A COMPUTERIZED INSTRUMENT PANEL

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After my friendly neighborhood mechanic stuck a jack through the wing of my newly purchased RV-4, I decided to redo the instrument panel while the plane was apart, so that I could practice ILSes without having to rent a spam can. This meant that the RV-4 panel was going to be stuffed to the gills, and it would be a real challenge to design a functional, pleasing panel.

Since I work for Apple Computer, it seemed appropriate to see if I could find a simple, inexpensive way to lay out the panel on my Macintosh, especially if I could do it with standard, inexpensive software, rather than a fancy CAD/CAM package. I wanted to explore different panel designs and choose which instruments to buy (a 2" or 3" G-meter? 2" or 3" manifold pressure?), and to print out a final, full size copy with all holes marked for centerpunching. I used inexpensive MacDraw II from Claris Corporation, but there are alternatives on the Macintosh and on those other machines.

The first step is to make templates for each size of instrument. MacDraw lets you use a grid, so that everything you draw is constrained to the grid. With the grid set to 1/8", lay out the hole patterns for a 3-1/8" instrument, putting in a little cross for each hole. Since the hole spacings are in nice round numbers from the center of the instrument, it's a lot easier to lay out the hole pattern vertically (Figure 1), select all of the crosses together, group them into one element, and then rotate the group 45 degrees to the standard orientation (Figure 2). Next, draw a circle 3-1/8" in diameter, and then draw a box 3-1/2" on a size, or whatever size you choose. This box will reserve blank space around the instrument hole for the instrument itself and for the space required between the instrument. Command the box, circle, and hole pattern to align themselves, left/right and top/bottom and group them together (Figure 3).

Voila! You now have a standard size instrument template which you can duplicate for each instrument. On each copy, put the name of the instrument and group the name with that template. You can include the screw sizes for all of the holes, and for those instruments which only require 3 mounting screws instead of 4, you can make that be part of the instrument template.

Do the same for 2-1/4" instruments, for avionics, circuit breakers, switches, a jack for tape recording your conversations with ATC (for protection against FAA enforcement excesses, which hopefully are behind us now), ignition switches, and everything else that seems to want to reside on your panel (Figure 4). On your templates, you can also draw the space required behind the panel
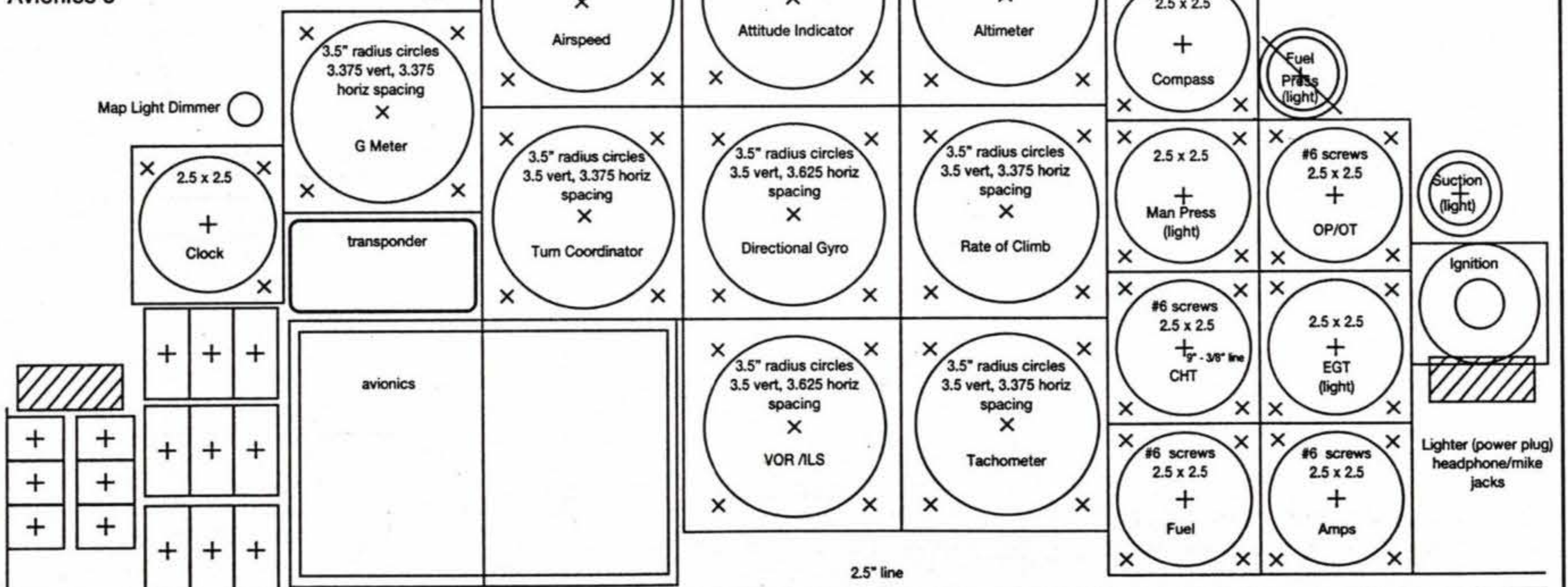

