# A Tower of an Enclosure

Here's a build-it-yourself tower enclosure you can tailor to your computing needs. Starting here with foundation information, we'll follow up with a stand-alone, fully buffered, powered and ventilated backplane bus expansion system that makes it a snap to expand your present system or experiment with new board designs.

CYANCE™
COMPUTING SYSTEM·

U.S. CYBERLAB
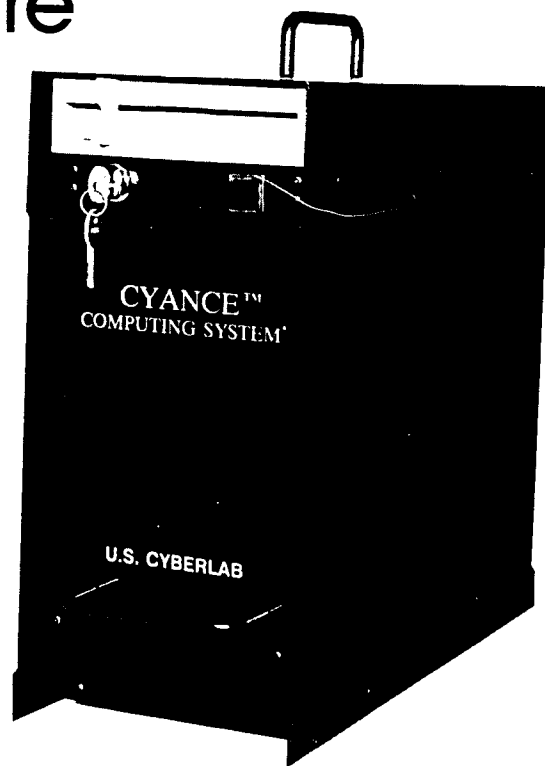
E xcept for a hard disk drive that fills up to capacity very quickly, however big, the greatest shortcoming most serious computer users find is a shortage of expansion slots. You become aware of the condition when you run out of slots to add a new plug-in card. Even if you do have a spare expansion slot, you doubtlessly dread disassembling everything in order to plug it in. Moreover, if you want to experiment with a new design you've put together yourself, you're likely to hesitate because if something goes wrong, it might blow parts of your computer.

All of the above have frustrated me for some years now. So I created a large module that takes care of every aspect very nicely . . . and safely. I call it CYANCE (pronounced "Science") because I intend to also use it as a scientific computing platform. Here are its outstanding features:

(1) It's a vertically configured platform that sits on your floor, desk or lab bench. This gives you more room to work, makes accessing side panels easier and provides better internal cooling conditions.

(2) It uses a front-load chassis, plac-ing your expansion bus and peripheral cards in the front of the unit to make changing boards and cables direct and easy to do. A side panel that's affixed by two knurled screws extends this convenience.

(3) It'll accommodate virtually any type of power supply, letting you scale it for the task at hand.

(4) It can be used to actively extend your existing computer bus by adding eight additional buffered and isolated expansion slots in a backplane design. This is particularly important when developing and experimenting with new peripheral card designs.

(5) It's also designed to be able to use virtually any type motherboard on the market, from 8088 to 80486 processors, if you wish to create your own special computer. This allows you to employ a motherboard of your choice, even including one from an old computer so that the whole shebang is more convenient to use.

(6) Finally, the tower looks just great: a rugged enclosure with all-black metal, a removable black Plexiglas front panel with a key switch, and rack-mount-like handles on top (for easy carrying purposes) and on front (for quick Plexiglas removal). You can build it yourself from plans to follow by visiting your local metal shop or purchase the metal parts (see Parts List) for only $99.95.

As you can see, CYANCE may be just the expansion system you need. We focus here on building the enclosure. In coming months, we'll address a bevy of ways its innards can be populated.

Design Considerations

The original IBM PC set a standard for computers built around the Intel 80xxx series microprocessors. Though the PC (and clones) is a good concept, access to its expansion bus is inconvenient. In CYANCE, the motherboard is rotated 180° so that its expansion slots face the front of the enclosure, which simplifies everything.

To access the interior of CYANCE, you remove two thumbscrews from the right side panel, which frees the entire panel to let you install your choice of motherboard, passive backplane or individual peripheral cards.

Convenience is carried an important step further as well. There are two front panels—a structural metal inner panel and a black plastic outer panel. Removing two screws drops off the front panel. This provides easy access to the connectors on any cards plugged into the bus. After plugging in cables, you route those that go to your keyboard and any device you'll be using temporarily, such as an EPROM programmer, down the inner front panel. Cables for devices you'll be using permanently—like a printer, video display, mouse, etc.—route in the same manner and then through the inner front panel and a slot in the rear panel for connection to the peripherals.

Once the cables are connected, you secure the plastic outer panel with the screws you previously removed. This arrangement hides unsightly cables and connectors and offers greater connection security since the front panel deters the cables from being accidentally unplugged from their connectors.

