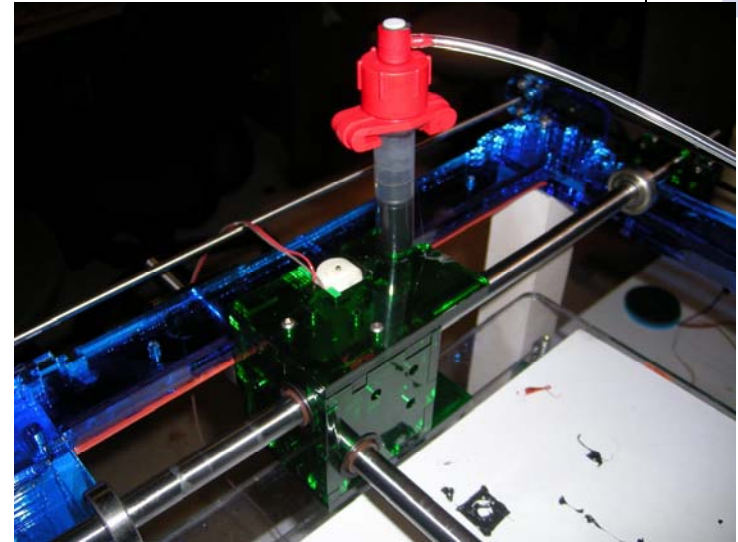
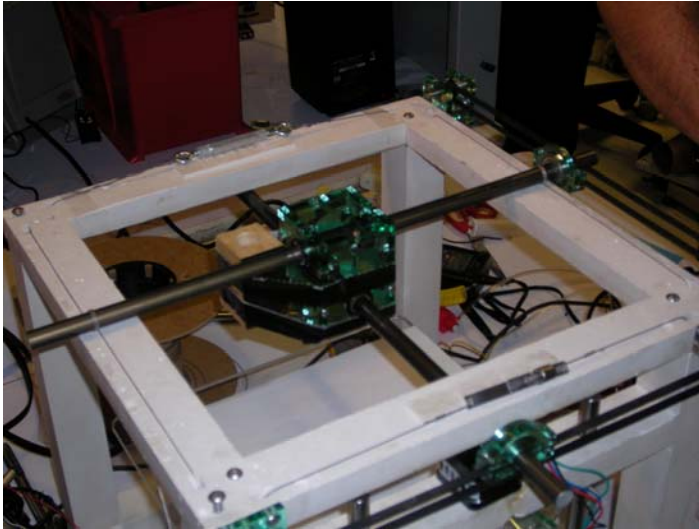
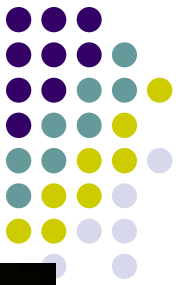
Z Carriage Mold



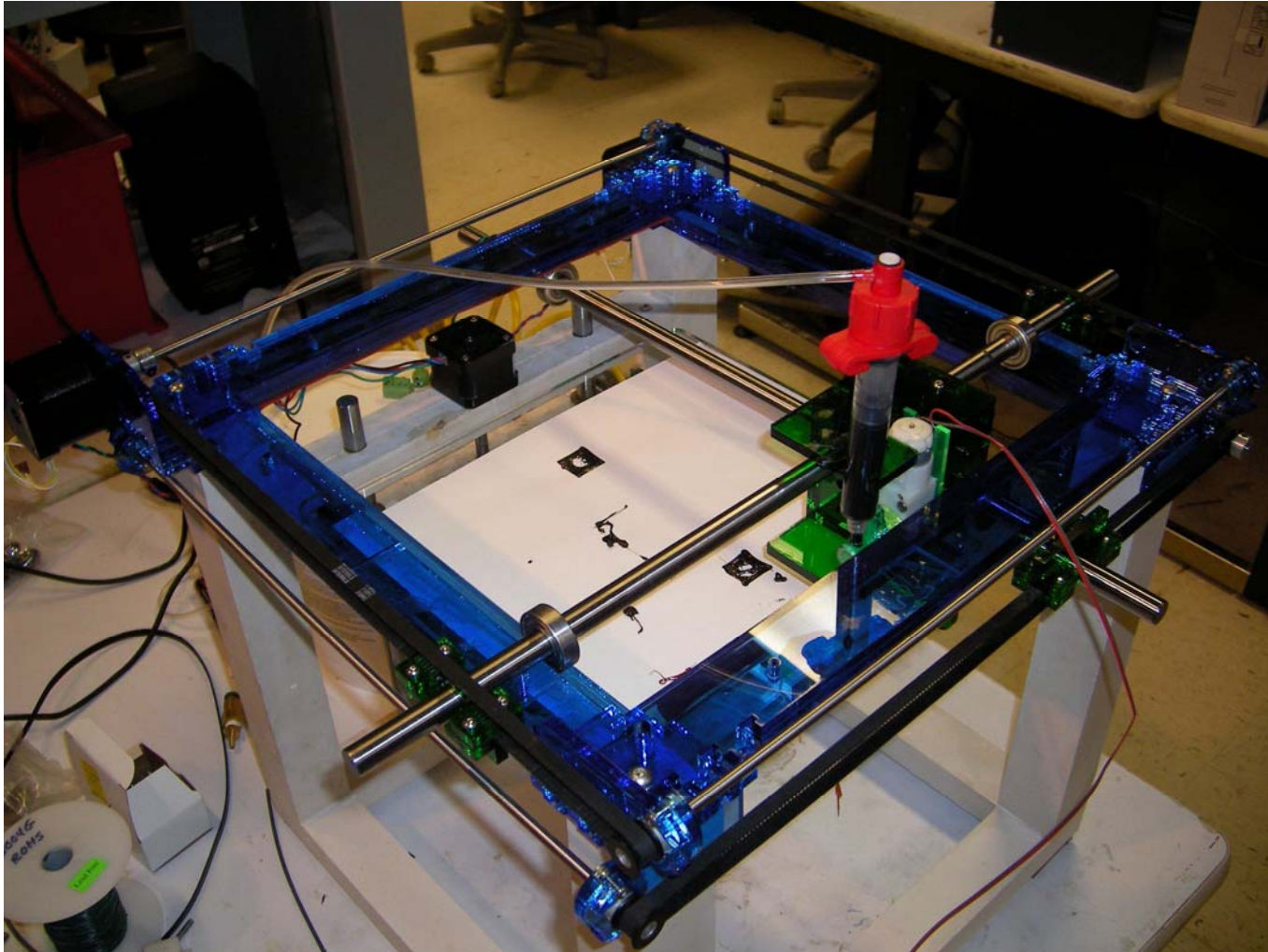
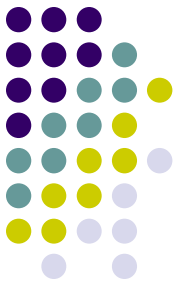
Z Axis



