

## Orac - The Box

VILA: Orac? Orac? Are you in there, Orac?

ORAC: Am I in where? What precisely do you imagine I am? Some sort of tame rodent in a cage?

VILA: That's precisely what I imagine you are. A rat in a box.

- *Blakes 7*, Series 2, Episode 2: "Shadow"

My original box was acrylic, glued with epoxy resin because I didn't know better. Epoxy resin has a yellow tinge (you can get clear stuff now, but not back then) and doesn't stick non-porous surfaces like acrylic very well, so the box is starting to come apart at the seams. This is actually good as it should be easy to dis-assemble it and re-glue it with acrylic 'glue'. I quoted the word *glue* there as this stuff isn't an adhesive per-se: it dissolves the acrylic and then reforms it as it dries, creating a chemical weld almost as strong as a single cast piece would be. I got it from [Wollongong Glass](#) over on the road out to Port Kembla. They do a lot of acrylic for signage. Call ahead for the 'acrylic joiner' as they don't carry much in stock. It comes in a squeeze-tube and is somewhat toxic\* when liquid, so use gloves and work in good ventilation.

\* You can get a chemical hazard sheet when you buy it from Wollongong Glass if you ask.

### Acrylic Joiners:



**WELD-ON™ 3** - very runny - almost water-like - best for very clean+tight joins and face-to-face joins. I tend to use this stuff more as a cleaner and finisher than an adhesive, applying it with a cotton-bud or a small paint-brush to smooth scratches or other blemishes.

**WELD-ON™ 16** - gel form, better for small gaps or slightly rough edge-joints. I find this joiner tends to go gummy almost immediately out of the tube, making it hard to get an even spread. Technically, it needs UV light to cure properly, though it sets well enough without.

**WELD-ON™ 40** (not shown) - 2-part paste form, I believe this can be used to fill gaps, though I have never used it myself.

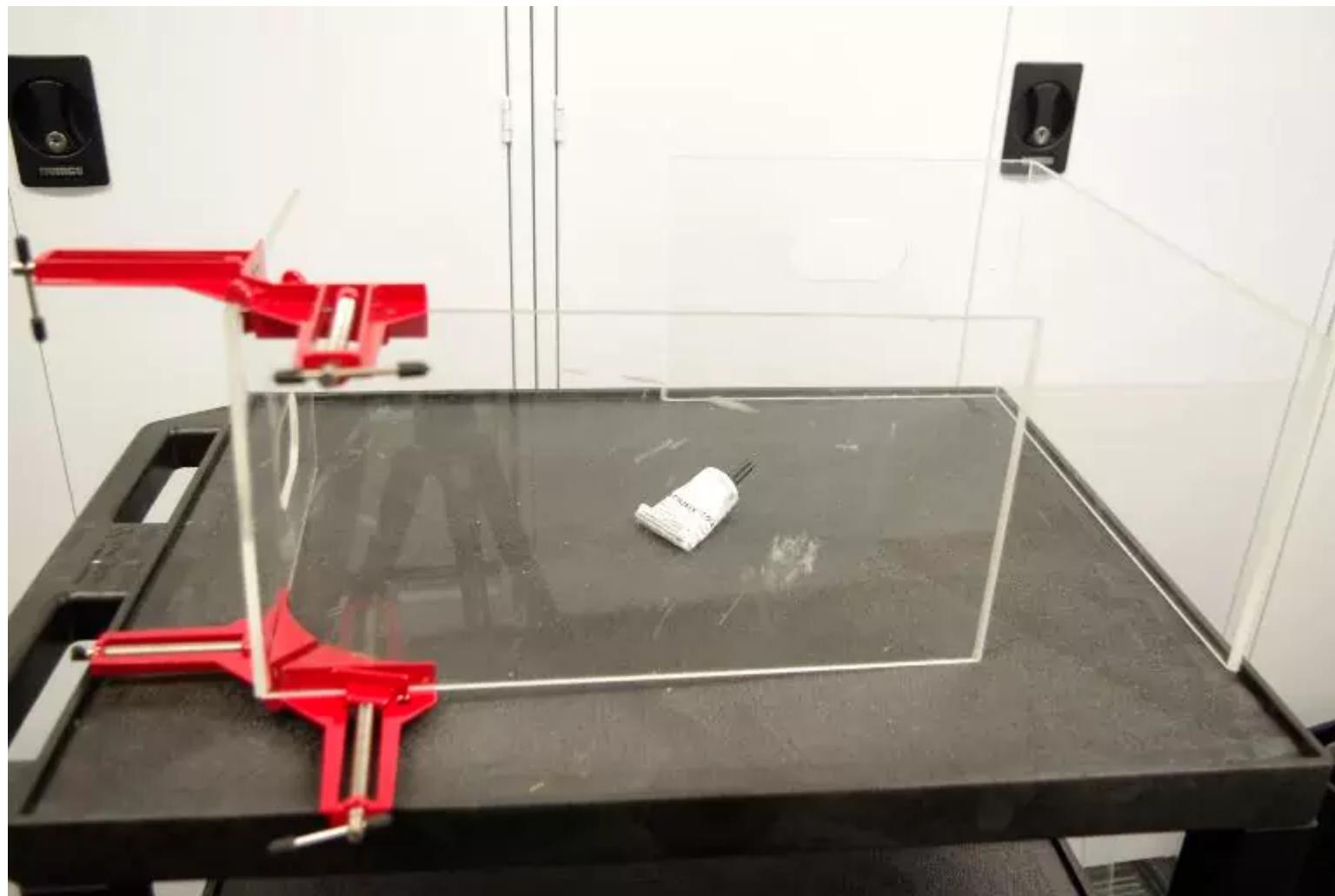
**Acrifix™ 192** - Similar to WELD-ON 16, from local source Wollongong Glass. This is currently my preferred joiner. Again, it technically needs UV light to cure properly, though it sets well enough without. I'm sure the Australian summer sun supplies enough UV if you do need a super-hard join, or several minutes under a UV lamp if you have access to one. We don't have any at the DMC, but I would be surprised if the FCA on Main Campus didn't have some around.