In high-power applications, "hot spots" can develop where high-density circuits create more thermal energy than can be reliably dissipated. CYANCE has a small fan mounted on its rear panel to eliminate heat build-up. Air is drawn under the front of the enclosure, through the chassis and is expelled through a top-rear exhaust port.
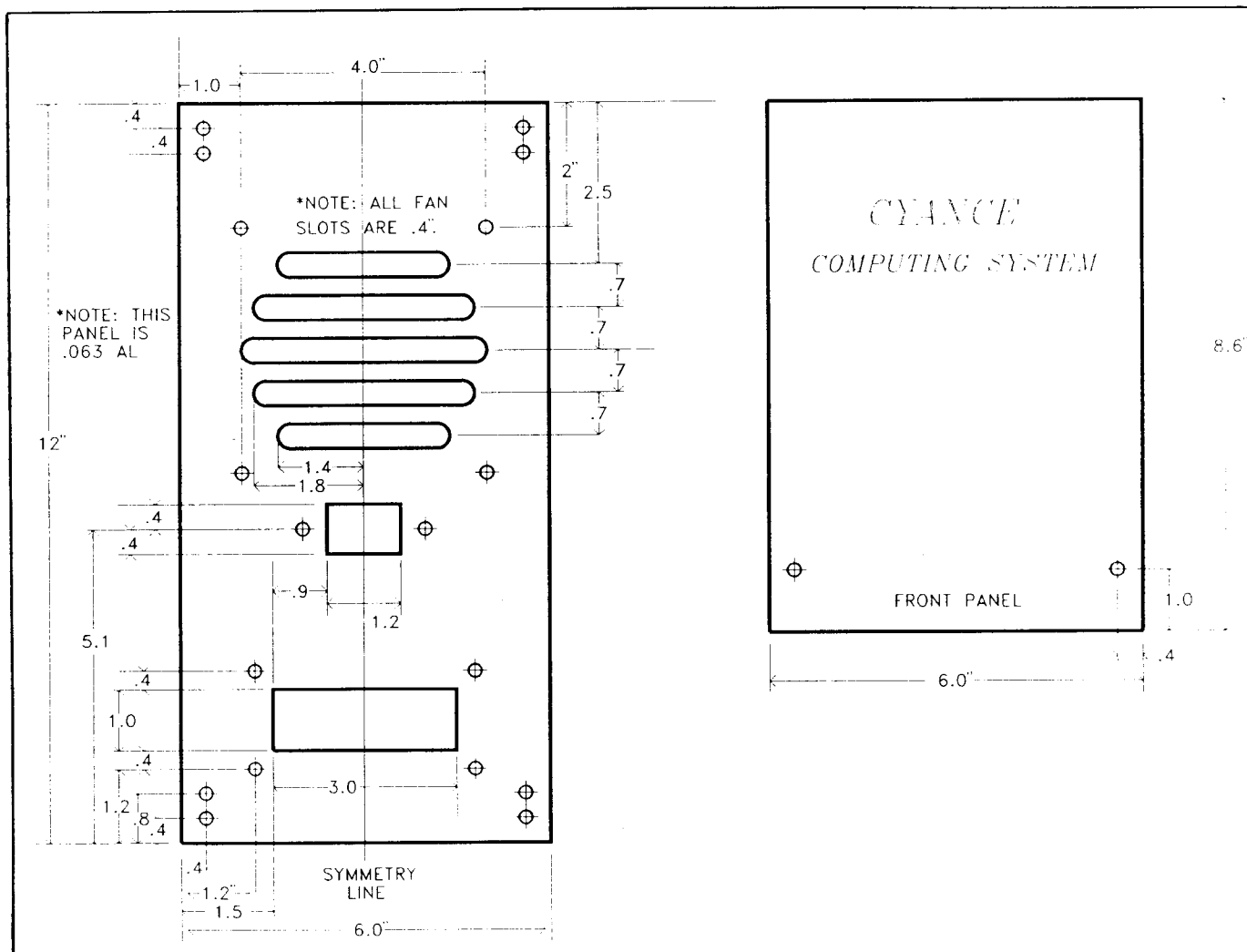
A switching-mode power supply (SMPS) is mounted under the upper shelf of the enclosure, near the fan for maximum cooling and physically isolated from the main area of the enclosure. You can select a power supply with sufficient capacity to power any system configuration you install inside CYANCE.

