

Mod Mania: Two Fabulous Case Mods

January 26, 2006

By [Joel Durham Jr.](#)

When deciding on a mod upon which to embark, it's fun to look at what others have done before. In this special, expanded column, we're going to look at a couple of inventive and spectacular mods that readers of this very column have accomplished in their spare time—if you consider hours upon hours of planning, labor, hard work, sweat, and missing meals "spare time."

One fine reader took a look at an old computer—make that an ancient relic of a computer—and decided to turn it into a modern game machine. That took a bit of engineering, considering that the original platform wasn't even a PC-style computer to begin with. Another reader decided to build his own case, and not out of parts from the store. It turned out to be a work of modern art and a functional PC at the same time.

I want to thank Allen Haid and Blake Betz for sharing their fantastic projects and for supplying a bevy of images and fantastically detailed answers to my prying interview questions. Hopefully, their genius will kinder ideas of your own. *Continued...*

When Blake Betz decided to upgrade his computer, he realized he could build another one. And by *build* I mean construct a case with his bare hands. Take a look at his copper computer, which he's thinking of naming Coppertop.

Mod Mania: *This is an amazing project. What in Heaven's name inspired you to build a case out of what appears to be brass water piping?*

Blake Betz: This project actually got started back when I upgraded my normal rig and started accumulating more extra parts around. I had an extra motherboard, some RAM, processor, hard drives, and a CD burner taking up more space than necessary. After a bit, I finally decided I'd just put together a second PC for the hell of it; if anything it'd be another computer to fold on. I picked up a few more components to set up a HTPC since I already had a Hauppauge PVR 250 (despite already having a DVR). All that was needed was a video card with TV-out, which after some searching led me to the Matrox G400 due to its great TV-out quality.

For the case, I decided I wanted to have something that was original but still looked good, whether through modding or building from scratch. I originally thought of building the case out of PVC since it'd be very easy to work with (connectors only need PVC glue to fasten and the pipes could be easily and quickly cut with only a handsaw, also much easier to drill into). I used to work at installing irrigation systems for houses and businesses during the summers while in college and we used a lot of PVC tubing.

During one job, I built a large support system that a submersible pump was connected to. It was set up like a sled so that the customer could pull it to the pond to pump water to the sprinkler heads. I kept thinking of other ideas but it kept coming down to the PVC or a suitcase mod. I decided on the PVC since I had already seen a few of the suitcase mods, but then while at Home Depot I saw the copper plumbing pipes and thought, *that's what I need to build my case out of*. The structure would be the same as that of my PVC idea, but copper would ground my motherboard whereas PVC case would not. Also, you can't

Mod Mania: Two Fabulous Case Mods

January 26, 2006

beat that copper shine. Finally, building the case out of copper would be me that one last excuse for finally getting my cordless Dremel, and a butane blowtorch (which also does a very good job at lighting charcoal for cooking out). *Continued...*

MM: *What are the specs of the computer?*

BB:

- A Palomino 1700+ with L1 bridge mod running at 150 FSB x 12 = 1.8 GHz at 1.85V (with a stock 2500+ heat sink I found in a dead computer in the garbage)
- Underclocked 512MB PC3200 Kingston ValueRam (it was cheaper at the time than PC2700)
- 120GB Maxtor DiamondMax 9 7200 RPM
- Matrox G400 32MB Dual Head graphics card (which offers a great picture on my Advent 27" TV with S-video)
- Hauppauge PVR 250, Turtle Beach Riviera 6 sound card (optical out to my Harman Kardon AVR 65, which I bought broken from eBay and repaired at authorized repair shop for much, much less than new)
- D-Link 520+ wireless card
- SYBA PCI USB controller
- TTGI 350W Modular PSU. *Continued...*

MM: *What tools did you use to build this case?*

BB: A cordless Dremel, three 10 ft. ½-inch copper pipes, 32 T connectors, eight elbow connectors, a butane torch, drill, tape measure, and a black Sharpie.

MM: *How did you determine the exact measurements needed?*

BB: I used a tape measure. It sounds stupid but that's what I did. I know I could have looked online to find the width of standard drive bays but I had a CD drive right in front of me along with my tape measure. The same with the motherboard mounting holes: I measured the distances between them to determine how far apart to place the vertical pipes to mount the board on.

If I were to build this case again I would try using a large sheet of copper with decent thickness to mount to the pipes then just drill mounting holes where needed. This would alleviate having to space the mounting bars the exact distance apart and trying to mount the motherboard standoffs on the copper cylinders. Overall it would be easier to do and also add to the looks I think by adding more copper shine in the back where right now all you can see is the back of the motherboard.