**Acri-bond™ 110** - This stuff is a bit runnier than the Acrifix 192 or WELD-ON 16, which makes it easier to spread. The plastic bottle is very convenient for squeezing out just a little, unlike the aluminium tubes that tend to suffer from gushes. I am still experimenting with this one but it looks like a goodie.

**Acri-bond™ UV3232** - Very similar to the 110 above but fixes stronger under ambient light as well as UV (hence the black bottle). Yet to test results... stay tuned.

You can order a range of acrylic joiners from [Acrylitech](#). They ship via courier next business day if you get the order in by mid-morning. They generously sent me some of the above joiners free so I could try them and put some info of those up here too. You will need to pay them via bank-transfer as they are a trade supplier, so don't have e-commerce set up for credit-card. I was able to do this from my building society's e-banking site with no trouble: I requested an order, Acrylitech sent me an invoice including their account details, I instructed my financial institution's computer to transfer the money and sent back transfer details copied from the screen to Acrylitech, they shipped the goods.

The old box came apart at the glued seams with moderate pressure. Having peeled off all the epoxy resin and given the edges a light filing (and the perspex sheets a warm soapy wash in general), I used right-angle (picture frame) clamps to put them back together with Acrylic Joiner gel. When using the gel-based joiners, don't put it on like PVA glue: a very thin even coat (more like you are applying gloss paint) will work better - especially if the faces of the join are a very good fit. The acrylic doesn't absorb the joiner, so excess will squish out the sides of the join in a gluggy mess that will need to be cleaned off. The joiner does, however, shrink and draw in as it sets, so a thin even bit of over-fill along join edges will get sucked back in nicely. Being a Friday, I was able to leave the box to set fully over the weekend. At the very least you need to leave it overnight before expecting the joins to take any pressure.



