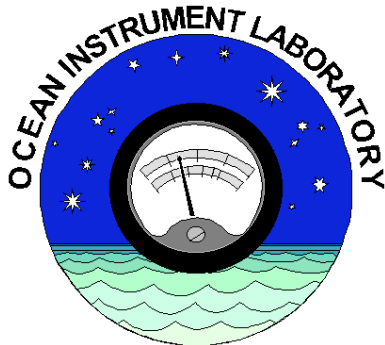


DESKTOP PC BOARD FABRICATION PIC PROCESSORS

UNOLS RVTEC MEETING
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Tom Wilson
Ocean Instrument Laboratory
Marine Sciences Research Center
State University of New York
Stony Brook NY
thomas.wilson@stonybrook.edu



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- ? Mention of a company in this presentation does not constitute an official endorsement by the State of New York, the State University of New York, or the Marine Sciences Research Center,
- ? The presenter has no ownership interest in any commercial entity cited.

Special RVTEC “No Chop-Busting” Disclaimers

- ? The presenter is not dating and has not dated any spouse, relative, or principal in any such company, nor is he ever likely to,
- ? No person connected to these products has taken me out for a fine dinner (although they darned well ought to after this talk),
- ? Anyone who implies otherwise is just looking for trouble.



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A Short Quiz: Please name the following “old school” objects...



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PCB fabrication options

Commercial board house:

Positives: Multilayer, silk screen, solder mask, large quantity.

Negatives: 20-50 piece/\$300-500 minimum, 3-4 week lead time.

Prototyping house:

Positives: 2 layer, solder mask, small quantity.

Negatives: 5 pieces/\$65-100, 1 week lead time.

Desktop fabrication:

Positives: Single pieces in 60 minutes, in shop or on ship, low cost.

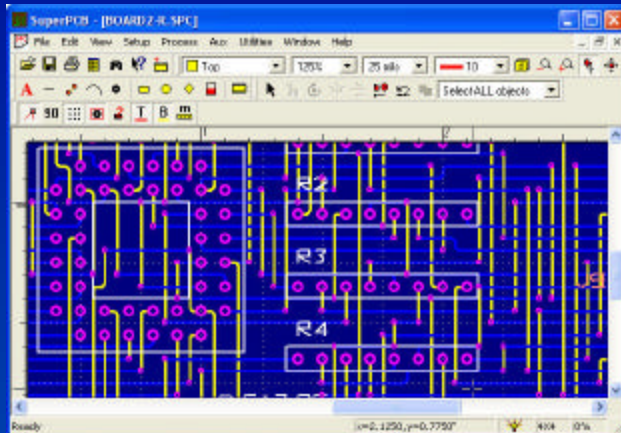
Negatives: No solder mask/silkscreen, double side not easy.



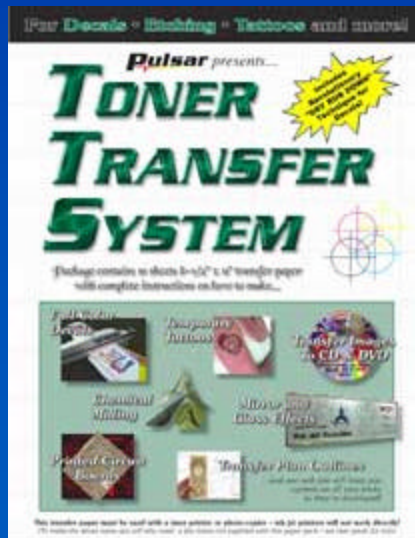
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Desktop PCB Fabrication



Step 1:
Design your board. Hint:
using 10 mil pad hole size
helps drilling later.



Step 2:
Print 1:1 output using laser
printer on "magic paper."



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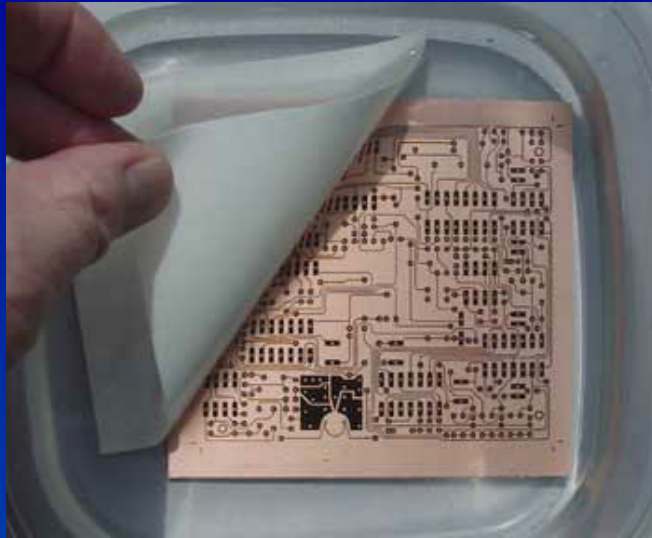
Step 3:

Cut blank copper board to size and clean with ScotchBrite scouring pad. 0.032" board can be scored and cut with razor knife. Kapton flex board can also be used.