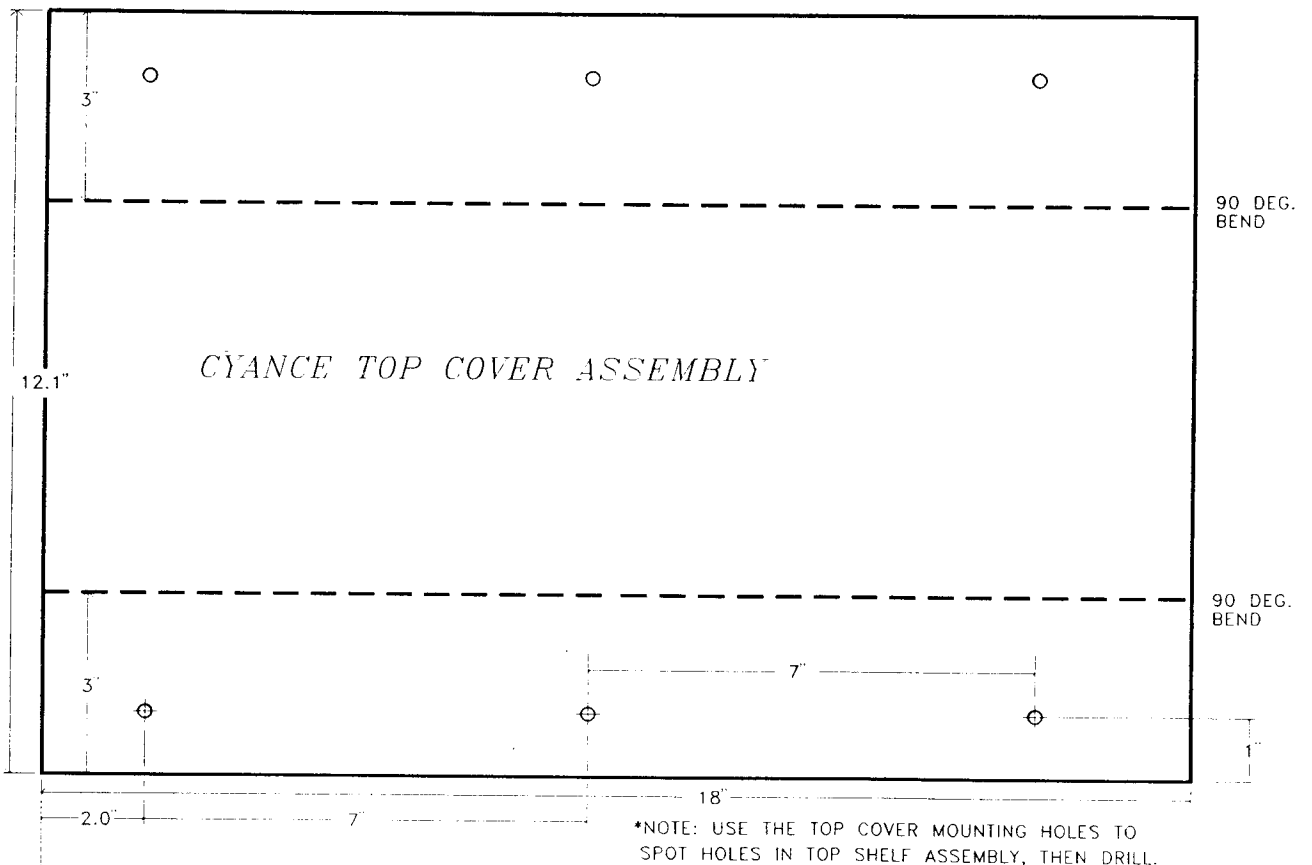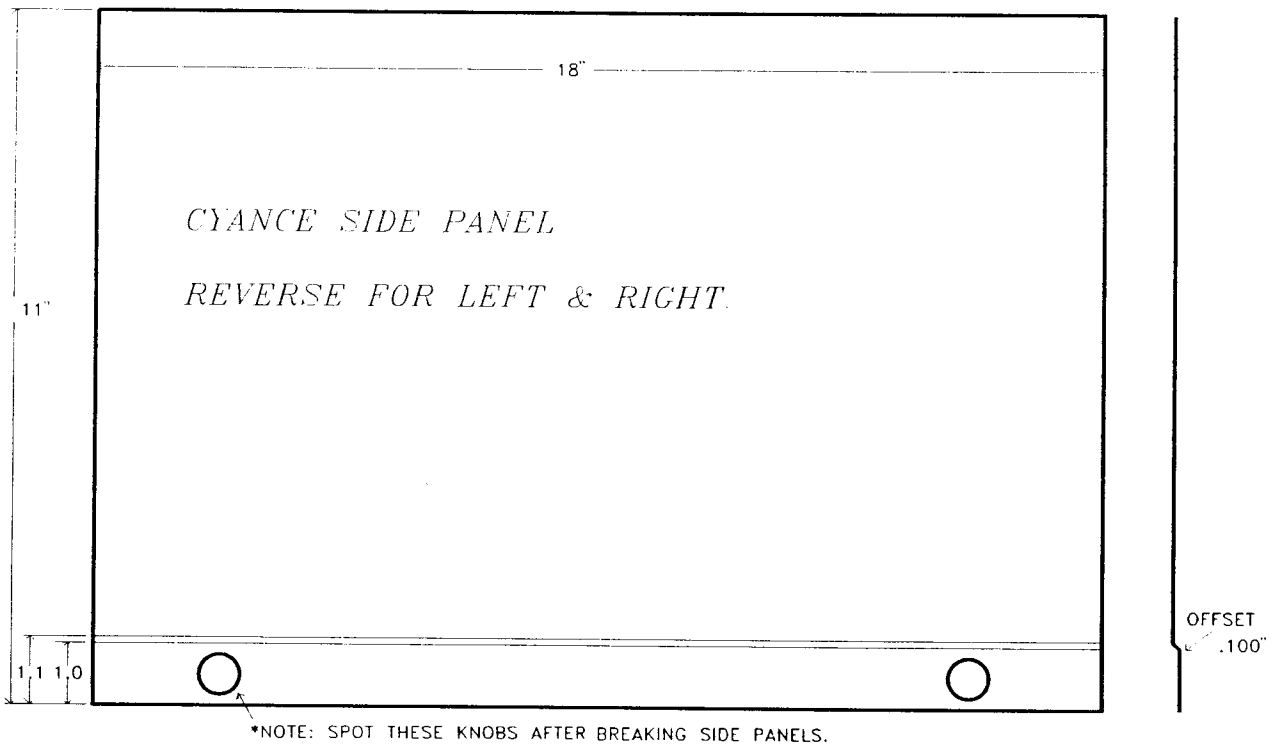Featured with this enclosure are a locking key-type POWER switch and lighted RESET pushbutton switch. Two disk drives can be installed inside CYANCE. One half-height drive bay is accessible from the front of the enclosure. It can accommodate a standard 5¼" floppy drive or, with an appropriate adapter kit, a 3½" floppy drive. Behind this, you can mount a hard drive.
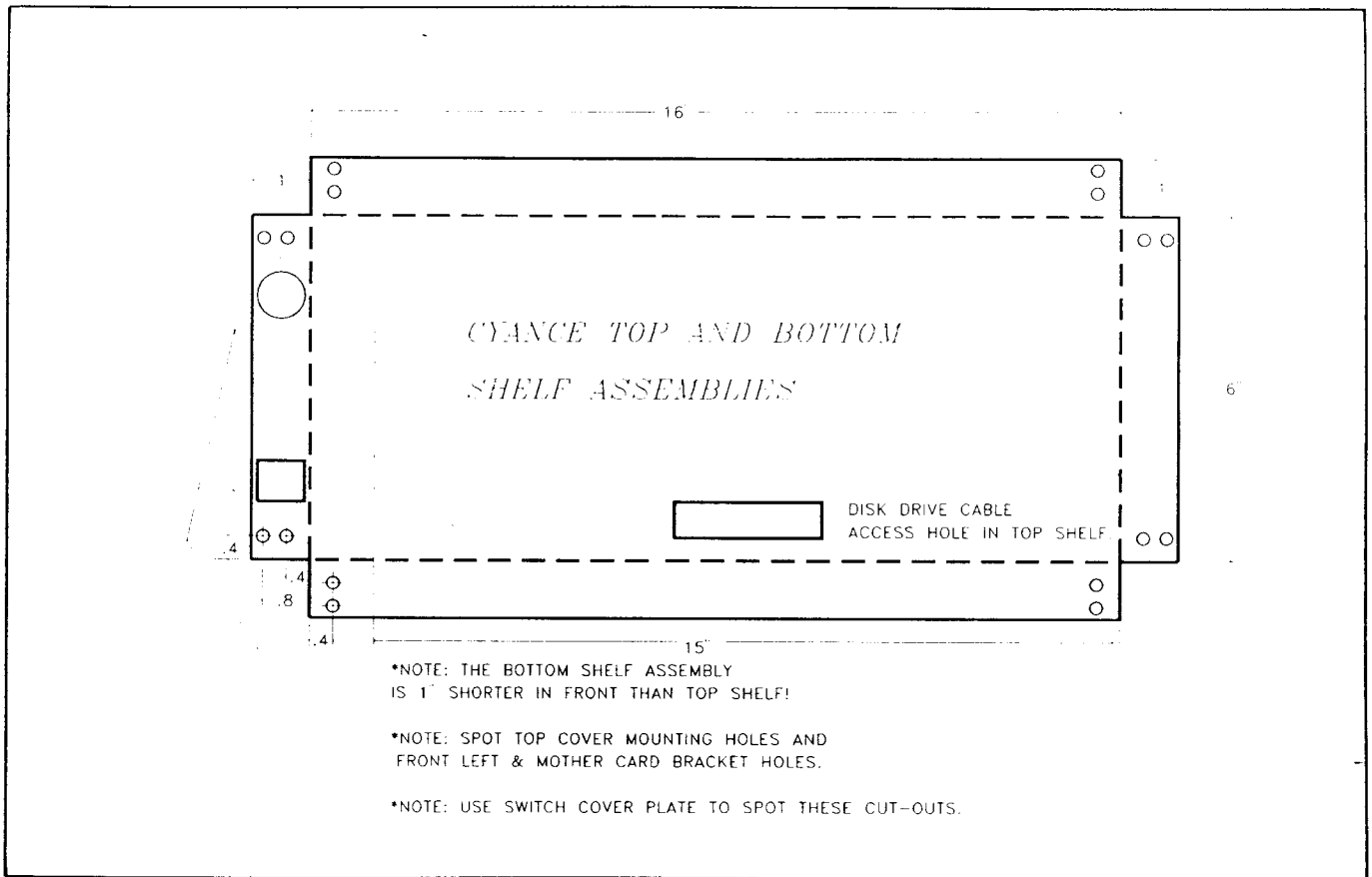
Building It

