C. Troubleshooting Techniques for Three-Dimensional Modules.

Now that the module can be run in the open air, trouble-shooting a failure can be done. The Cray 2 modules are three dimensional in design and require some method to reach inside the module to perform signal checking. To do this, special probes have been built to extend the oscilloscope probe's capabilities. The probe is very simple in design, made either of a varnish coated armature type 26 gauge wire, or of piano wire or guitar string coated with a durable insulating enamel. One end of the wire is soldered to an oscilloscope probe tip to accomodate the scope probe and ground, and a tiny hook is made in the opposite end.

This hook is made small enough so that it will fit around chip leads without shorting to other leads, components, or solder connections. The wire itself is made long enough so that it will extend half the distance across the module, so that probing can be done from either side.

With these probes, the technician can reach inside the module, either between the long and short leads on the chip, or between the top of the chip leads and the board level above, and hook any chip lead wanted. The probes are marked at various intervals to show the positions of the chips on the board to determine the depth the probe must be inserted.

This sounds difficult to do at first, and indeed, on the first few attempts, it is difficult to probe the correct pins and be sure of the results. However, it does not take long to acquire skill, and probe these modules with confidence. Using a good probe, signal checking on a Cray 2 module is not much more difficult than a conventional module.

The important thing to realize is that ANY chip lead is accessible. ALL signals can be seen with the module stacked together. The Cray 2 modules are not that difficult to troubleshoot.

1) Documemtation.

In addition, to simplify troubleshooting and minimize probing as much as possible on these modules, every effort is being made to document the module tests thoroughly. Module descriptions, Timing and/or Block Diagrams, and Test Descriptions will be included with each test to aid troubleshooting of both new construction, and modules in the field.