Circuit Breakers:
Starter/Lighter
Panel Lights/EngGauges
Map Lights/Turn Coord
Avionics 1
Avionics 2
Avionics 3

Post Light Dimmer

Map Light Dimmer

3.5" radius circles 3.375 vert, 3.375 horiz spacing — G Meter

2.5 x 2.5 — Clock

transponder

avionics

3.5" radius circles 3.5 vert, 3.375 horiz spacing — Airspeed

3.5" radius circles 3.5 vert, 3.625 horiz spacing — Attitude Indicator

3.5" radius circles 3.5 vert, 3.375 horiz spacing — Altimeter

2.5 x 2.5 — Compass

Fuel Press (light)

2.5 x 2.5 — Man Press (light)

#6 screws 2.5 x 2.5 — OP/OT

Suction (light)

3.5" radius circles 3.5 vert, 3.375 horiz spacing — Turn Coordinator

3.5" radius circles 3.5 vert, 3.625 horiz spacing — Directional Gyro

3.5" radius circles 3.5 vert, 3.375 horiz spacing — Rate of Climb

#6 screws 2.5 x 2.5 — CHT

2.5 x 2.5 — EGT (light)

Ignition

3.5" radius circles 3.5 vert, 3.625 horiz spacing — VOR /ILS

3.5" radius circles 3.5 vert, 3.375 horiz spacing — Tachometer

#6 screws 2.5 x 2.5 — Fuel

#6 screws 2.5 x 2.5 — Amps

Lighter (power plug) headphone/mike jacks

2.5" line

Switches: Battery, Alternator field, avionics master;
belly strobe, tip strobe, fuel pump;
pitot heat, nav lights, landing light.
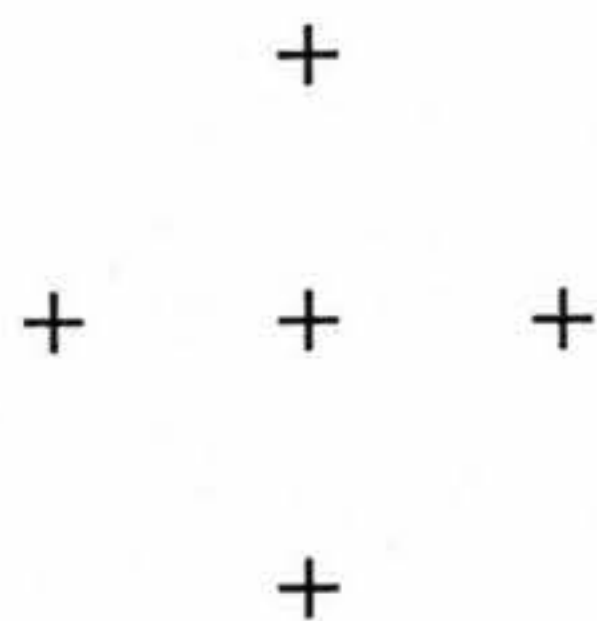Top 2 rows normally all on for t/o & landing.

Figure 1. Instrument mounting holes, rotated 45°.