Last, I mounted the bars to support the PSU. I measured the vertical distance between the two levels of holes. I drilled another mounting hole in the upper right corner of the PSU so that the two rows of holes were even and not staggered as they are on most power supplies. I eyeballed the distance between the drive cage and motherboard from my

Mod Mania: Two Fabulous Case Mods

January 26, 2006

acrylic computer. I decided to make the width a little wider than that of my acrylic computer to protect the components inside a bit.

Luckily, I was able to get away without needing any mounting structure for the PCI or AGP cards. My AGP slot has a plastic lock on it that keeps the card in place very well, and I have a PCI USB hub that is not very tall that holds the other cards up well. The wireless card helps as well since it's light. I made the placement of the horizontal support bars on the corners of the case to keep the bars as close to the ends of the case as possible. I couldn't find any 3-way 90 degree elbow connectors in 1/2-inch copper so I came up with the style shown in the pictures. This way, however, did give the advantage of acting as case handles whenever I have to move the computer. I try not to move it often as it has an exorbitant amount of connections to it. *Continued...*

MM: *What were some of the concerns getting the parts to fit? Did you have to cut the piping to length yourself?*

BB: The concerns are pretty much as stated above: to get the mounting bars in the exact place needed and mount the standoffs on a cylinder by trying to drill straight into them and not slipping with the bit. To help keep this from happening, I cut a small notch with the cutting attachment of the Dremel where I needed to drill a mounting hole. In hindsight, using some mounting plates might have been easier, and I might not have had to void a warranty on the PSU a new hole into it. (If you do the same, make sure to test the PSU to make sure it's not dead on arrival, and do not drill in with too much pressure so that you don't fly deep into it the PSU casing once the drill bit gets through the metal).

For the drive cage, I spaced the vertical bars so that the CD drive fit precisely. For the hard drive, I used standoffs that came with my acrylic computer for 3.5-inch drives in the 5.25-inch drive bay. I connected the drives using hangers for plumbing pipes; I cut off the section that screws on the 1/2-inch pipes; I used the section that you screw into wood beams to mount the drives. This way I could add more drives or remove them without having to leave all the mounting hardware on the case. Also, it helped because I had to make fewer cuts with the Dremel.

I made all the cuts by hand with my cordless Dremel. If I'd had a pipe cutter, the project would have been quicker and easier. Either way, I made certain all the pipes of corresponding lengths were equal in length. I did this by first cutting one section and grinding the ends with the grinding attachment of my Dremel. Then I placed the end connectors of the pipe on in place and measured the connector to connector distance with my tape measure. After I grinded the first section so that it was the exact length needed, I cut all the other pipes about 2-3 mm longer than needed then grinded them down. I would place the ends on the pipe then hold it up so that the connectors on either end of the first 'master' pipe would touch those of the new pipe. If the new pipe was still long, I'd do more grinding until the pipes were the same length.

By creating the case this way, the pipes would only have to be fitted once, and then pushed together as hard as possible before using the blowtorch to solder them into place.

Mod Mania: Two Fabulous Case Mods

January 26, 2006

The solder was also built into the connectors in a ring around each opening. This helped immensely when I finally connected all the pieces. While putting the computer together, I made sure to use steel wool to shine up every connector and pipe. The blowtorch gave the copper a rainbow effect, which I kept this for a while since it added a lot in the conservation aspect of the case, but for show I think the shined up copper is best.
Continued...

MM: *Are the expansion cards secured in any other way than simply being seated in their slots?*

BB: The USB and sound card are the bottom two PCI cards and are also the smallest so that they help support the Hauppauge and D-Link card. After installing all the cards, it was evident that no extra supports were needed to further secure the cards. If I take the computer somewhere in the car I make sure to lay the case down so that the side with the back of the motherboard is facing down and the cards are straight up. I got lucky by not having to worry about a potential issue.

MM: *Obviously, with an open case cooling isn't an issue. But what about making sure the components stay safe from kids, cats, prying fingers, etc?*

BB: The dimensions of this case, at 21 x 23 x 10.5-inches (H x L x W), make it a little bigger than my other mid tower. Since I was able to keep the components in the center of the case and leave a bit of room between them and 'outside' the case that offers a little bit of protection. Luckily, our dog couldn't care less about electronics or cords (although she has chewed on a cell phone before). Besides that, the only other protection I use is good common sense; I just keep it where it won't be in the way, since the mouse and keyboard are wireless, plus the S-Video cable to the TV is 12-ft. long.