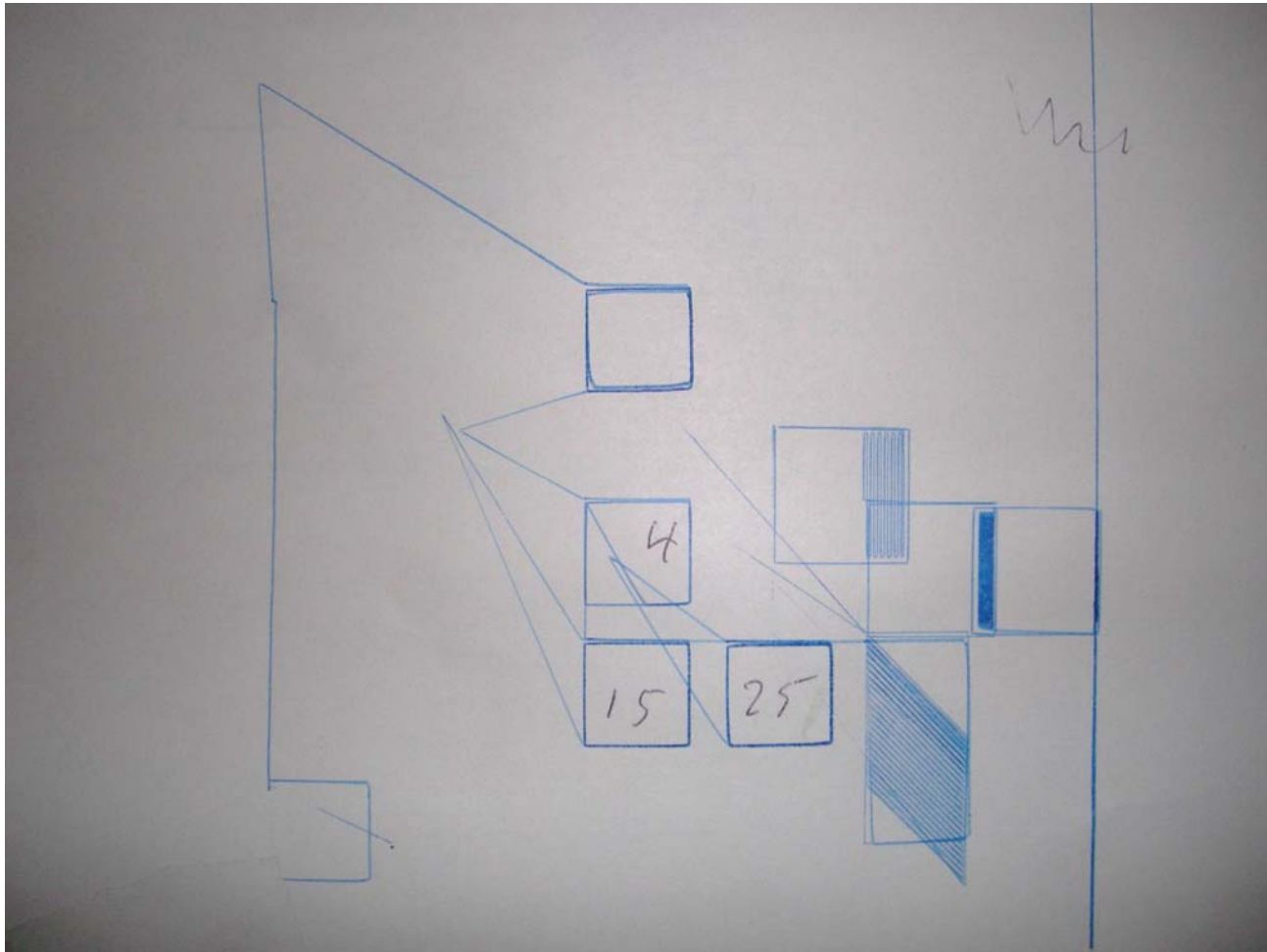
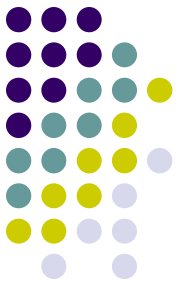
Shuttle and Yankers



