

## CCC CRAY-3

graywolf

**Manufacturer:** Cray Computer Corporation**Clock Speed:** 0.50GHz**Dates Used:** *Friday, October 1, 1993 to Saturday, March 25, 1995***Microprocessor Peak Teraflops:** 0.00**Memory (terabytes):** 0.00TB**Number of Processors:** 4.00**Electrical Power Consumption:** 90.00 kW**Experimental/Production:** Experimental

The Cray-3 was the brainchild of Seymour Cray. He had begun its development while still chief architect with Cray Research, Inc. (CRI). CRI had spun Seymour and the Cray-3 development team, located in Colorado Springs, CO, off as an independent company in 1989, and Seymour named this new company Cray Computer Corporation (CCC). In the early, 1990's, CCC had built four prototype Cray-3 systems and was building four additional systems which it hoped to market.

On May 24, 1993, CCC delivered a Cray-3 supercomputer to NCAR as a test and evaluation system. The gray, four-foot tall machine was called Graywolf, following an NCAR tradition of naming computers after 14,000-foot peaks in the Colorado Rockies. Seymour had decided to loan Graywolf to NCAR, in part, to expose it to use by NCAR scientists and thus help CCC to develop its operating system, compilers and libraries in a real-world environment. In doing so, he had said "If the Cray-3 can survive NCAR, it can survive anywhere."

Graywolf was S/N 5 of the Cray-3 product line and the first 'production-ready' system. The first four systems had been built and used in-house at CCC for hardware design and software check-out. The Cray-3 was unique in that it used gallium-arsenide circuits, which could be clocked faster than silicon-based integrated circuitry at that time. The Cray-3 was designed to have eight "octants" of circuit boards, immersed in a circulating Fluorinert bath to keep the circuitry cool. Graywolf was a two-octant Cray-3 and, while capable of having up to four processors, it had two processors, 128 megawords (1 gigabyte) of memory, 20 gigabytes of disk space, and a clock speed of 2.08 nanoseconds (480 MHz) — the fastest clock speed of any supercomputer then available. It was connected via HIPPI to NCAR's Mass Storage System. Graywolf ran CCC's Colorado Springs Operating System (CSOS), which was based upon the Cray-2 version of Cray Research, Inc's UNICOS operating system, CCC's vectorizing Fortran and C compilers, optimized math libraries, debugger and performance tools.

The Cray-3 used gallium arsenide integrated circuits in place of silicon for all its logic circuitry. This circuitry and the system's memory was contained under a translucent smoky gray acrylic lid in the top eight inches of the system cabinet. The larger portion of the Cray-3 cabinet beneath the lid contained the Fluorinert circulating pumps, power supplies, and system control and monitoring devices. Graywolf required 90 kilowatts of power and produced 310,000 British thermal units of heat per hour — enough to warm six 2,000-square-foot homes.

NCAR used Graywolf to run atmospheric and oceanic circulation simulations and was used for CCC software development. It is noteworthy that NCAR's atmospheric circulation model helped CCC to discover a Boolean logic error in the square-root hardware of the Cray-3. The Cray-3 had introduced a new square-root instruction not previously available in the Cray-2 or Cray-1, and the hardware produced the wrong result for one out of every 64k operands. Once discovered, CCC provided a temporary fix in the compiler (i.e. don't use the new square-root hardware) and provided a fix to the hardware three months later.

Graywolf was decommissioned on March 26, 1995, the day after CCC filed Chapter 11 bankruptcy, and was returned to CCC's Colorado Springs facility.

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