MM: *What external peripherals do you use with this wonder? (Keyboard, mouse, monitor)*

BB: Everything listed above in the specs, including a 27" Advent TV for the monitor (through S-Video), and a Belkin wireless optical mouse/keyboard combo. (I sit on the couch to use the computer).

Also, I made a power switch since I got tired of jumping the pins on the motherboard with a screw driver to every time I wanted to start the computer. The switch is a push button inside a 3x3x3-inch wooden box I made out of some scrap plywood. I kept the box pretty bare to go along with the case. The cord to the box is about eight feet long so I can snake it under a rug and use it on the couch. *Continued...*

MM: *How long have you been modding?*

BB: Since I got rid of my first Compaq in 2001 when I discovered the motherboard didn't have an AGP slot to upgrade the video. I sold the computer to my parents cheap since they didn't run any hardcore apps, and pieced together a new rig to which I put on some

Mod Mania: Two Fabulous Case Mods

January 26, 2006

window panels. That lasted for a few years then I bought the parts for my acrylic case and decked it out in more LED fans, UV lights, and glowing cables than you could possibly sleep with at night. This project is my first project in which I built a case from scratch, though.

MM: *Why do you mod in the first place?*

BB: Because mine is bigger...at least that's the mentality. Sometimes people do mods to increase performance, and sometimes they do it just for aesthetics. It just feels nice looking at the finished product after a project and being able to see your work. Also, it lets someone with as little artistic talent as I have make something that actually evokes a strong reaction from people. Most people either love the look of the copper computer right away or they immediately think it's ugly and bare. I figure as long as they're not indifferent to it, then that's fine by me.

MM: *What else would you like readers to know about your amazing case, and/or about you, and/or modding in general?*

BB: I had the idea for this mod for a few months but never acted on it. Finally, when my girlfriend had to be away for a week for work, I decided to work on this project during my free time in the evenings. Using my cordless Dremel, I usually only had about 2 - 2.5 hours of run time for cutting and grinding the copper pipes before it would lose a charge. If I started right away when I got home then maybe I'd have enough time to charge the battery to work for another 30 minutes before it got too late to see that well outside (we were in an apartment in Washington, DC so all the cutting and grinding was done outside on our porch). The project took about a week and a half to complete, usually with about 2 - 2.5 hours of work done each night; on the weekends I was able to do quite a bit more. All of my plans were rough sketches with approximate lengths figured in after I measured drives, mounting holes, and my other computer case. In the end, less than 12-inches of the original 30 feet of pipe was left.

Some other mods to the copper case I've thought about are adding more horizontal bars on the sides of the case to give the illusion of the case having more substance. Also, I've seen websites with diamond mesh screens available that would look good as side panels, should I make another copper case. (I've been looking to upgrade finally to a 939 system, either single- or dual-core Opteron; when I do this, I'll set in motion plans for another copper case with the mesh sides, a copper mounting plate, expansion slot support, a white cold cathode light and 120mm fan mounts).

As for myself, I am a recent graduate of The Ohio State University with my bachelor's degree in Electrical and Computer Engineering. Most of my friends figure that computer modding and engineering go hand in hand, but in all honesty building a computer is like putting together Lego blocks (certain pieces go in certain spots). Furthermore, dropping a few lights and LED fans in a computer isn't hard to do at all. I've seen a few cases where just putting in a UV light, some cable sleeving, and EL wire to follow the outlines of a side window looks really tasteful. I just appreciate the ones where more skill is required

Mod Mania: Two Fabulous Case Mods

January 26, 2006

than screwing in the screws for a new multi-color fan, putting in some Velcro strips to mount a cathode light; the mods where cutting, painting, drilling new holes, etc. are required tend to let the creator mod 'outside the box'. *Continued...*

Allen Haid (or BigAl, as he's known on many forums including ExtremeTech's own), of [BigAl's Computers](#) has been computing since before the IBM PC took over the market. This is evidenced by the fact that he owns a relatively obscure 4MHz Osborne Executive. He decided to make that old computer new again, by any means necessary.

Mod Mania: *Would you describe the original Osborne Exec computer and its capabilities?*

Allen Haid: The original Osborne Executive computer was a follow-on design from Adam Osborne, and it was intended to address some of the "improvements" requested by the users of the original Osborne 1 machine. We are talking about the early 1980's, a time before laptops as we know them today. The Executive model caught my eye in mid-1983, as I needed my own computer to support my electrical engineering studies at California State University Northridge (CSUN). This machine operated on the CP/M OS, had two 5.25-inch floppy drives, and a built-in monitor that was slightly larger than the Osborne 1 model. The Executive ran on a Z80a CPU (4 MHz) and came with tons of software, such as Calc, WordStar, and MSBasic, all of which helped me complete homework assignments. The machine was advanced for its time.

