1954 THE IBM 701

The IBM 701 computer was delivered to the Lab in 1954—it was 12 times faster than its predecessor, the Univac-1.

The Origin of FORTRAN

The Univac-1 was a simple computer to program in machine language; however, the IBM 701 was more difficult to use—one reason was its reliance on punch cards for input and output. Programmers in companies and laboratories that owned 701s talked among themselves informally, and various "home-brewed" systems resulted. IBM soon began to develop a higher-level language, FORTRAN (formula translation), and the Laboratory sent Robert Hughes to IBM for an extended visit to contribute to the effort. The original FORTRAN manual lists four contributors, one of them Robert Hughes.

Speed Is the Game

With delivery of the IBM 701 in 1954, the Laboratory dramatically improved its capability to perform scientific calculations. With 72 cathode-ray tubes, 2,048 words of memory, and accompanying gadgetry, the machine was the first commercially successful "scientific" supercomputer because of its speed. It was 12 times faster than its predecessor, the Univac-1, which the Laboratory acquired during its first year of operation. The Univac-1 correctly predicted the Eisenhower landslide victory in the 1952 presidential election with only 7 percent of the vote tallied, but Livermore's needs quickly outgrew the machine's capabilities.

Even before the Laboratory was a reality, founders Ernest Lawrence, Edward Teller, and Herb York understood the need for mammoth amounts of computing power. Almost from the opening of the doors in 1952, a sizable team of Livermore people was learning to use the Univac-1 and troubleshoot its problems. At election time, the machine earmarked for Livermore was loaned to a TV network to predict the results. Acquisition of the Univac-1, and soon after the IBM 701, marked the beginning of the Lab's not-so-coincidental links to commercial supercomputing—their nearly identical birth dates, efforts to develop the fastest and most powerful machines, and use of machines to solve large, complex problems.

The IBM 701 and all of Livermore's supercomputers since have been developed in part at the Laboratory's encouragement. The IBM 701 was the last vacuum-tube model before magnetic core and transistor memory. With the change in technology to transistors, computer speed and storage capacity have rapidly advanced in accordance with a phenomenon dubbed "Moore's Law," formulated in 1965 by Gordon Moore, founder of Intel Corporation. The law has accurately predicted that every 18 months technology advances would allow a doubling of the number of transistors that could be put on a computer chip. Ongoing work at the Laboratory on extreme ultraviolet lithography (see Year 1999) aims to extend Moore's Law to approximately 2010.

Livermore is also part of the National Nuclear Security Administration's Advanced Simulation and Computing (ASCI) program, which was initiated in 1995 to increase supercomputer speed and capacity faster than afforded by Moore's Law. In the ASCI supercomputers, thousands of the most powerful microprocessors industry produces are configured to work in parallel. The IBM ASCI White machine at Livermore, the world's most powerful computer in 2002, consists of 8,192 processors and is able to perform 12 trillion operations per second (12 teraops)—30 billion times faster than the Univac-1 (see Year 2000).

Livermore's terascale computing capabilities keep the Laboratory at the forefront of scientific computing in the early 21st century. They promise to help experts maintain the nation's nuclear deterrent and open many new avenues of scientific discovery.

Delivered in May 1960, the building-size LARC (Livermore Advanced Research Computer) was built by Remington-Rand to specifications provided by the Laboratory.