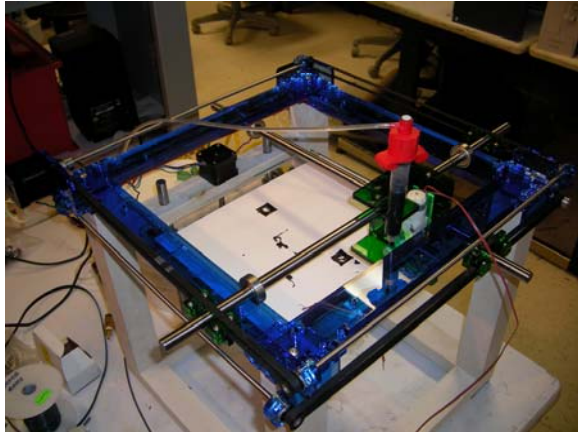
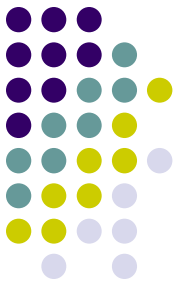
Completed PD



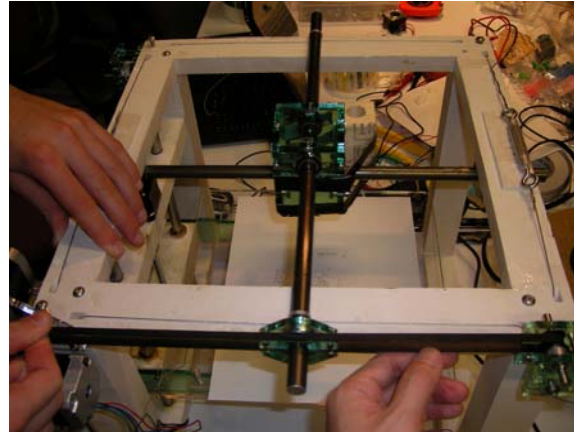
PD Repeatability Test



Driving Mechanisms



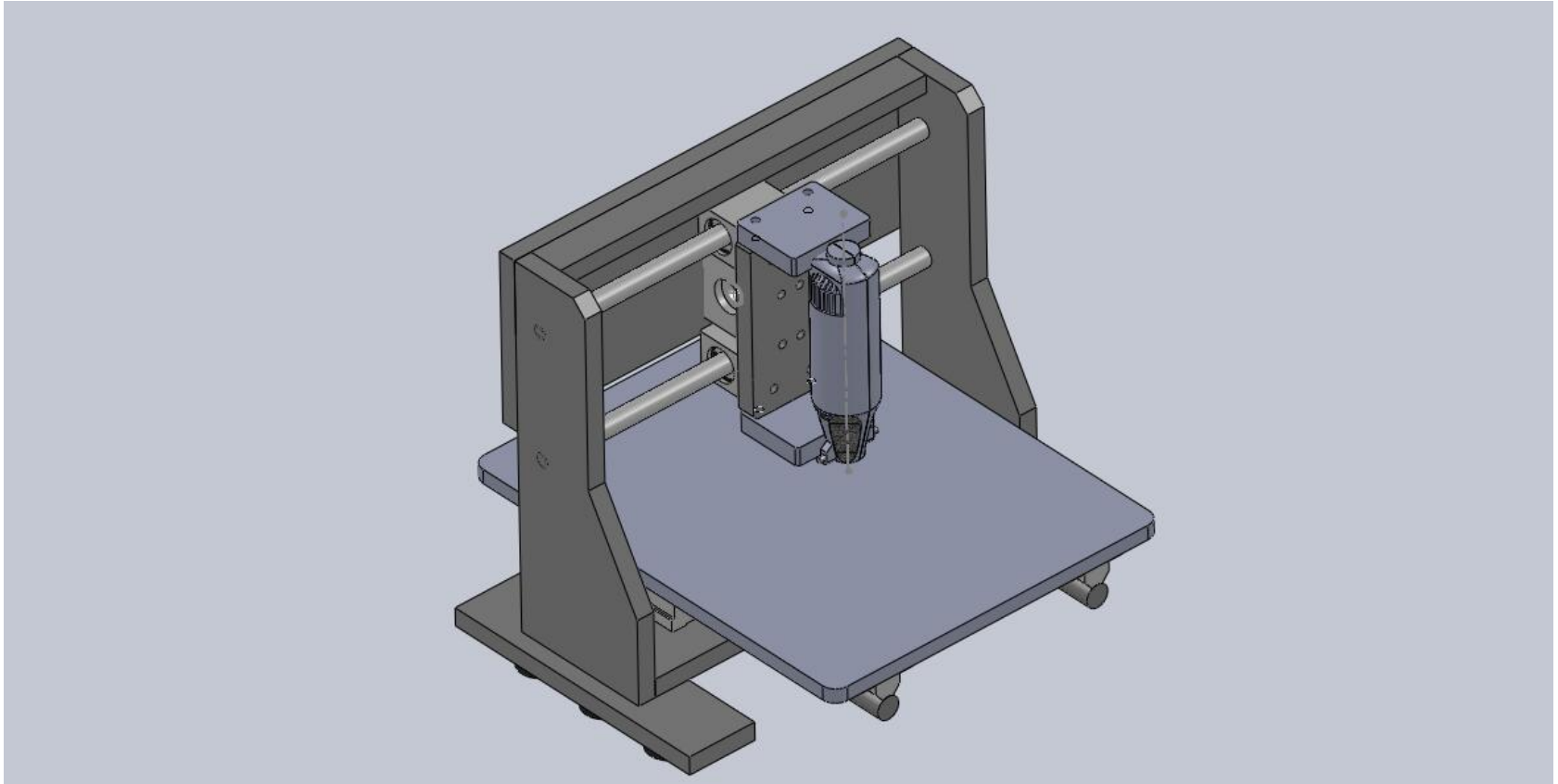
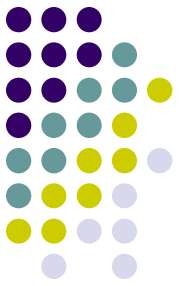
Belt Drive