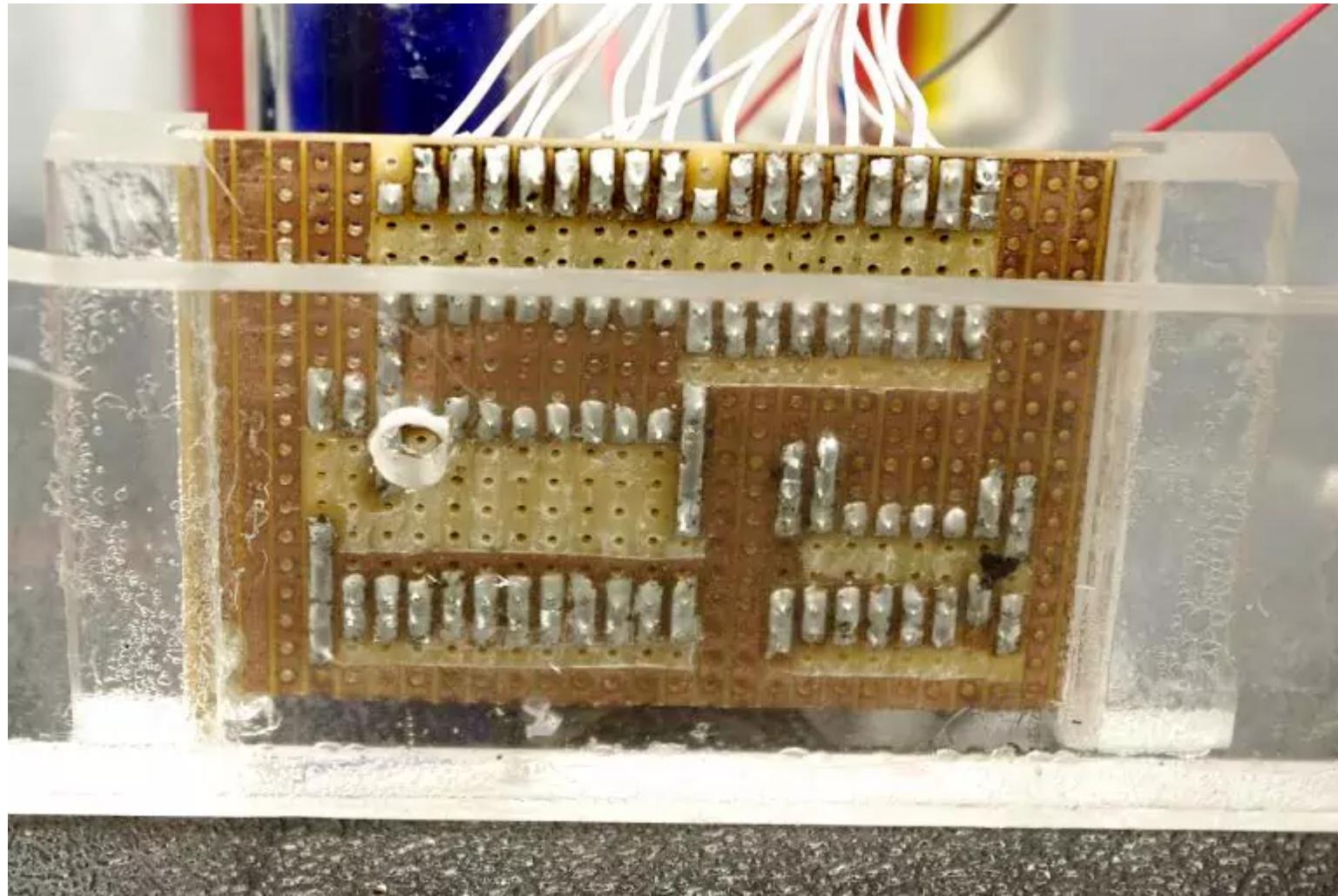
Having the sides of the box together, I measured up and marked on the outside with a white board pen where I wanted the support arms of the light ball to go. I did this before putting the top and bottom on the box for ease of access, as well as to allow the box to be deformed slightly during fixing of the ball: with the box on its side, I prised the long sides of the box slightly apart so there was a 5mm gap allowing me to squeeze some acrylic joiner between the arm-end and the box inside surface. I put the ball in before applying the joiner in order to not get joiner smeared all over the place while sliding the ball into position. I then let the box return to shape which was just tight enough to hold the ball-arms without bowing outwards. I put a roll of speaker wire from the store room on top to make sure there was enough pressure to hold everything firm. After half a day to semi-set, I carefully turned over the box, bowed it out and put in the acrylic joiner for the other arm, then let the box return to shape snugly against the arm-end again, roll of wire on top. I left it to fix overnight.

With the ball in place, the next morning I set the box on its top, put acrylic joiner around the bottom edge of sides and put on the bottom panel, weighting it with some rolls of speaker-wire to ensure a tight join. After lunch I did the same to fix the top panel. Again over-night to fully set (much of

the rest of this project will be 5-minute bursts of activity then leaving things to set for hours - that is fine: I have plenty of other work-related things I must do anyway). The bottom plate also has some small transparent self-adhesive 'rubber' feet from back when I made the original. Being transparent, they match very well.