CYANCE's chassis is simple to assemble from metal components you can have a sheet-metal shop fabricate from the drawings presented here or obtain them from the source given in the Note at the end of the Bill of Materials. Though most sheet-metal shops can cut and bend the aluminum, in many cases, the equipment used may not be precise enough to produce satisfactory results.

Machining details for enclosure's rear metal and plastic outer front panels.

CYANCE SIDE PANEL

REVERSE FOR LEFT & RIGHT.

18"

11"

1.1 1.0

OFFSET
.100"

*NOTE: SPOT THESE KNOBS AFTER BREAKING SIDE PANELS.

3"

90 DEG.
BEND

CYANCE TOP COVER ASSEMBLY

12.1"

90 DEG.
BEND

7"

3"

1"

18"

2.0   7

*NOTE: USE THE TOP COVER MOUNTING HOLES TO
SPOT HOLES IN TOP SHELF ASSEMBLY, THEN DRILL.

The side panels are the reverse of each other.

CYANCE TOP AND BOTTOM
SHELF ASSEMBLIES

DISK DRIVE CABLE
ACCESS HOLE IN TOP SHELF

*NOTE: THE BOTTOM SHELF ASSEMBLY
IS 1" SHORTER IN FRONT THAN TOP SHELF!

*NOTE: SPOT TOP COVER MOUNTING HOLES AND
FRONT LEFT & MOTHER CARD BRACKET HOLES.

*NOTE: USE SWITCH COVER PLATE TO SPOT THESE CUT-OUTS.

For the top shelf, you must drill the side holes and cut the disk-drive cable access slot and round and square holes for key type and pushbutton power and reset switches. Only mounting holes through the sides of the bottom shelf are needed.

If you have a sheet-metal shop fabricate the parts, insist that all bent members form sharp 90° angles. Have the shop fabricate the parts out of 0.050" or 0.063" thick sheet aluminum. The heavier aluminum makes for a much sturdier chassis, though it's more difficult to work.

You can bore all holes with a hand drill. Be sure to very carefully measure and mark everything and center-punch each hole before actually drilling to keep the drill bit from wandering. Always "pilot" the initial hole with a drill bit that's half as small as the final hole size. It's often best to start large holes with a smaller bit and increase drill sizes several times to reach final hole size. It's also good practice to wear cotton gloves when you work with unfinished metal to minimize the possibility of being cut while handling sharp metal pieces.

