

## **Thermal Conduction Module (TCM)**

By 1987 the information processing power of electronic computers of the 1960s could be held in one hand. The Thermal Conduction Module was the marrow of the large IBM 308X computers. Six inches square, the TCM had room for up to 133 chips, each with 704 circuits. Each ceramic block of the material had 28 to 33 differently wired layers. More than 350,000 holes provided paths for the vertical wiring for layer-to-layer communication. The chips were joined to the substrate through a total of nearly 16,000 contact points, using IBM's unique chip-joining technology. All that circuitry generated 300 watts of heat -- enough to destroy the chips. But the heat was drawn off through spring-loaded aluminium pistons that pressed gently against each chip. In turn, the pistons were housed in a "hat" filled with helium, an excellent heat conductor. Chilled water flowing through a conduit attached to the hat whisked the heat away. One TCM alone -- there were about two dozen in a 3081 computer -- packed as much computing punch as a medium-size System/370 of only a decade before.