

7600 Computer Now in Operation At Livermore Lab

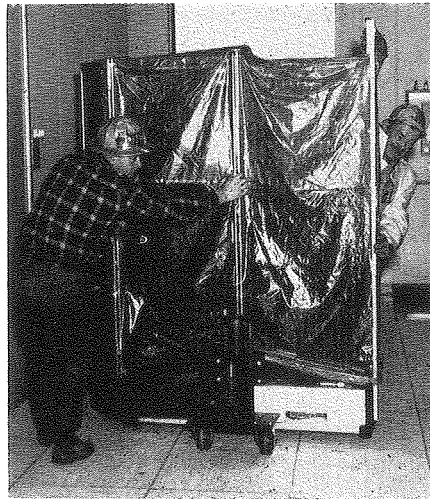
The Control Data 7600 computer—the machine that takes the current art of computer science to a new level of component sophistication—went into operation at LRL Livermore last month.

The new computer, received on January 27, passed its final acceptance tests on March 26, and began full experimental operation a few days later. As is usually the case with LRL Livermore computers, the Control Data 7600 is the first of its kind, and the most powerful computer now operating in the world. LRL Berkeley is due to receive a 7600 computer in the fall of 1970.

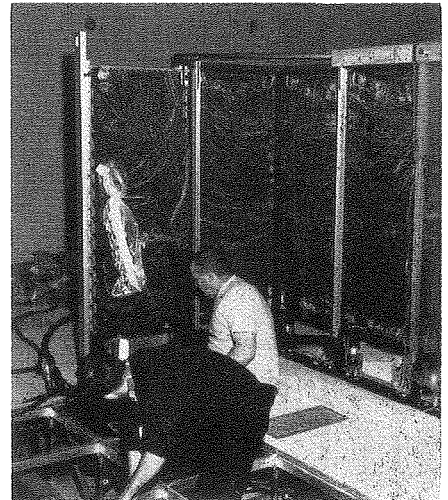
In the Control Data 7600 (which is from four to ten times faster than its predecessor the 6600, depending on the type of problem being run), designers have developed new techniques in component miniaturization to achieve higher data transfer rates, thereby increasing the system's throughput capability. In the new 7600 computer, for example, the limiting factor on the switching rate is actually the velocity of light—that is, the speed at which electrical impulses can be transmitted through matter. Thus, further progress in this area can come about only through such developments as miniaturization—decreasing the distance the impulses have to travel.

All this does not mean, however, that the 7600 is the fastest machine we'll be seeing in our computer centers. On the contrary, Sidney Fernbach, head of LRL Livermore's Computation Department, and his staff are already talking with enthusiasm about the next generation of computers—the machines of the so-called "pipeline" design. In such computers, identical mathematical operations will be grouped together to increase efficiency. For example, the "add" commands of a segment of the problem would be executed sequentially with a high degree of overlap, followed by another instruction, such as "multiply." Then the next segment would be partitioned in the same way. Through this method, dramatic increases in speed and efficiency may be gained without a major breakthrough in hardware performance.

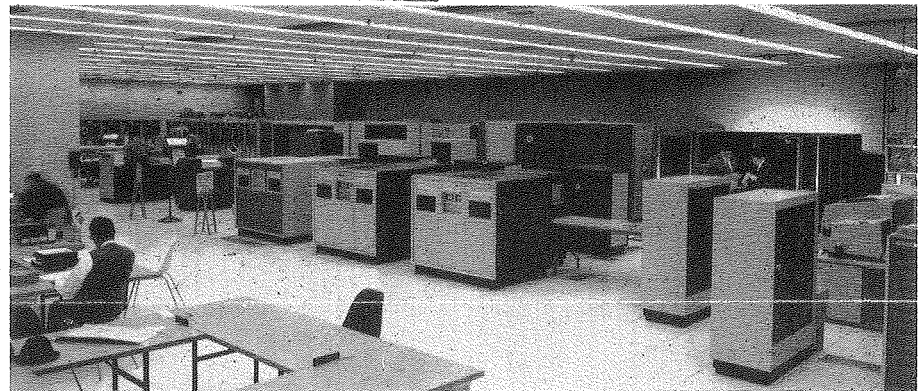
The Control Data 7600, while maintaining the conventional sequential approach used in the 6600 and earlier models, brings this design up to a higher potential of speed and performance. Major gains have been made without sacrifice of memory size by separating the information storage function of the



HERE SHE COMES—the world's first Control Data 7600 is rolled into LRL Livermore's computer center by equipment movers Bob Fiala (l.) and Pete Pavusek.



INSTALLATION is quick and easy, as workmen remove sections of false floor to hook up wires. The new computer has translucent glass sides that reveal mass of circuits within.



THREE GENERATIONS of "Model No. 1" high-speed computers—each, in its day, the fastest and the best—are lined up in Livermore's computer center: l. to r., the 3600, the 6600, and the new 7600, all manufactured by the Control Data Corporation.

Central Processing Unit (CPU) into two cores—a faster "small-core memory," which stores about 65,000 60-bit words of information with a 275 nanosecond read-write cycle time—and a slower "large-core memory," which stores about eight times as many words but has a much slower (1760 nanosecond) cycle time. In addition to the CPU, the system also has ten peripheral processing units (PPU's), with the capability of expansion up to about 14.

To best utilize the memory hierarchy (slow memory to fast memory) capabilities of the new machine, a major reprogramming effort was necessary in the area of operating and systems programs. According to Bill Mansfield, head of the Systems Development Section of the Computation Department, the basic approach was what he calls an "overlay system"—that is, the placement of each operating module of the system at the slowest possible level of memory, thus freeing the lion's share of the small "fast" memory for actual job programs.

Systems Development staff members

worked on the development of software for more than a year while the 7600 was being designed and built in Control Data's Chippewa Falls facility. By the time the computer arrived at LRL in January, the programs had already been written and tested extensively on a 7600 simulation routine which ran on the 6600 computer. Staff members made several trips to Chippewa Falls, in Wisconsin, carrying out lengthy field checks of the system on the 7600 even before it was completely built. Thanks to this long-range planning, the new software was able to go into full operation along with the hardware last month. Work is continuing, however, on improvements to the system programs, and on the reprogramming of specific application codes.

A second Control Data 7600 is due in Livermore this summer. The Livermore Laboratory's computer inventory, valued at about \$50 million, will then include two 7600's and four 6600's. Older equipment, predating the 6600's, will gradually be retired at Livermore.