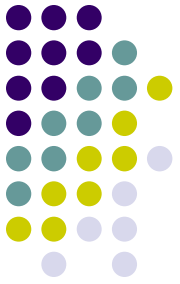
Capstan and Belt Drive

Lead Screw Drive

Lead Screw Concept

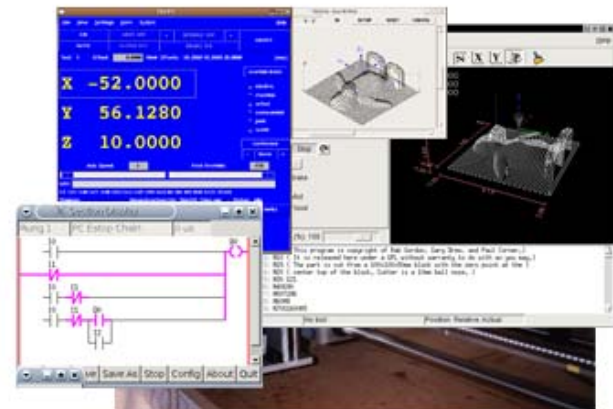


Lead Screw Drive Demo

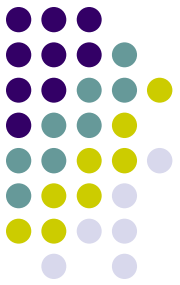


Software

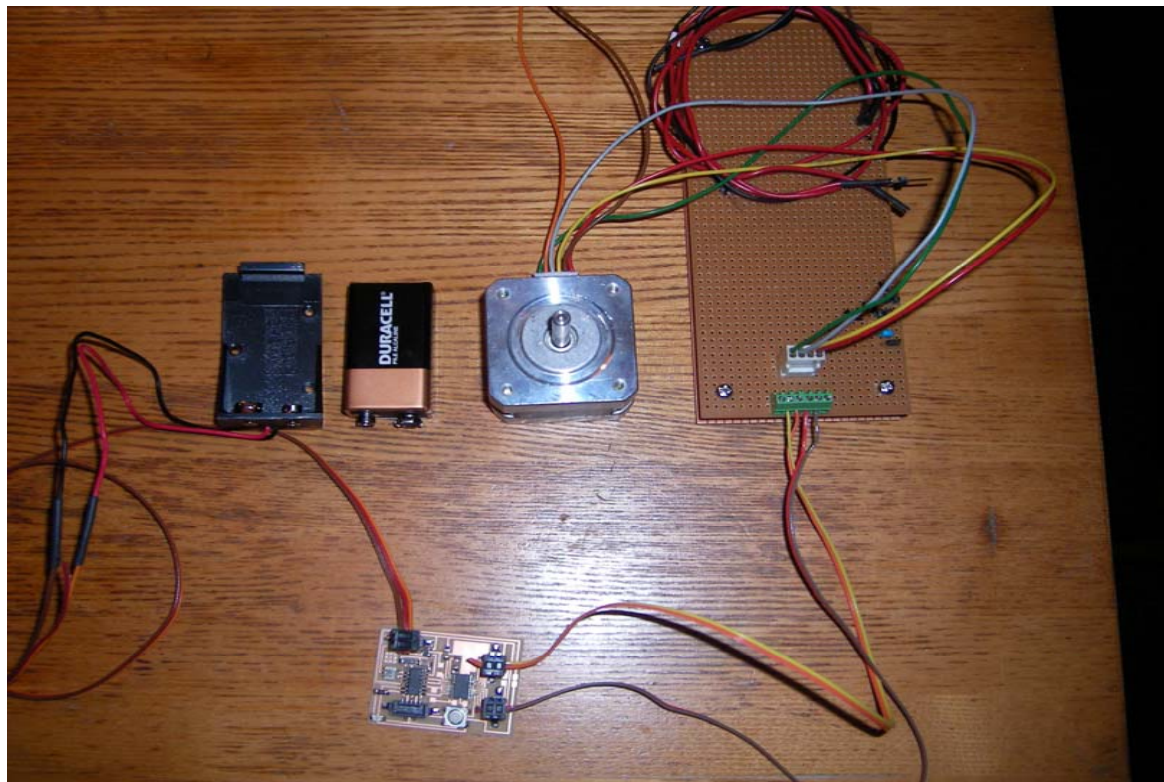
- Linux CNC
 - Does not work on notebook
- Fab@Home
 - Work notebook