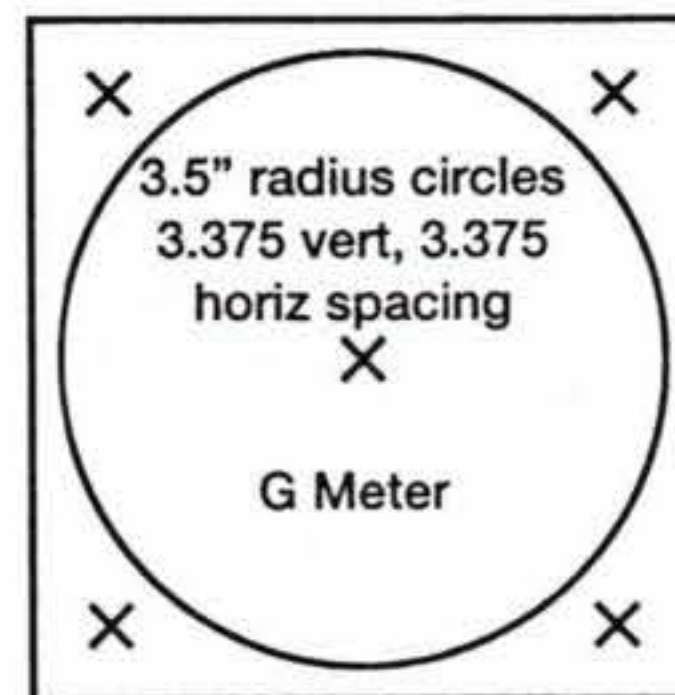Figure 2. Instrument mounting holes, normal orientation.

Figure 3. Completed Instrument template.

by each item, so that you don't lay out something where it won't fit. For example, the ignition switch has a small panel requirement, but requires a lot of space behind the panel. You can also draw in aircraft structural pieces that will obstruct space behind the panel. (I didn't leave enough room between circuit breakers for wiring, although I thought I did, so don't count on the computer to do your thinking for you!)

You can also write down the screw sizes for all of the holes, and for those instruments which only require 3 mounting screws instead of 4, you can make that be part of the instrument template.

Once you have a collection of outlines, you can try many different configurations of panel layout very quickly to find one that works best for you. By using the grid feature, the instrument layouts will align themselves to the nearest 1/8" (or whatever increment you select), and snap into place. This means that you don't have to do any tedious tweaking, fiddling, or fine alignment of your layout. The computer is a lot faster, easier and more precise than cardboard.

With the computer, you can also try various switch layout and combinations. For example, on my panel all of the switches accessed in flight are on the left, except for instrument knobs like EGT cylinder select and altimeter setting. (The ignition switch is on the right so I can keep my left hand on the throttle when starting.) The top two rows of toggle switches are normally on for takeoff and landing. Or you might prefer to place switches in a Cessna standard arrangement.

I probably tried 30 layouts to get one that I could live with, yet all of these trial layouts were done very quickly with every precise spacing.