Step 4:

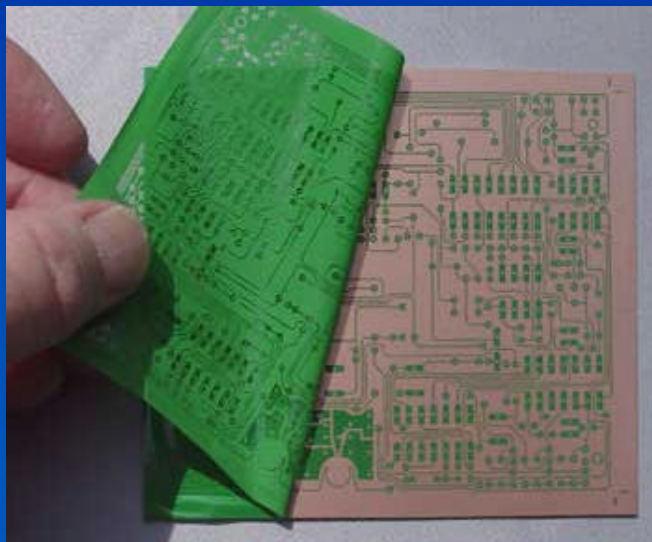
Laminate toner onto board.





Step 5:

Soak in water, paper slides off, leaves toner (resist) on board!



Step 6:

Rinse board in distilled water and dry. Laminate green “TRF” toner sealer onto board, peel off.



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Steps 7-12:

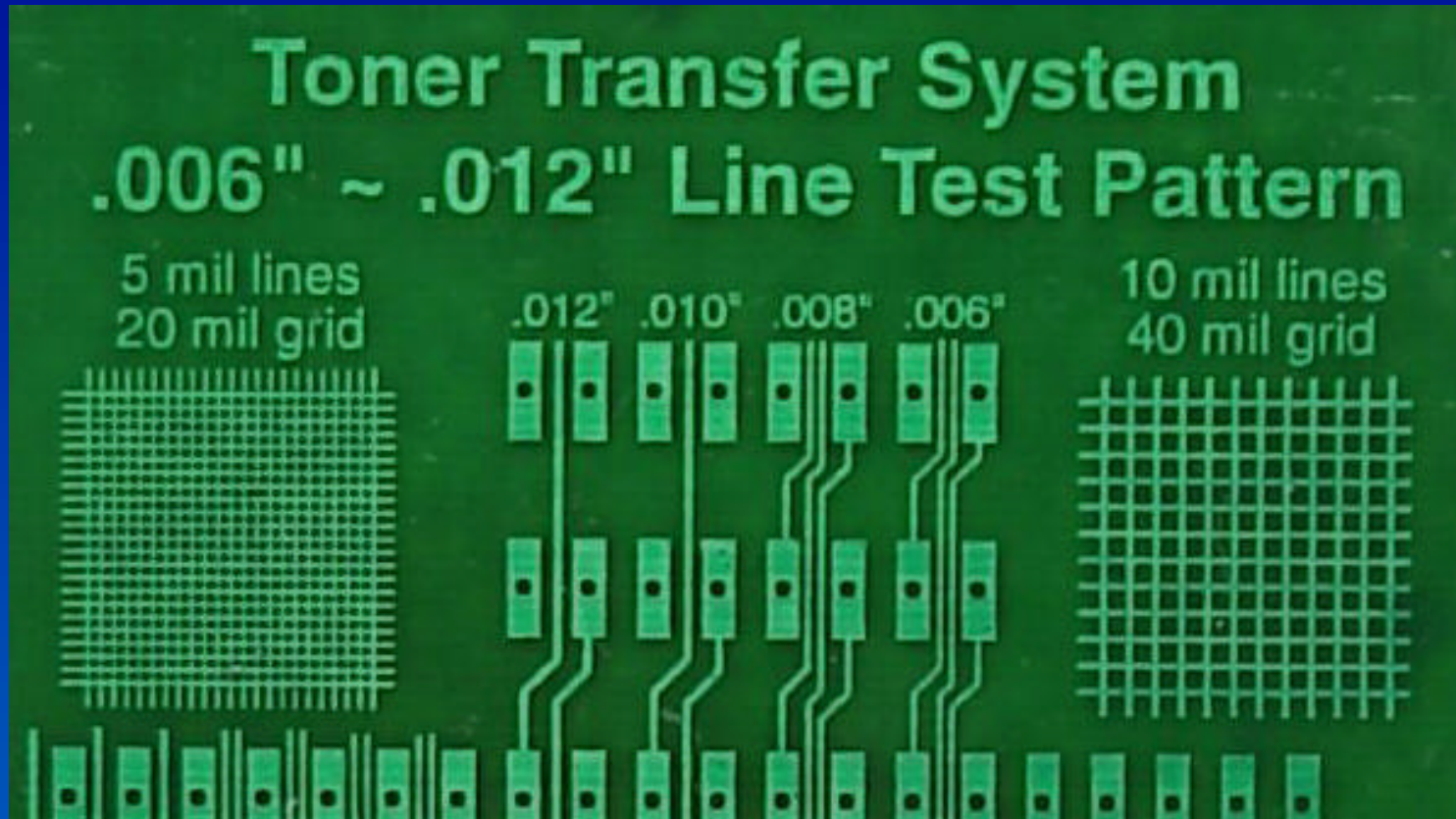
- ? Etch with FeCl and sponge,
- ? Clean off resist with lots of acetone,
- ? Drill,
- ? Tin plate (optional),
- ? Assemble,
- ? Conformal coat (optional).