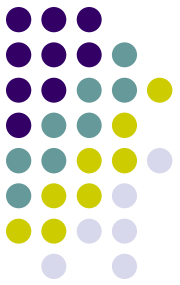
Power Electronics



- Allegro A3984
- Improving batwing power dissipation

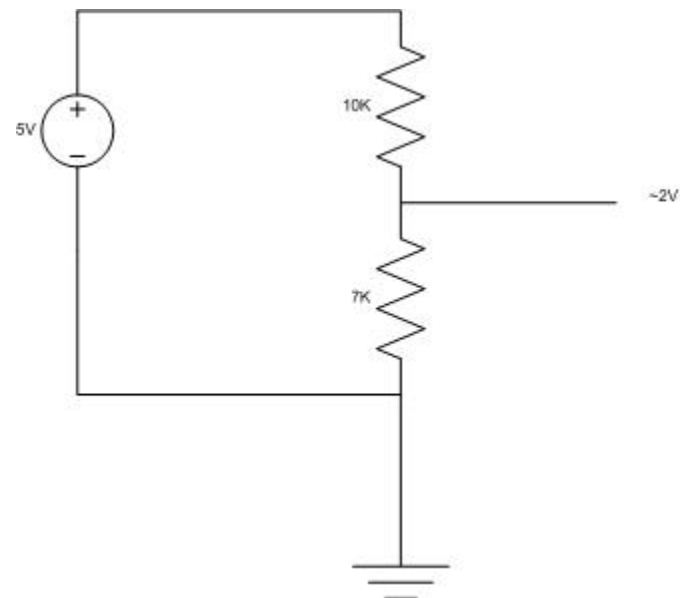


Selection of sense resistors and reference voltage

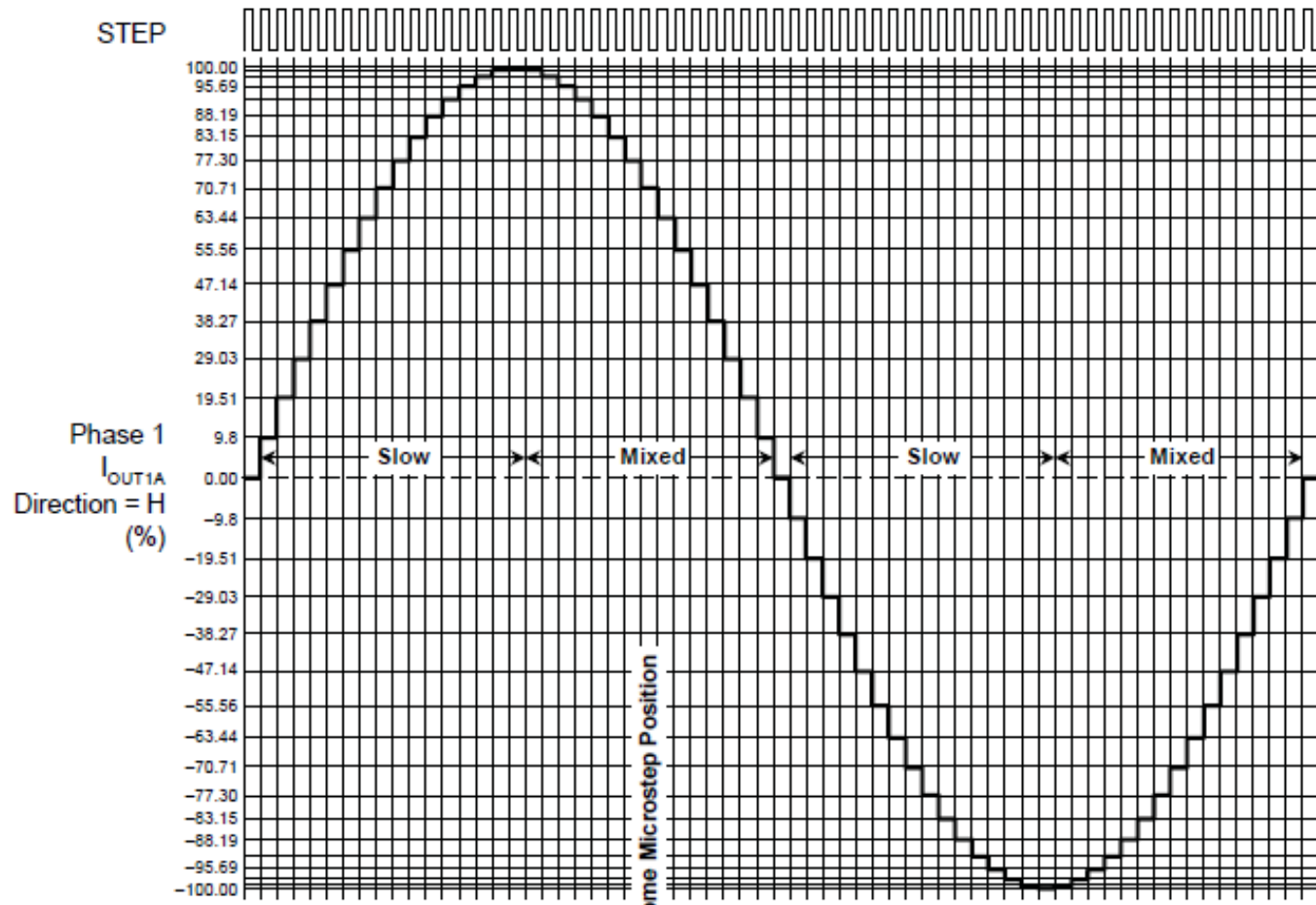
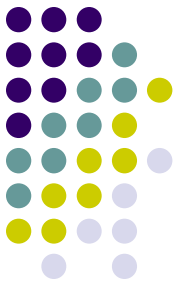


