Case Hack for BMOW Floppy Emu – The Floppy Emu][

How did it all come about? Back in the early 80's we had a second-hand apple][computer which dad had brought home. We used to mainly play games on it but that slowly turned to simple programming and typing programs in from computer magazines and trying to write our own games before it fell into abandonment shortly thereafter. 30 plus years since I last saw it, we found it stored under the house and it was not in pretty shape.



That began the restoration and I got totally hooked on its friendliness to being worked on. There was no floppy drive except for the empty drive case in two halves. The great thing was that now there was the internet and a huge amount of people on line who love to help. Without all these helpful people and resources (I'm looking at you applefritter), the apple][would still be an oversized paper weight. I ended up buying a disk][but it had issues. Replaced the usual trouble maker chips which got it sporadically reading, but the spindle bearing had too much play in it, so I needed to repair that. I had read about the Floppy Emu some time ago and it was amazing. It was very clever in what it could do and had the nokia screen. Shortly thereafter Steve from BMOW brought out the new version with the OLED screen and it just popped with style and I knew I was eventually going to get one of these things. Eventually I purchased it and it was just great. All of a sudden, I had access to all these games from online repositories that didn't exist when I was young.

I liked the compact Floppy Emu in its cool little case but it looked too modern to me.



The apple][had come up so nicely, I was looking for something more retro style wise to match the computer.

The 1.3" OLED screen on the Floppy Emu looked the same size as the door lever on the drive][case I had. Started thinking I could put the OLED screen in there and run some buttons into the face. Another fellow had done this very idea and I thought it looked pretty cool. I planned to also have an SD card extension cable to access the SD card on the Floppy Emu that would be buried deep within the case.

The more I sketched my ideas the more it seemed the 1.3" OLED was disproportionate to the size of the intended disk][case shell. I was also beginning to have doubts about permanently destroying the disk][face plate for this mod. That was it. I decided I would make a completely new face panel that could be bolted via the existing fittings holes and screws without altering the original case in any way. I took the old disk face around town trying to find anyone who could replicate that style of aluminium label and no one I saw could do it.

A bit of a side note. While all this planning was going on, I stumbled on an apple 2 for sale in my city that had 2 disk][drives in great condition with it. You guys outside Australia and particularly in the states don't know how lucky you are with the second-hand market for apple][gear. Floppy Emu is great but it won't read old disks. Was so happy to get some of this old data of mine across onto the SD card in the Floppy Emu.

I started tinkering around with Front Panel Designer, a free software package from Front Panel Express. Obviously that software is provided free of charge so as to drum up business and.... it totally worked on me hahaha. I decided they were my guys for this project. But first I had to come up with a design concept layout for the front panel.

I've always had a bit of a thing for understated hifi equipment from a style point of view and started looking at brands like Cambridge Audio, Creek Audio etc for styling guidance. I was also going to have to teach myself some SVG editing skills for the artwork. Started perusing the app store for the Mac and a little affordable program called Boxy SVG caught my eye. This thing was such a pleasure to use and did everything I wanted. I enjoyed this part of the process the most. As well as being simple and stylish, I also wanted the panel to look like it belonged with the normal disk][drives. So that pretty much dictated certain elements of the design. The logo was going to be in the bottom right and in exact same location. There was no requirement for a large slot for 5.25" disks but it needed something, so the horizontal graphic line element was added to replicate the disk slot. There was still a disk, but it was much smaller now in the form of a microSD card. That was placed in the centre and below the line and it felt like the natural location for it and is kind of where the disk door used to be. Next was the business side of things, the actual Floppy Emu display and the buttons. The Floppy Emu display was going to be upsized to the 2.42" version of the OLED which I knew was going to be ok as Steve had already shown it as working on the Big Mess Of Wires website. Going back to looking at HiFi components I chose symbols for each of the 4 buttons instead of the words on the Floppy Emu circuit board and I wanted something a little different to that shown on the Perspex Floppy Emu case. When it came to arranging these, I wanted to be able to clearly see the screen unobstructed while using the buttons. I'm right handed and I knew I wanted the drives to be on right side of computer so having screen on left and buttons on right was the way to go. I wondered if this is what Steve was thinking when he designed the Floppy Emu. The Floppy Emu has 2 indicator LEDs instead of 1, so that was a straight up duplication. The main font on the front was Motter Tektura, but anyone looking into this for apple][uses soon sees there are variations on the standard font. Thankfully Chris Torrence has provided a modified version online along with a video about font editing. Thanks Chris. So with all this in mind, this is what came out of it.



Started working in front panel designer and I had the co-ordinates for everything from BoxySVG so that made it easy to get everything to line up between the mechanical panel and the graphic image. Got datasheets for the 2.42" OLED and crosschecked with callipers against the module I had actually purchased. The module takes M2.5 sized fasteners so I decided to use that size for most of the welded studs on the back of the panel. It's a pretty light duty item so I chose the thinnest aluminium panel available from FPE which was 1.5mm. I also wanted the screen to be behind a sheet of Perspex so as to hide surrounds and other little features of the OLED modules. To hold this in place it, the cut-out for the screen needed to be edge milled at the back of the panel to accommodate the Perspex. This was all well and good but it had the effect of setting the Perspex back from the front face where as I wanted it to be perfectly flush. Looking at the milling in FPD I saw some bevelled options available. This gave me an idea to mill the panel and the Perspex sat relative to the panel. This ended up working a treat. On the final panel this ended up being perfectly flush with the front face of the panel.