MM: *What in Heaven's name inspired you to modernize that old fossil?*

AH: I used this machine to run my masters project (a learning device for developing children), toting it back and forth to demonstrate interim updates to my professors, so you can see I depended on the machine quite a bit. I actually damaged the CRT when carrying it up a staircase in the engineering building, as I hit one of the steps and must have broke something in the tube. I had to buy an external monitor to get back in business, and I tried to figure out what I broke several times. I took it apart, poked around a bit, but nothing seemed damaged. I was too cheap to take it in for service, but figured that some day I would fix the machine and make everything right again.

Last summer (2005), I noticed somebody trying to mod an old Kaypro computer, which is similar in concept to the Osborne series. The guy doing that mod ended up losing interest in the project, and either sold it or gave it to a friend. I figured that my Osborne had waited long enough. I decided that the Holiday period of 2005 was going to be the time for me to rebuild the Osborne Executive into a gaming machine that would look like an Osborne yet perform orders of magnitude above the original design. *Continued...*

MM: *Can you supply its current specs?*

AH: I had to go with a micro-ATX motherboard due to the limited space within the Osborne's case, and since I only build AMD-based machines, I also decided to make the jump and try an Athlon 64 X2 CPU. Here's a list of the major components:

Mod Mania: Two Fabulous Case Mods

January 26, 2006

Processor	AMD Athlon 64 X2 3800+ (socket 939) (Check Prices)
CPU Cooler	Zalman CNPS9500 LED (Check Prices)
Optical	Plextor PX-740A-BP-BL IDE DVD (Check Prices)
Display	Sony G520 21-inch CRT
Motherboard	ASUS A8N-VM-CSM micro-ATX (Check Prices)
Memory	Corsair 2 X 1 GB XMS 3200 c2 (2 GB total memory) (Check Prices)
Graphics	BFG Geforce 7800 GT (Check Prices)
GPU Cooler	Arctic Cooling 5 NV Silencer (for 7800 GT) (Check Prices)
HDD	Hitachi Deckstar T7K250 250GB drive with NCQ and 3.0GB/s interface (Check Prices)
Keyboard	Cooler Master Aluminum (Check Prices)
Mouse	Kensington Expert Mouse (Check Prices)

MM: *With such high-end specs, cooling must have been an issue. How do you cool that monster?*

AH: Actually, cooling wasn't an issue with my design. If there is one thing I have learned from modding computers over the past five years (check my site for pictures), it's how to get sufficient air moving through the case. I carefully considered airflow options as I pulled the guts out of the Osborne, and when I started cutting things with my Dremel tool, I made sure I didn't get carried away. That hole left by the old CRT, combined with an open back, provides most of the air access I need. The Osborne had some built-in air passages, a few of which I enlarged and added some fine screen (from window screens you use on a house) for effect. The Zalman CPU cooler has a very easy time moving the air through the case, and combined with the Arctic Cooling GPU cooler and PSU fan, I didn't need any extra case fans. I did add a small 50mm fan to the keyboard tray to cool the SATA hard drive that I placed in there, but that's separate from the main case. Overall, OsbornAgain is nice and quiet for such a powerful machine. *Continued...*

MM: *What tools did you use to chop up the old case?*

AH: My tool of choice was the Dremel tool, and I used several cutting discs, grinding stones, and things of this nature (I love quoting Arnold Schwarzenegger). Sometimes I used metal shears, and these are great for metal brackets, case side panels, etc. There were the usual tools too—soldering iron, wire cutters, and screwdrivers.

MM: *What were some of the concerns getting parts to fit? Those old all-in-1 boxes didn't have great, big, graphics cards that demanded coolers and other such modular components.*

AH: Getting the parts to fit was my biggest concern of the entire project, next to explaining to my wife how much money I was spending on components. I must have spent two weeks trying out different ideas, including trying to shoehorn in a full size ATX motherboard. I wanted to retain most of the original look and feel of the Osborne Executive, so that meant keeping the optical drive placement where it was. I considered using an outboard power supply (like I did for my Sun X-Terminal mod early in 2005), but I settled on having the PSU on its side, right next to the Zalman cooler (I'm talking about 0.5 inches separating them.). The Arctic Cooling GPU cooler is

Mod Mania: Two Fabulous Case Mods

January 26, 2006

actually the tightest fit, because the fan hub is about 0.25 inches from the case of the optical drive. I securely mounted the graphics card to the case using an old bracket salvaged off some other computer I worked on years ago. Rule number one for case modding—save all parts, throw nothing away, and place the parts where you can find them later.