As you begin to build the CYANCE unit, keep in mind the hardware you'll be installing inside it. If you plan on permanently mounting some connec-
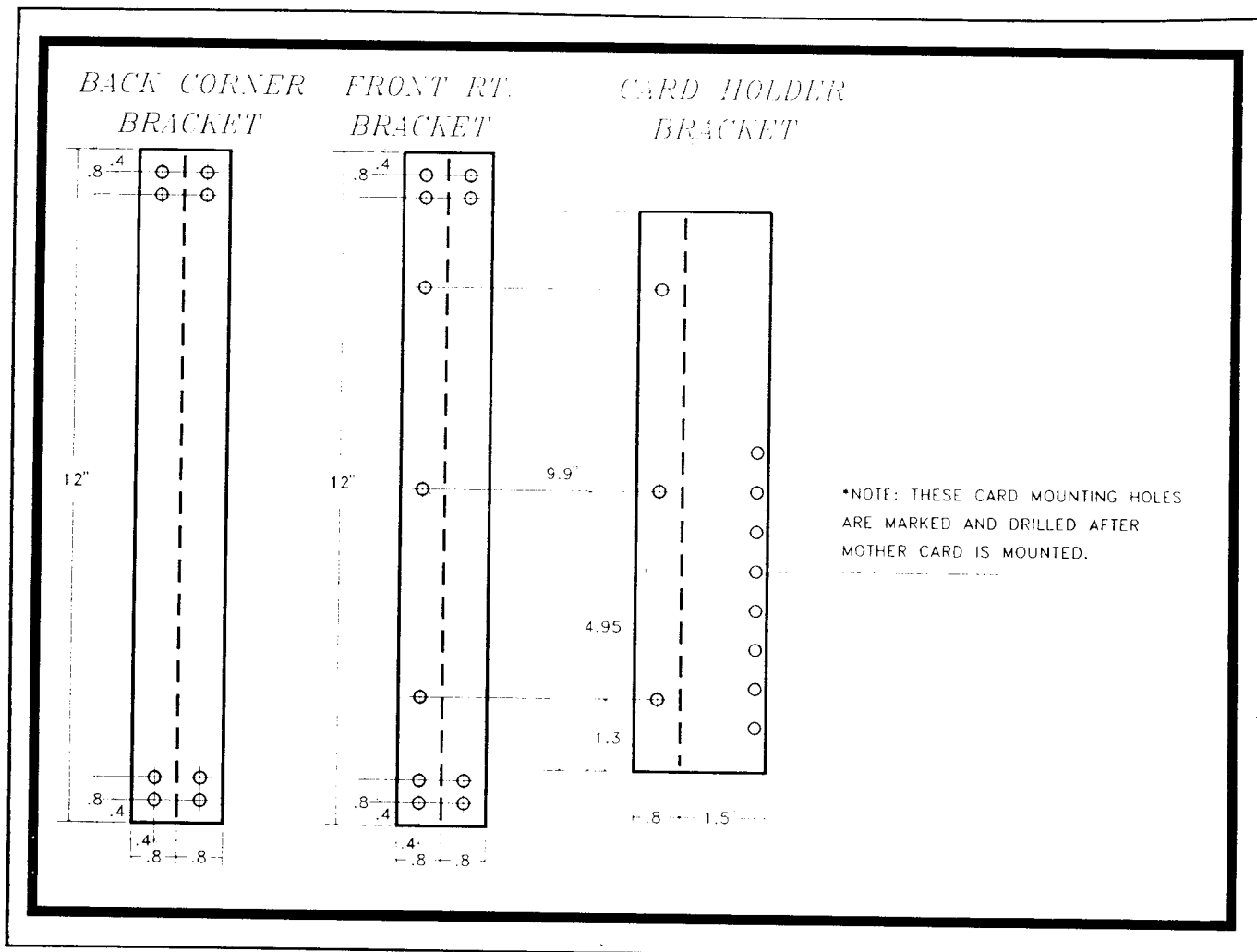
tors on the rear panel, for example, drill the holes and make cutouts for them now. If you want a digital or other type of display on the front panel, make suitable arrangement for it before proceeding further.

Once you have all aluminum members ready to go, use a metal file to "break" any sharp straight edges formed during the machining process. Deburr the sharp edges of round holes with a reamer or a Moto-Tool fitted

BILL OF MATERIALS

Qty.	Description	Part No.
1	Top shelf	4510
1	Bottom shelf	4511
2	Rear corner bracket	4512
1	Rear panel	4513
1	Front panel	4514
1	Switch cover panel	4515
1	Switch backing panel	4516
1	Front-right bracket	4517
1	Front-left bracket	4518
1	Card-holder bracket	4519
1	Mother-card bracket	4520
1	Top cover	4521
1	Left Side panel	4522
1	Right Side panel	4523
62	4-40 ¼" button-head screw	
22	4-40 Thread-Sert	4103
1	Large handle	4319
1	Small handle	4320

Qty.	Description	Part No.
2	Threaded 4-40 × 1" spacer	4321
4	8-32 thumbscrew	4322
4	8-32 Keps Nut	4104
4	Rubber feet	
1	Key-operated switch	5006
1	Lighted pushbutton switch	5007

Note: The following items are available from U.S. Cyberlab, Inc., Rte. 2 Box 284, Cyber Rd., West Fork, AR 72774 (tel.: 501-839-8293: Complete kit of all metal parts for enclosure, $99.95, 10-MHz turbo 8088 motherboard, $99.95; 16-MHz 80286 motherboard, $239.95, 16-MHz 80386SX motherboard, $349; 33-MHz 80486 motherboard, $1,395 (call for latest prices). Add $8.95 P&H for metal kit. Arkansas resients, please add 5% sales tax. MasterCard/Visa accepted.