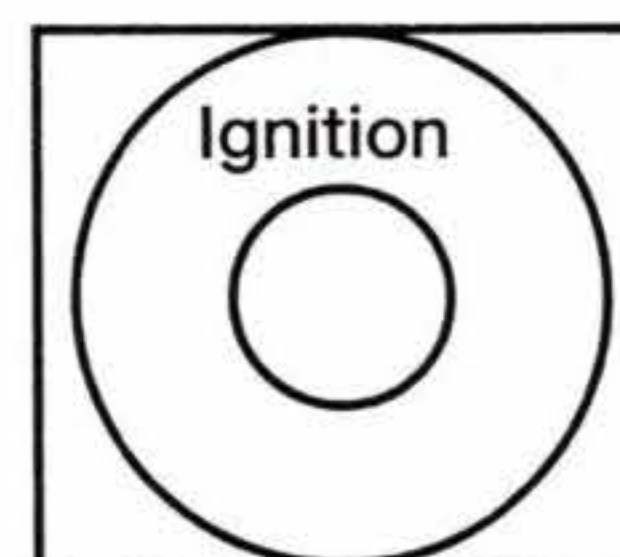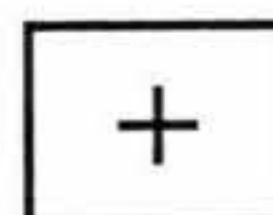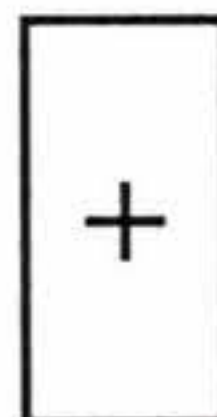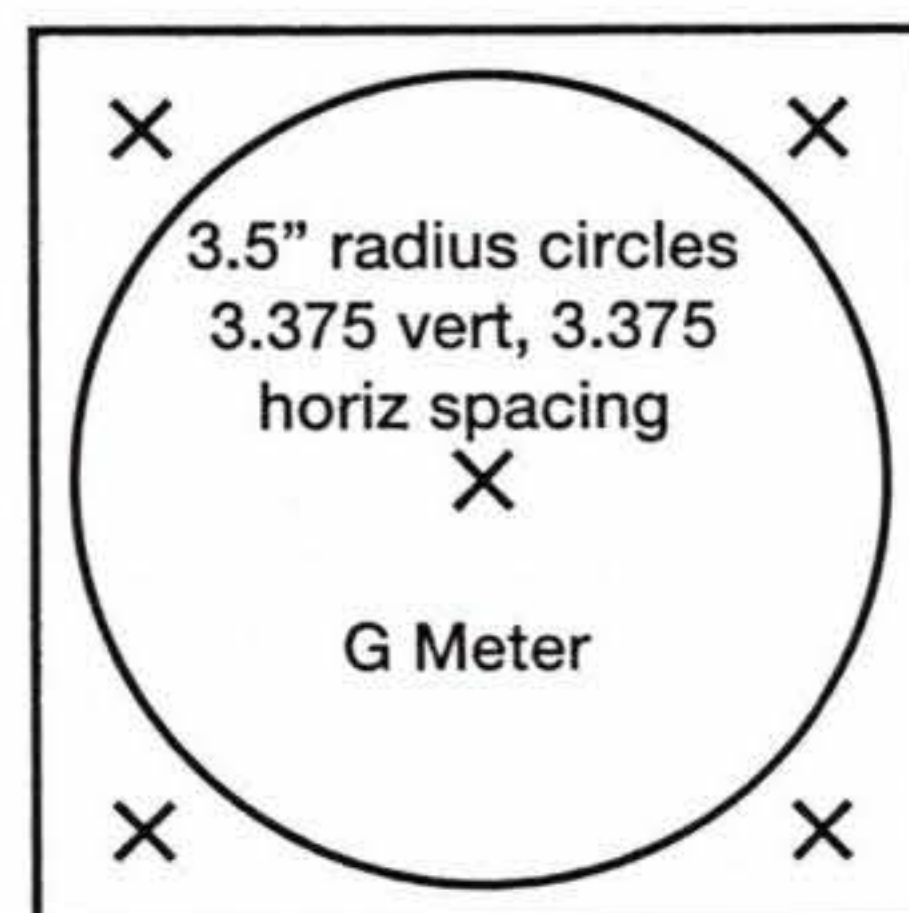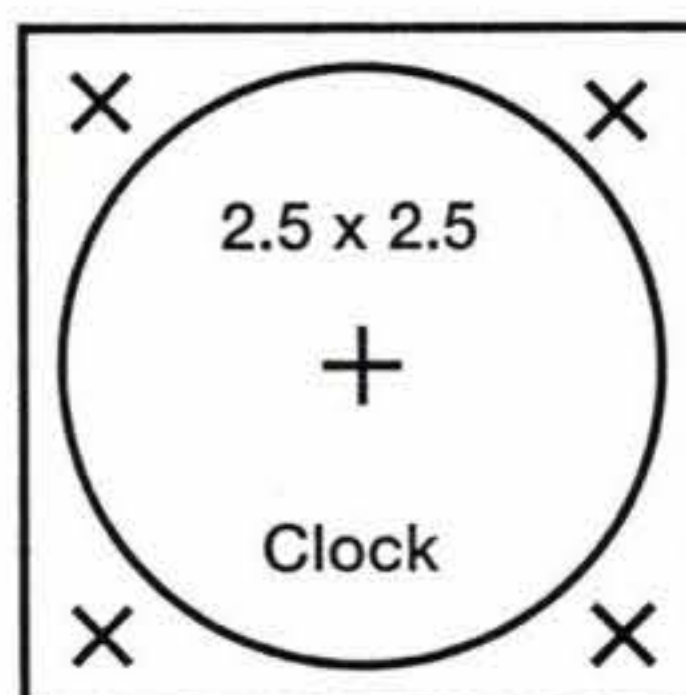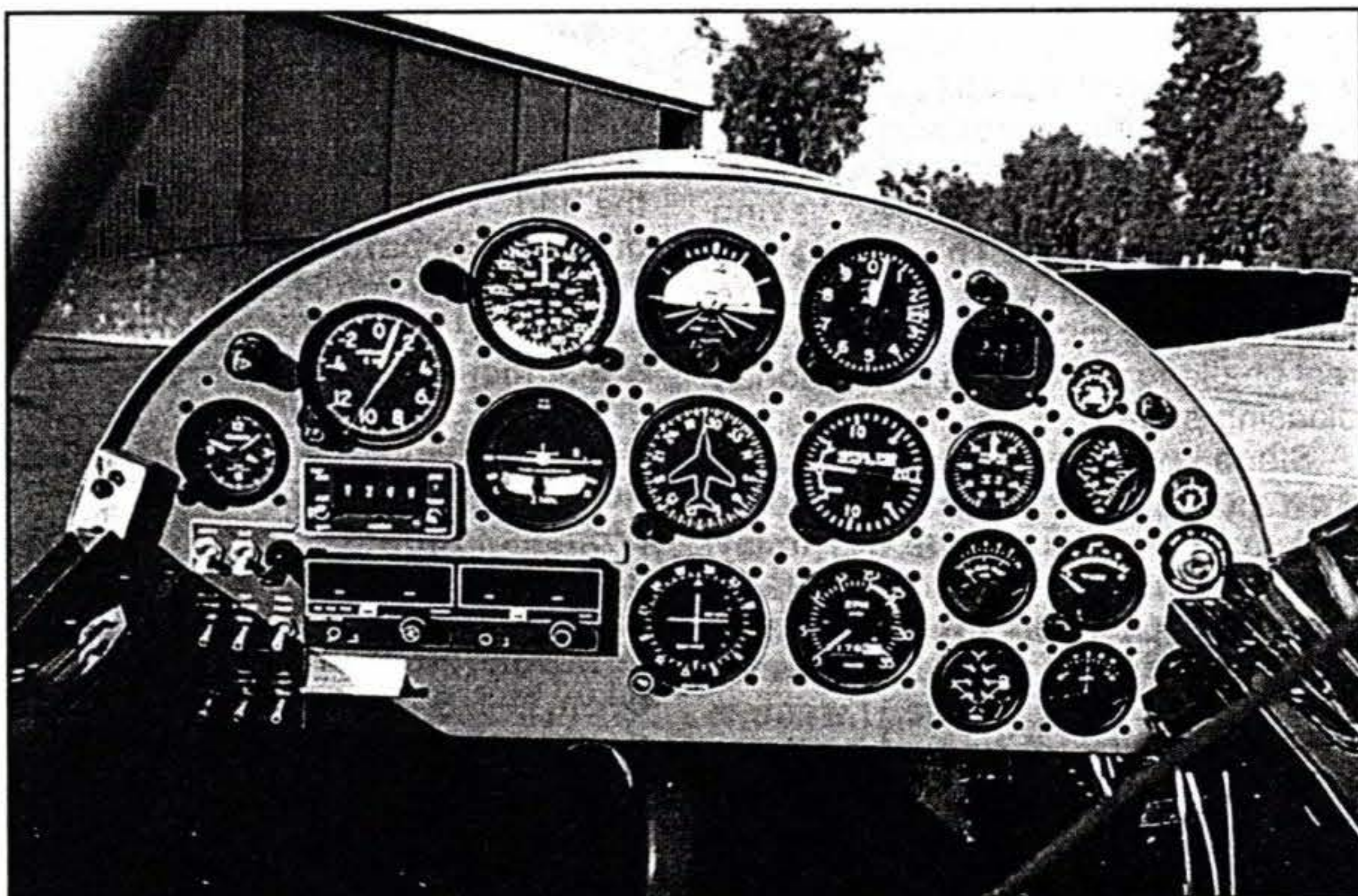When time comes to print out your panel, beg, borrow or steal a LaserWriter. You probably know

Figure 4. Templates, ready to go.

somebody who can let you use theirs at work after hours. You can print out full-sized layouts on multiple 8-1/2" x 11" sheets, or print at reduced size to see the whole panel on one sheet.

There are a few tricks to printing out full sized sheets, however. Laser-Writers, like most electrostatic printing technologies, have minor errors in the final drawing size, but this is easy to measure. Make a sample drawing with two lines 10" apart, print it, and measure how far apart the lines really are. The LaserWriter I used was off by 1/3%, and the smallest adjustment I could make was 1%. For my purposes, I could live with the error. Another trick is in aligning the pieces of your layout across page breaks. I found that some added 45 degree lines, drawn to go across the page breaks, made alignment of the sheets much easier when I printed out the full sized layout, or you can break the layout into smaller pieces, each of which fits entirely onto a single sheet, and print those individually.

If you want a copy of my RV-4 panel layout and templates, mail me an initialized Macintosh disk, and enclose a return mailing label and stamps for return postage. I'm not on any electronic bulletin boards, but feel free to post the panel layout.