The LEDs were going to have the same style bezels as the disk]['s. I chose a hole diameter to match the plastic bezels. At least I thought I had haha. This ended up being one of the happy little stuff ups along the way that ended up working in my favour. The holes were too big and the bezels with the LEDs flopped around in the opening. The bezel still covered the hole fine but the mechanical fit between the panel and the bezel was too loose. So I designed up

a little adapter ring to pack out the shortfall. The bonus to this is that there are all sorts of different bezel sizes with their little changes. By using the adapter I could fine tune the fit for all sorts of different sizes. So there was a win.

Moving onto the buttons I found some cheap little buttons on eBay which had matching tops to the style I was after. Ordered those and started knocking up a PCB in Kicad to hold them. The pcb could then be easily bolted to the panel via more welded studs. Again layout was carefully matched to the coordinates from the SVG graphic.



The design was sent to OSHPark for manufacture. I love using these guys for any small prototype runs.



That left the final task of the SD card opening and the Floppy Emu board itself. I kept going round and round in circles on this one. Do I mount the board to the baseplate of the drive and run one of those SD card extender cables to the front panel? Is that cable an unnecessary expense and a possible point of failure? How do I fix the panel to the case and incorporate the Floppy Emu pcb? Long story short I decided to mount the Floppy Emu directly behind the panel via a cradle. I was also worried if the Floppy Emu design changed in the future and I wanted a new improved board in there would it no longer fit. So I placed the two cradle mounts out wide with the view if there was a new pcb in the future I could accommodate it up to a certain point with an updated 3d printed cradle if necessary. The SD card to grab onto to remove when needed. I decided it wasn't ideal but it was workable. More on this later.

The final thing was to provide some studs for mounting to 3d printed brackets which would hold the whole panel and insides in place. I was ready to get a quote for manufacture. I sent the file to Front Panel express for them to quote. As part of their checks they pointed out that the welded studs I had chosen required the panel to be 2mm thick instead of 1.5mm. This was fine but had implications to the Perspex window and more crucially the SD card protrusion from the panel. This ended up being another unexpected bonus, as I decided to mill out the back of the cradle location by 1mm which was enough for the Floppy Emu pcb to move forward 0.5mm after losing 0.5mm by the thicker panel. I also included that mill out area in the 3d printed cradle to help key it into place as the SD card socket and the SD card panel opening required pretty close tolerances.



After those tweaks, the order was placed.

While that was on order I moved onto finalising the 3d printed parts which were done in Bricscad. The sides needed to mount to the disk][baseplate via the existing holes and also needed to accommodate the raised bosses in the base. There is also a step down at the front which needed to be dealt with but not a major problem. In the interests of saving print time and amount of filament used, triangular voids with rounded corners were added to the sides. I printed that version off and it seemed a bit too flimsy with its ability to twist so I added 2 small buttresses to each side and printed again. This seemed strong enough for what was required. The steel disk][shell is doing all the heavy lifting.



The Floppy Emu cradle needed to be a little more robust. It was subject to cable strain from the rear and SD card insertion and removal forces from the front.



The rest of the parts were pretty minor and straightforward. The beauty of 3d printing is you have great flexibility for any little problems that pop up. Respin a new version and print and it's all good (hopefully).





I received the panel back from Front Panel Express. I was extremely happy with how it had come out. One problem was I had used too thin a line work on some of the text and it was hard to read. This has since been thickened up for subsequent versions. The other minor problem was the text and linework was supposed to be bare aluminium like the disk]['s. I'm pretty sure this was a mistake in my settings while transferring the graphic to FPD which was done via pdf. I'm putting this down to another happy accident as I really like the white.



Then it was all down to assembly. Everything fitted together well and all I had to do was lightly widen some holes to allow the studs to pass through freely. I used shake proof washers on all connections so nothing slowly works itself loose during use. For the LED's I used solid core wiring and soldered onto the Floppy Emu board being careful of polarity. I'm

changing this to pluggable connectors with polarised plugs. I desoldered the SMD LED's on the Floppy Emu board prior to doing this but I think this may have been unnecessary and possibly a mistake. It's not wrong and they work fine, but it may have been ultimately better to leave them in. I need to investigate that.

For the switches I just used Dupont header cables and soldered one end directly to the corresponding tactile button locations on the Floppy Emu. The OLED screen was just plug and play. Unplug the old and plug in the new via a cable again taking care to watch cable plug orientation. This kind of stuff is always done at your own risk. I didn't want to damage the Floppy Emu and have to buy another one just yet.



It worked first shot. Happy times ;)



The only downside was that the pixels were shifted one pixel to the side due to different chipsets in the 1.3" vs 2.42" OLEDs. This had been noted by Steve during his trialling of the display. I sent an email to him out of courtesy before I posted about the hack online. I wasn't sure how he would feel about someone tinkering with his baby. I am very happy to say he has been nothing but supportive of this little project and has offered advice and even sent a hotfix for the Floppy Emu which dealt with the pixel shift. He had done that in less than 24 hours. I can't thank him enough for the original product and the support. One of the best purchases I have ever made. Thanks very much Steve.



And there it is, the project is done, it works great, is completely reversible and with no physical damage impinged on rare apple parts. Investigations are currently underway for making kits available for others. Stay tuned for further details on that. Thanks again to everyone who has answered my dumb questions in the various forums.

Cheers Dave