BACK CORNER BRACKET   FRONT RT. BRACKET   CARD HOLDER BRACKET

*NOTE: THESE CARD MOUNTING HOLES ARE MARKED AND DRILLED AFTER MOTHER CARD IS MOUNTED.

A variety of brackets and a switch plate and switch backing complete the metal members you need to build the enclosure.

with a ball-type abrasive or steel accessory "bit."

If the aluminum members have any oil on them or are excessively dirty, scrub them with soapy water and 000 steel wool. Thoroughly rinse the parts and pat dry with paper towels. Allow them to thoroughly air dry.

Aluminum is a remarkable metal in terms of strength-to-weight ratio, machinability, etc. However, it's difficult to paint properly. You may have had some experience painting aluminum chassis in the past, only to find that the best paint job is extremely easy to scratch. This can be attributed directly to the fact that aluminum oxidizes easily and becomes so smooth that paint primer can't "grab" the metal surface to assure a good bond. In industry, special chemical processes called "conversion coatings" are applied to bare aluminum to make paint bond to it quite easily. Aluminum

parts from Cyberlab are processed with an Irridite™ conversion coating that makes them appear iridescent gold. Paint bonds extremely well to these surfaces, and unpainted parts have a professional appearance.

If you have a sheet-metal shop fabricate your aluminum parts, prepare them for painting by carefully dipping them in ferric-chloride (printed-circuit etchant) diluted with an equal amount of tap water. Allow the ferric-chloride solution to etch the surface of the aluminum for a few minutes. *Do this in a well-ventilated area—never inside your home*. Etching removes unwanted surface scratches, machining burrs and chips, and roughens the smooth surface of the aluminum.

When the finish looks uniform, carefully remove the part and rinse it under cold running water. Then lightly wipe off any excessively dark areas with a cloth and rinse again. The idea

is to leave enough aluminum chloride on the surface of the part to provide a good microscopic metal "primer."

When the parts are dry, finish them with any good spray paint. I recommend using a flat or semi-flat black paint, which is easier than other colors to touch up when scratches that will inevitably occur appear.

One final prototyper's trick is to use textured "trunk paint" available from automotive supply stores. When applied to the side panels as an undercoating, this will give CYANCE the look and feel of a textured finish like that on mainframe computers and cash registers. Your CYANCE parts should now look like they were professionally manufactured.

Before you assemble the chassis, double-check all measurements and parts to make sure everything is in order. If everything checks out okay, refer to the photos provided here as
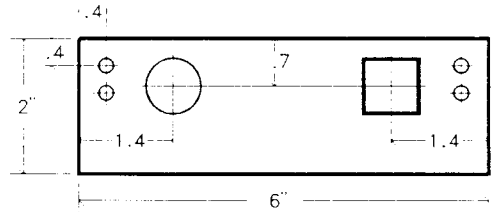
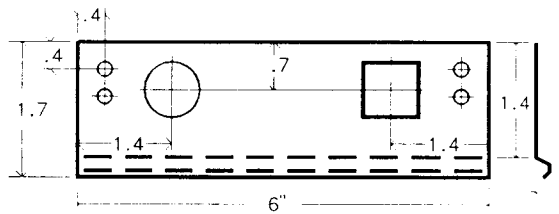## FRONT LEFT BRACKET
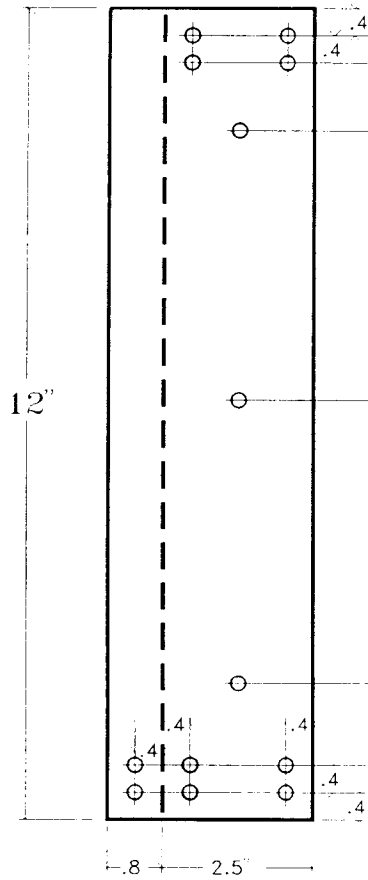
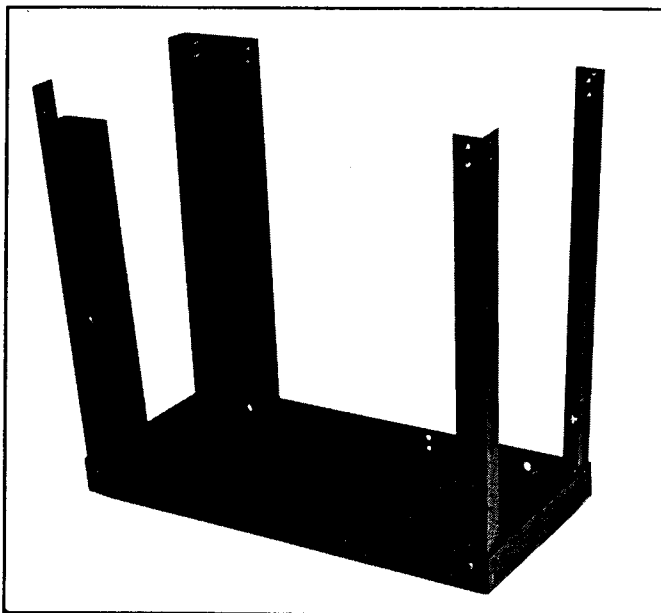## MOTHER CARD BRACKET
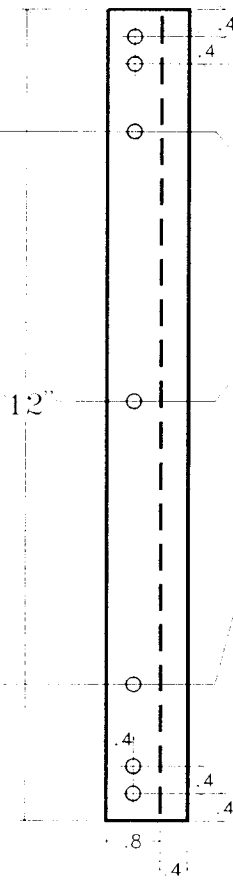
SWITCH COVER PLATE