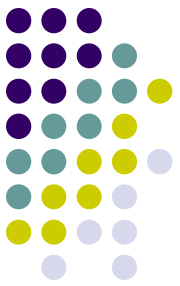
$$I_{\text{TripMAX}} = V_{\text{REF}} / (8 \times R_s)$$

- Rtop 10K and Rbottom 7K
- $R_s = 0.5 \Omega$
- $V_{\text{ref}} = 2 \text{ V}$



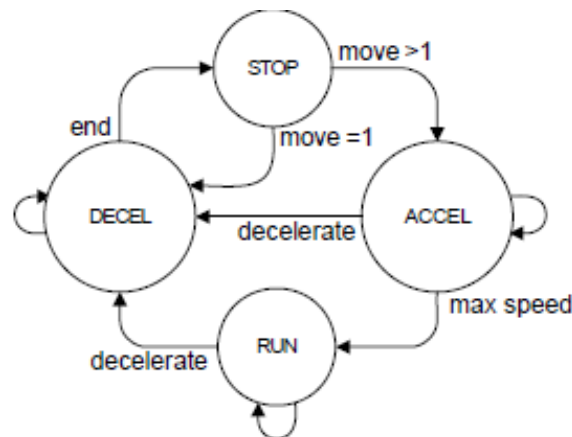
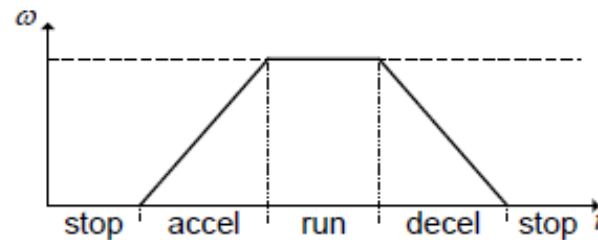
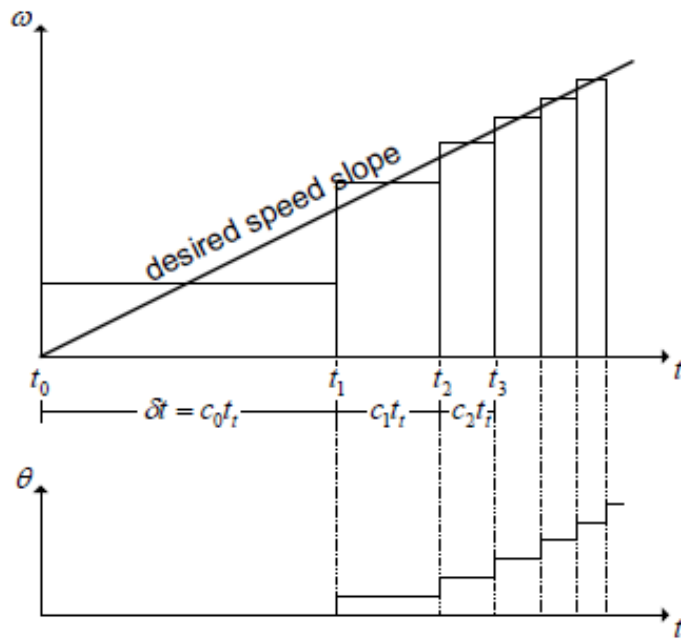
A3984 Microstepping