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How good can it get?



6 mil traces allow 2 traces between standard DIP IC pads.



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How much does it cost?

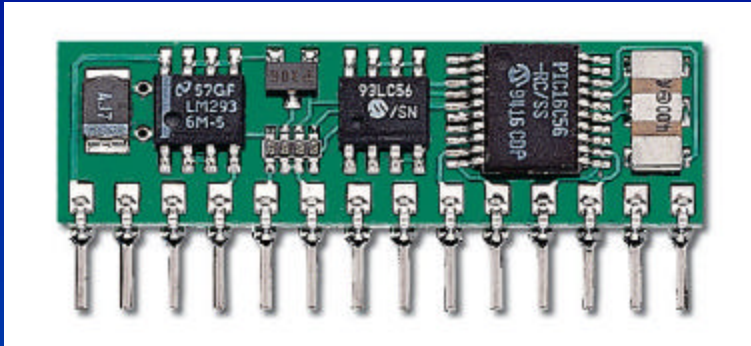
1. Laminator	\$100
2. Blank board – 2 8x10” sheets .064 SS	\$25
3. Transfer paper & green film	\$25
4. Etchant, acetone, Scotchbrite, baking dishes	\$20
5. Carbide drill bits	\$10
Minimal investment:	\$180
6. PCB design software	\$150
7. Mini drill press	\$160
8. Mini board shear & box brake	\$160
Deluxe end of fiscal year investment:	\$650



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PIC Processors



Parallax BASIC Stamp

- ? \$29.00 each
- ? No industrial temp range



Microchip 16C56 PIC

- ? \$5.00 each
- ? -40 to +85 C



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PIC Processors



A complete microcontroller
on a chip:

- ? CPU, RAM, ROM, I/O, clock,
- ? Military / extended temp ranges,
- ? Clock to 40MHz, internal oscillator
or external crystal (high precision),
- ? Low power modes (or use 40KHz
xtal for *REALLY* low power),
- ? 8 - 40 pins,
- ? 1K - 16K code space,
- ? Register mapped pin definitions,
- ? Digital I/O,
- ? Some have A/D (typ. 10 bit),
hardware UARTs, PWM output,
X-10 I/O, etc, etc.,
- ? \$2 - \$12 each in singles.



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The big hurdle - programming

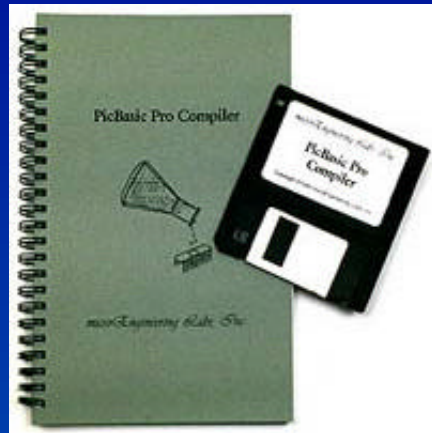
- ? Problem: who has time to learn another language / assembler / instruction set?
- ? Solution: Micro Engineering Labs PicBASIC Pro compiler:
 - ? Powerful,
 - ? Reasonably priced,
 - ? Easy to learn (you probably already know BASIC even if you don't want to admit it).



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PIC Development Kit



PicBASIC Pro compiler: \$250



Serial programmer: \$120



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Some sample projects

PCB projects:

1. Front end for “gender changer” A/D converter: surge protection, 4-20 mA input, precision reference,
2. YSI 4800LC linearizing circuit: 10K thermistor in, RS232 temperature out,

PCB plus PIC:

3. Watchdog timers,
4. Sample controllers (valves, motors, etc.),
5. A/D, digital, frequency to serial converters,
6. Sensors to short range wireless, see transceivers at www.okwelectronics.com for inspiration.