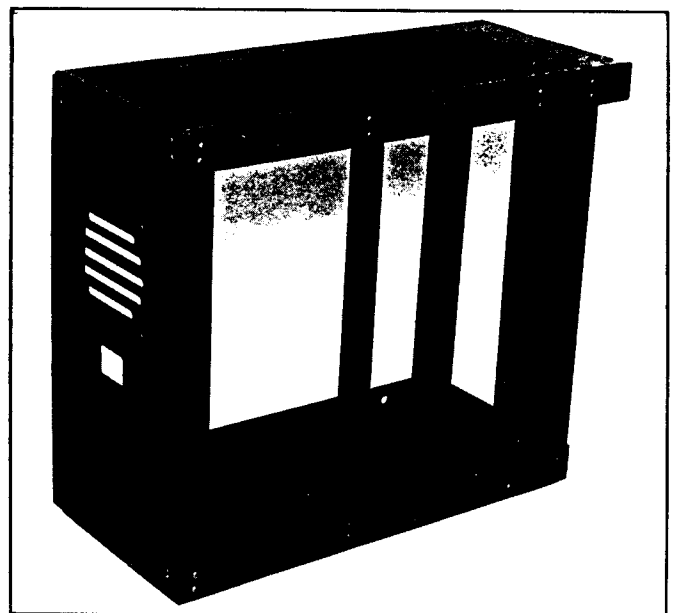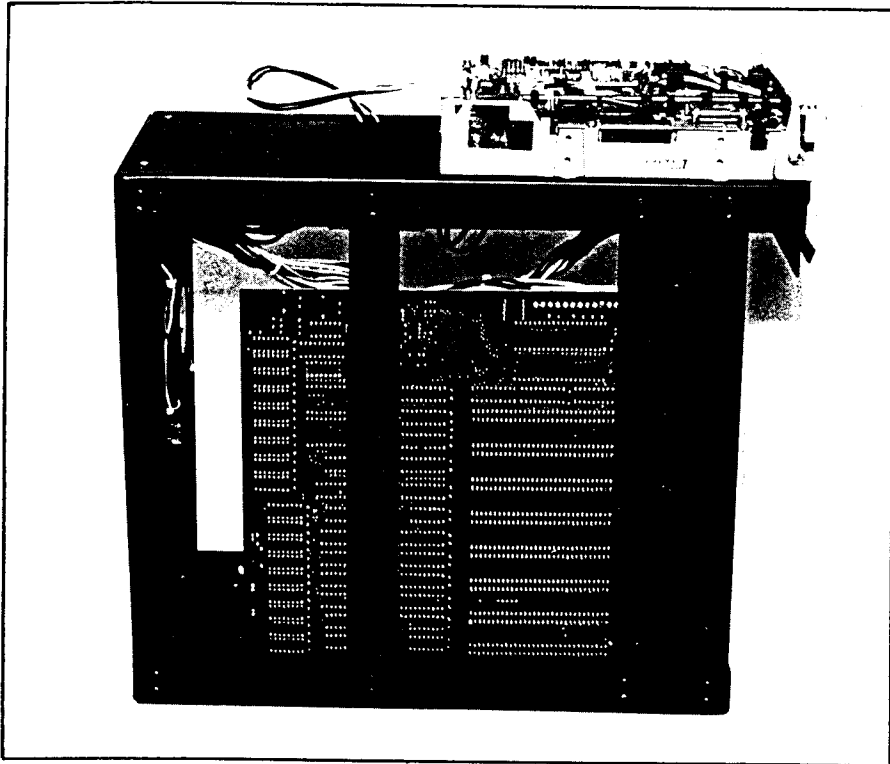*NOTE: THESE MOTHER-CARD MOUNTING HOLES ARE LOCATED PER YOUR CARD.

SWITCH BACKING

*NOTE: THIS LIP HOLDS FRONT PANEL IN PLACE.

Begin assembling the main chassis by loosely bolting the corner brackets to the bottom shelf.

After securing the motherboard brackets to the bottom shelf, secure the top shelf to the ends of the upright brackets.