Speed Control

- Non-Linear
- ATmega88 Timer Interrupt



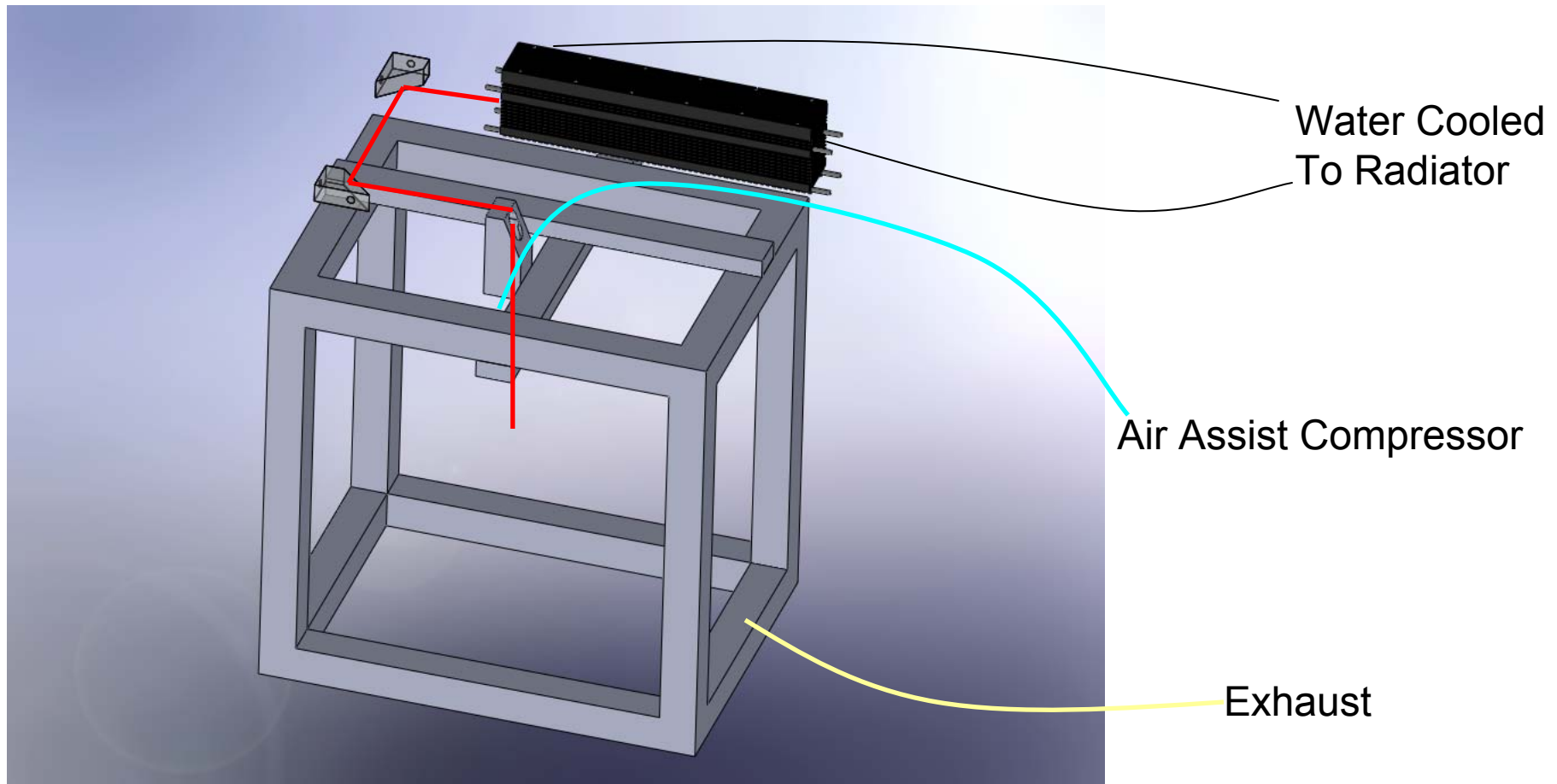
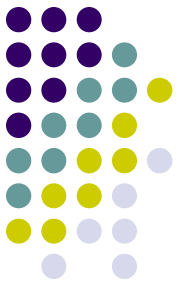
$$c_0 = \frac{1}{t_t} \sqrt{\frac{2\alpha}{\dot{\omega}}}$$