MM: *Did you etch the windows yourself? How was it done?*

AH: I wanted custom laser-etched windows for OsbornAgain, but I knew I could not do this job myself. I did some research on the web and found that [HyperKore Computers](#) makes custom laser-etched windows, so I ordered two in the same size but with different images. You just submit your images and credit card number, wait about 1-2 weeks, and back come beautiful laser-etched windows. I even did a product review on the windows they supplied me, which you can find at [Velocity Reviews](#). The Big AI's Computers logo laser-etch window was destined for the top of the case, and the AMD logo laser-etch window went into the keyboard tray. *Continued...*

MM: *What did you use for lighting?*

AH: Lighting is my favorite thing to talk about. Sometimes I go overboard and my cases contain all the colors of the rainbow, but this time I was careful to limit myself to green and blue. Green was the color of choice to match the AMD corporate theme; blue goes with green and both colors are available in many forms—LEDs, cold cathode tubes, switches, etc. As you can see with the finished build pictures, I am using a glass desk / storage rack to hold OsbornAgain and the 21-inch Sony G520 CRT monitor. During a previous mod (my 2004 printer-to-computer-deja-vu), I learned how to attach cold cathode tubes to the back edge of the glass top, so that light would be efficiently transmitted within the glass and provide a sweet effect along the opposite (front) edge. Of course I used cold cathodes to light up the custom laser-etched windows from HyperKore. You can use either cold cathodes or LEDs for this purpose, but cold cathodes provide more light and were the right choice in my build.

MM: *An amazing amount of the old Osborn case and its controls survived the mod. How much of what we see is functional, and how'd you make it so?*

AH: I really wanted to use the original Osborne power switch, but not to power on OsbornAgain. That was an old AT-style switch, meaning it wasn't a momentary contact type. I am using it to control all the lighting within the case though. Push it on and it lights up along with all the cold cathode lights. The old keyboard is gone, as I cut it out with a Dremel tool. The keyboard tray now holds my hard drive, two USB ports, one Firewire port, and that small 50mm fan for ventilation. Besides some structural pieces within the cavity (to support the original power switch), there isn't much left over from the controls this machine once had. *Continued...*

MM: *Why do you mod?*

AH: I like to think it's because I'm a creative person. Creative, but not artistic. I can't paint, mold clay, or do any of those other art activities most people do. Maybe I'm doing this out of necessity. Early computer builds required some small modifications here and there—cutting with a hacksaw, drilling a larger hole, etc. I think it grew from that seed. There was one major turning point on my way down this path though. I saw a toaster that had been turned into a computer at some Web site—maybe [CaseModGod](#). I thought that was pretty sweet, and I even printed that picture so I could hang it on my office wall.

Then again, perhaps I'm just a frustrated engineer. I finished school and got right into space technology, doing component engineering, reliability engineering, and then system safety engineering. These were not design positions, so I didn't get that thrill of seeing something I designed fly in space. I think all engineers would love to see something they design succeed in

Mod Mania: Two Fabulous Case Mods

January 26, 2006

the marketplace. For me, I get that thrill with the feedback on my projects that I receive in various forums.

MM: *What else would you like readers to know about OsbornAgain, or about you or modding in general*

AH: Project OsbornAgain was very successful. I didn't ruin any part I was modding, it was stable on the first boot, and it's now the most powerful gaming machine I have. It got to this point because I was careful to double-check tolerances, performance variables, and prices. All these things should be considered before you start buying the components.

In addition, the key to successful modding is helping others. Nobody is an expert at all things, especially in the world of modding. I am terrible when it comes to painting a case—I just don't have the patience to sand between coats. It can take 1-2 weeks to paint a case, but only a second to scratch it and proceed to blow a head gasket. So if you need help, ask for it in your favorite forum. If you are good at something, then share your ideas, and provide recommendations when people ask for help. I have been on both ends of this, and I continue to learn new things every week. If only money grew on trees.....

Click here to read more articles on case mods.

Next Time...

...we start a new project! To kick it off, we'll look at different ways to secure a window. See you then!

Joel Durham Jr. is author of the recently released Build it Yourself Visually: The Ultimate Game PC for Under \$999 (Wiley, 2005) as well as PC Modding for Dummies (Wiley, 2005).

Related articles:

Copyright (c) 2006 Ziff Davis Media Inc. All Rights Reserved.