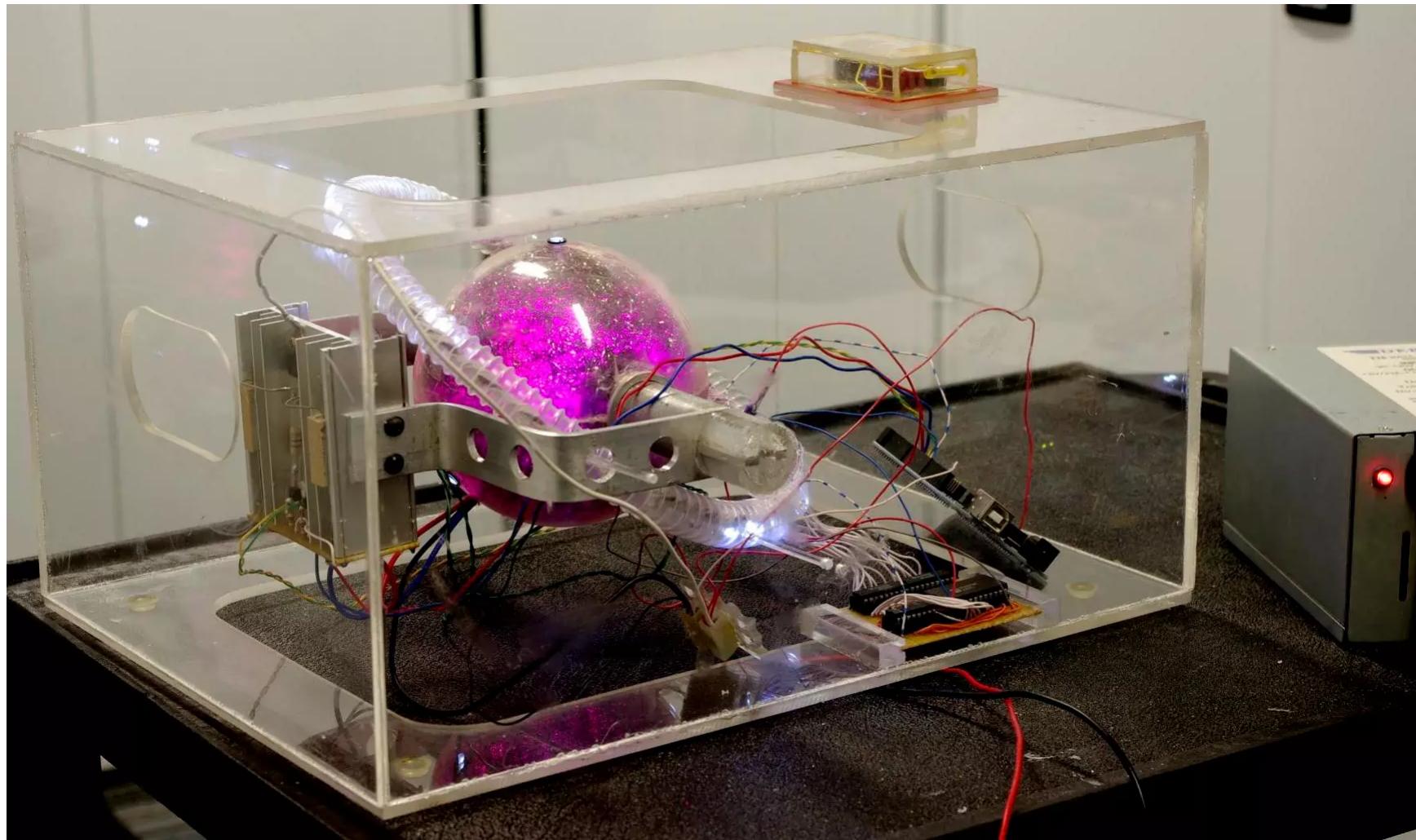
After threading the ring around the ball (on a jaunty angle!), I hooked it up and soldered the remaining 8 wires. I used some thin acrylic rod (light-guides salvaged from rackmount hard-drive enclosures, though a few twizzle-sticks would have been much the same) slotted and chemically joined into 3mm holes in the sides of the box. These were skewered into soldering-iron melted holes in the ring, supporting it in place. I used some slotted strips of acrylic to mount the ring-driver circuit to one side of the bottom of the box.

I fixed the ring-driver circuit board to the bottom-front of the box with two notched strips of acrylic:



You can see a hole in the box-base in the image above - after I had irretrievably mounted the board, I noticed two of the Ring's LEDs were not lighting. I traced the fault back to an unsoldered pin on the chip-carrier. I had to drill the hole to get the soldering iron in to fix the problem. I could re-fill the hole, but since it is on the base, it really doesn't matter.

At this point I wanted another test run. I merged the two previous code snippets into a single program, fed it into the Arduino and wired it all up. At this stage, I added some extra wires to my 5V distribution point into the Arduino 5V and GND pins, so I didn't need to power it by the USB cable any more. Then I powered up my bench-PSU:



Above, you can see the Arduino floating free (for now) inside the box to the right, just above the mounted ring-driver circuit.

All worked perfectly!

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