Square up the enclosure and tighten all hardware and mount the switches in their respective holes and your choice of disk drive to the top shelf. Also, install your choice of motherboard, passive backplane or bus-expansion system.
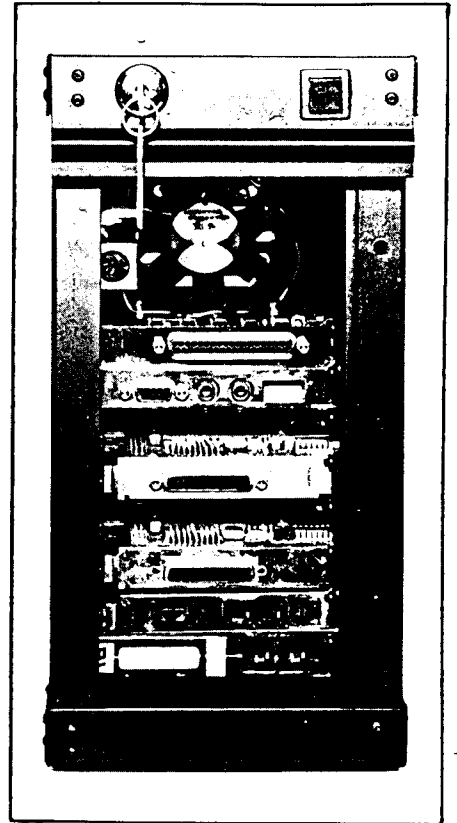
This enclosure design provides easy access to the connectors on expansion cards plugged into the bus. After connecting and routing cables, you mount the top panel and left and right panels and finish up by installing the plastic outer front panel.
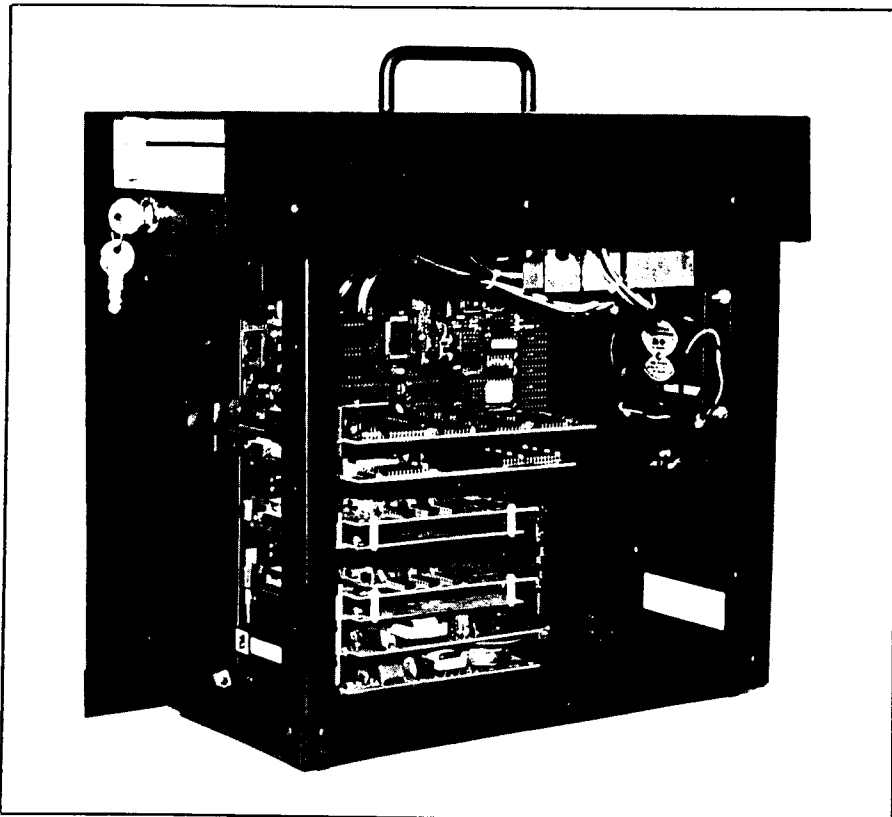
After securing the top cover and left side panel to the enclosure, plug expansion cards into the bus and then use thumbscrews to secure the right side panel.

you proceed with assembly.

Begin assembly by securing with four 4-40 × ¼" button socket-head screws the switch cover plate and switch backing plate to the front of the top shelf assembly. Don't fully tighten any screws until you've completely assembled the enclosure so that you have the slack needed to properly align the chassis.

Next, mount the POWER keyswitch and RESET switch into place. Check your work against the photos. Notice how the lower edge of the switch cover plate offsets to hold the removable front panel.

Secure the bottom shelf assembly and both rear corner brackets in place with 4-40 × ¼" screws. Then secure the top of both rear corner brackets to the top shelf assembly. Notice that the rear corner brackets mount inside the shelves. This is important for proper fitting of the side panels.

Mount the front-left and front-right brackets to the top and bottom shelves with 4-40 × ¼" screws. Notice that the front-left bracket has a wider side flange than that on the front-right bracket. This flange is used to mount a motherboard.

Now secure the card-holder bracket to the front-right bracket with three 4-40 × 1¼" screws and nuts. (Kit parts are provided with "thread-serts" that eliminate the need for nuts. These nuts are fabricated directly into the aluminum part for a professional finish.) Then finish this step by mounting the mother card bracket to both top and bottom shelves.

Mounting the rear panel to both rear corner brackets completes assembly of the basic CYANCE chassis. All that's left to be done is to tighten all screws. As you do this, make sure everything is straight and "true." You don't want a chassis that stands at a 93° angle!

Finish up by test fitting the left and right side panels, using thumbscrews to secure them in place. Mount the front panel bottom spacers on the front left and right brackets. Handles are optional and can be "spotted" wherever you wish to place them. The prototype unit has one on the top for carrying and another on the front panel for easy panel removal.

When you're done assembling your CYANCE enclosure and have had an opportunity to check out its interior and exterior features, you'll soon come to realize just how versatile is this platform. Whether you build it as an expansion chassis for your present computer or as the housing for a new motherboard or backplane computer system, you'll readily appreciate its many advantages over traditional system-unit boxes. ∎

Nick Goss