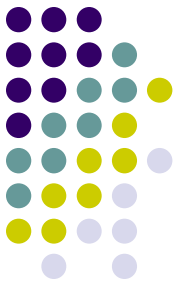
$$c_n = c_0 (\sqrt{n+1} - \sqrt{n})$$

Taylor Series Approximation

$$c_n = c_{n-1} - \frac{2c_{n-1}}{4n+1}$$

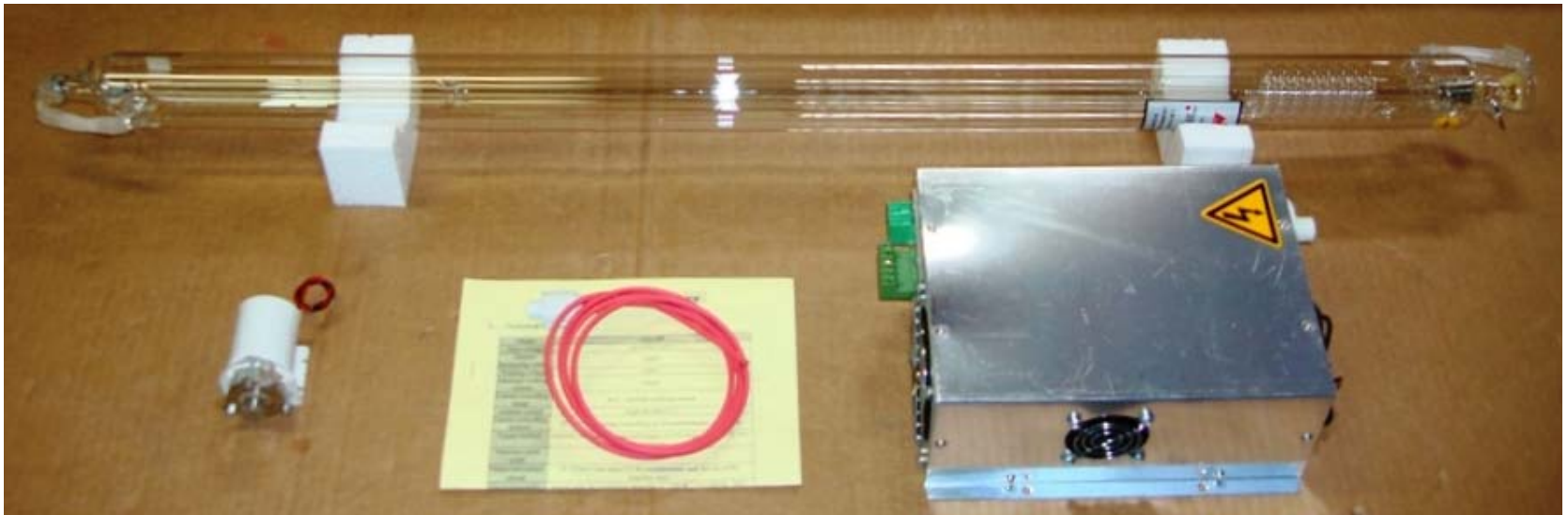
Laser Machine Concept



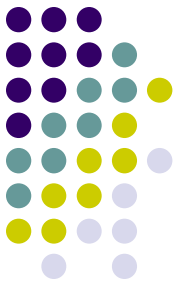


Laser Tube – CO2

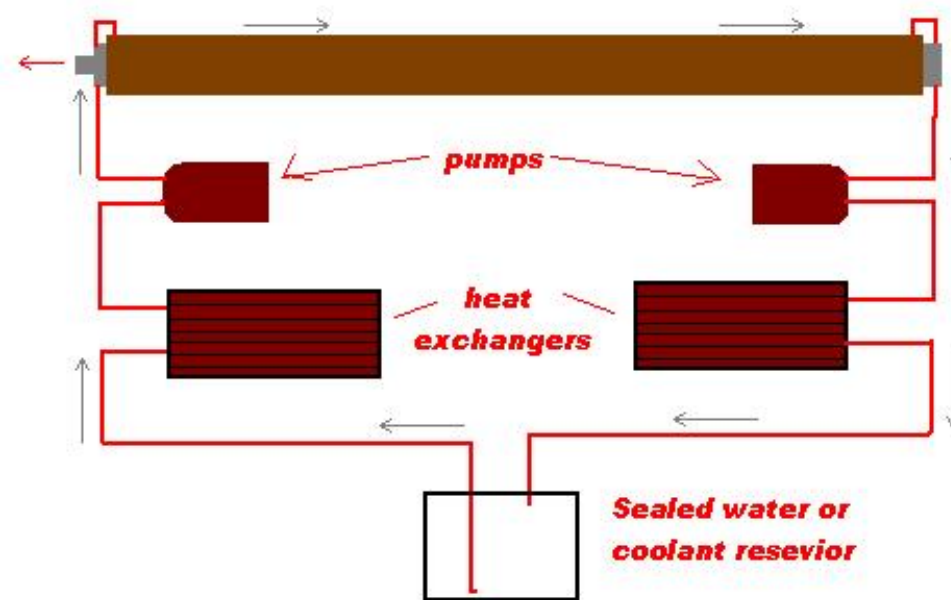
- 40W CO2 Laser Power Supply
- 40W CO2 10600nm Laser Tube
- Water Pump
- \$1200 (Ebay)



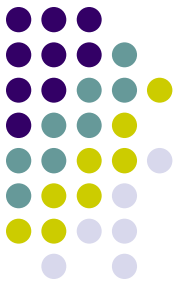
Cooling system for CO2 Laser



- \$320



Fiber Laser



- Compact Fiber Laser

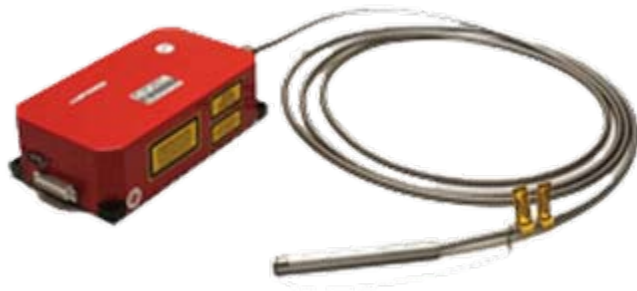
- 1.6W
- US\$20,000



NovaWave Technologies
900 Island Drive
Redwood City, CA 94065
TEL: 650-610-0956
FAX: 650-610-0986
www.novawavetech.com

Quotation

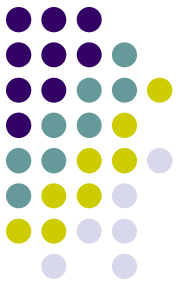
Customer: MIT
Attn: Kwang Lim
Voice: 617-460-7567
Email: kylim@mit.edu



Quotation #	Quotation Date	Quotation Expiration	Salesperson
SFL041709-1	4-17-09	45 days	Larry Peterson x108

Item	Item/Description	Delivery/ARO	Quantity	Price
1	Single Frequency Laser, 1064.2 $\pm$.2 nm, Spectral Linewidth: <400 kHz. Polarization Extinction Ratio >16dB. 1m fiber length. Includes a High Power Isolator, external, net output power – 1.6W, FC/APC connector.	6-8 weeks	1	\$20,400
2	Desktop Controller for SFL	With above	1	\$2,250

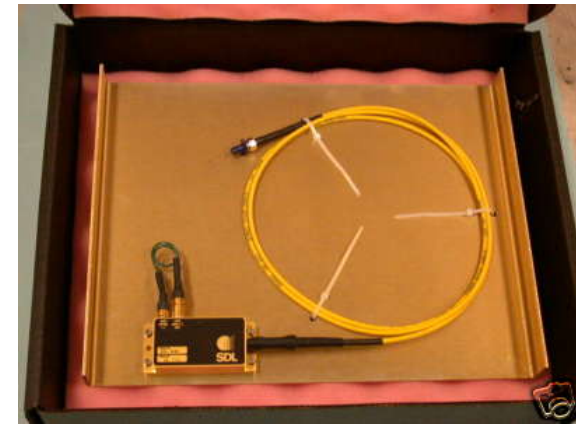
Used Fiber Laser



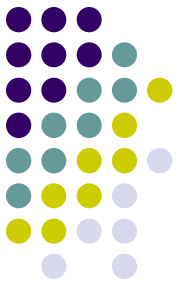
20 W 1565nm
US\$399



1 W 830nm
US\$149



20 Watt 808nm
US\$399.95



What Next?

- Acceleration and deceleration code for ATmega88
- Laser cutting using ~800 nm laser

**Thank you for a
wonderful semester!**