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REMEMBER...

1. Only YOU can keep the “E” in “ET”,
2. And on those long cruise legs...



Circuit design
beats scrimshaw.



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Sources

Ocean Instrument Laboratory, Marine Sciences Research Center, <http://kilroy.msrc.sunysb.edu>,

Frank Miller, inventor of desktop PCB fabrication, www.pulsar.gs.

PCB software: many out there, we use SuperPCB from Mental Automation, www.mentala.com, starts at \$149.00.

PCB material: (example ½ oz copper single sided, 0.064” thick FRP) Digikey 182-1020-ND, \$23.95 / 2 x 8x10 inch sheets.

Toner transfer paper: DigiKey 182-1003-ND, \$14.95 / 10 sheets.

Green Toner reactive film: DigiKey 182-1021-ND, \$6.95 / roll.

Laminator: GBC Heatseal H200 laminator, Staples GBC1701320, \$99.99.

Note: see www.pulsar.gs for minor modifications to improve performance.

Etchant: Radio Shack 276-1535, \$4.29 / 16 ounces.

Carbide drill bits: Hosfelt www.hosfelt.com, “resharps”, various sizes available, \$3-\$5 for pack of five.

I recommend #65, #61, and #55 as a good size assortment to start with.

Tin/silver plating: Recommended: Kepro immersion tin plating, www.dalpro.net, ITP-1QT, \$28.20 / quart.

Alternative: Coolamp silver plating: www.cool-amp.com, \$50.00 for 4 oz bottle.

Board shear, Micro Mark model 82820, \$159.95. www.micro-mark.com

Drill press. Micro Mark model 81361, \$159.95.

PIC processors: MicroChip. www.microchip.com, \$2 - \$12 each.

PICBasic Pro compiler, Micro Engineering Labs, www.melabs.com, \$249.95.

MeLabs Serial programmer for 8-40 pin PICs, Micro Engineering Labs, \$119.95.

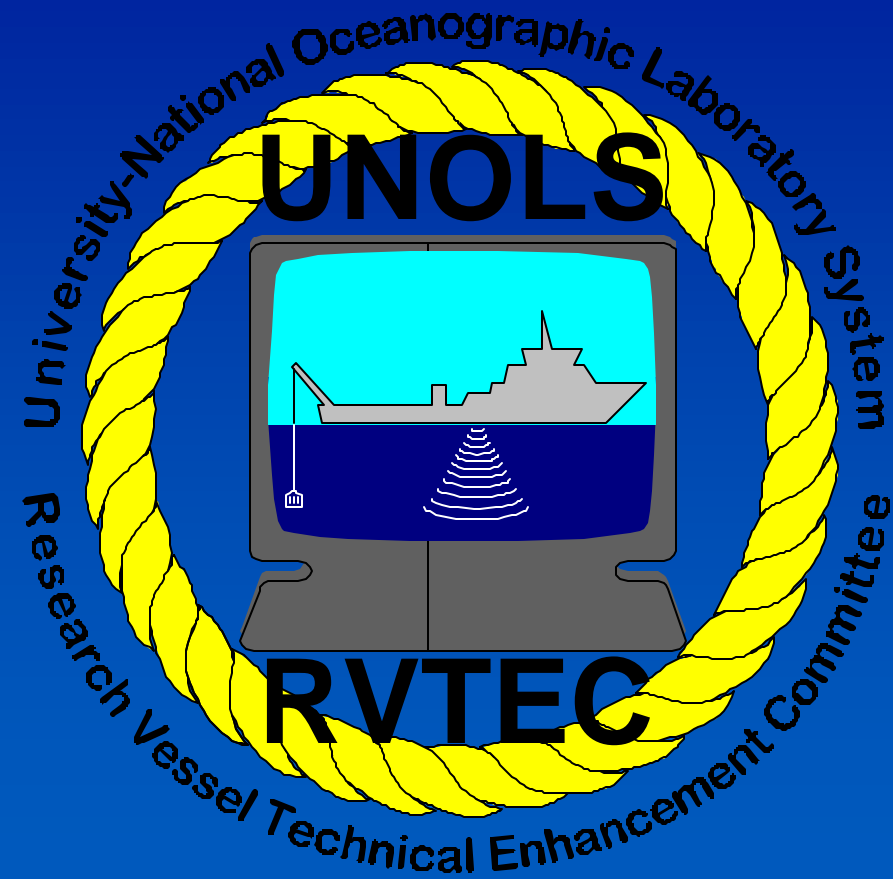
Short range wireless radio modules, www.okwelectronics.com, \$20 - \$50 each.



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It's great to be back!



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