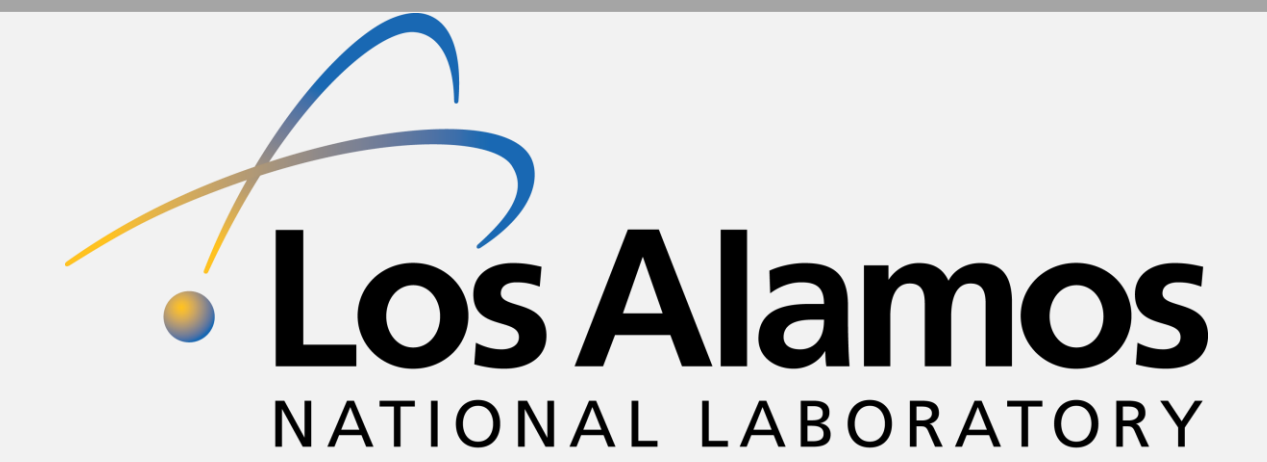


# Falling STAR: How Livermore's Mistake Brought the Cray-1 to Los Alamos



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## Abstract

It is widely known that the very first Cray-1 underwent evaluation at Los Alamos in 1976, but few realize that Seymour Cray's iconic supercomputer almost went elsewhere. If not for Livermore's involvement with developing and failing to detect a fatal flaw with a less-well-known supercomputer from the Control Data Corporation (CDC), the Cray-1 might have been installed for evaluation at Livermore instead.

## The Scalar Bottleneck

Supercomputer performance was still increasing rapidly in the mid-1960s, exemplified by the CDC 6600, but experts like Sidney Fernbach, leader of Livermore's Computational Division, worried that a slowing of component improvements in conventional scalar architectures would form a performance bottleneck in the future. As a result, Livermore and the Atomic Energy Commission (AEC) contracted with CDC to produce the first commercially available "vector" supercomputer, the STAR-100.



Sidney Fernbach, leader of Livermore Computational Division, 1952-1979. *Image LLNL*

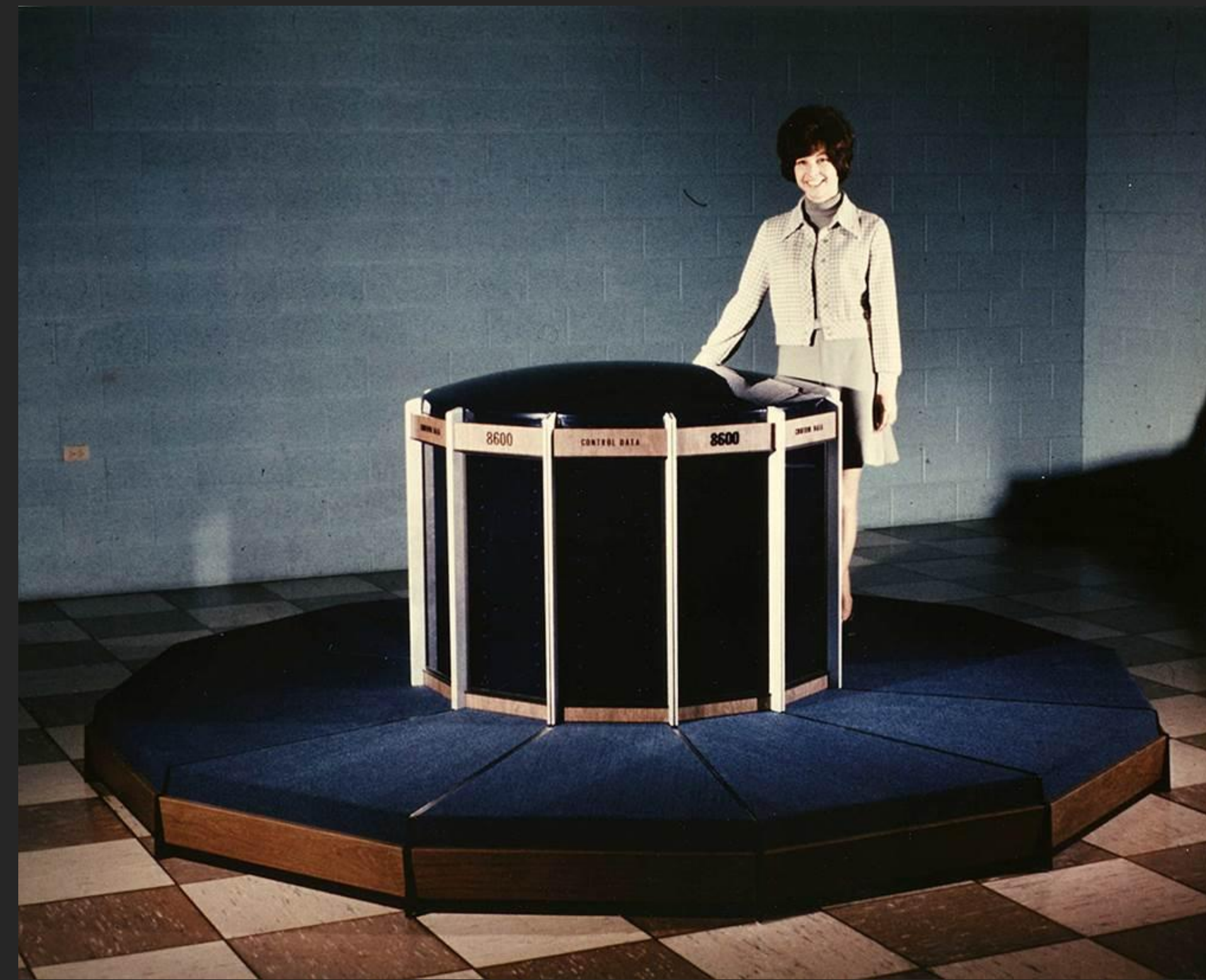
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While the CDC 6600 was extremely powerful for its time (mid-1960s), some supercomputer experts, like Fernbach, worried that the "scalar bottleneck" would mean diminishing returns on performance improvements in the future. *Image CHM*

## A Tale of Two Companies

In the early 1970s, CDC had two supercomputer projects underway, the STAR-100, and the 8600, Seymour Cray's follow-up to the 7600. After the 8600 encountered severe setbacks, CDC canceled the project. In response, Cray left to form his own company Cray Research, Inc. (CRI) in 1972.



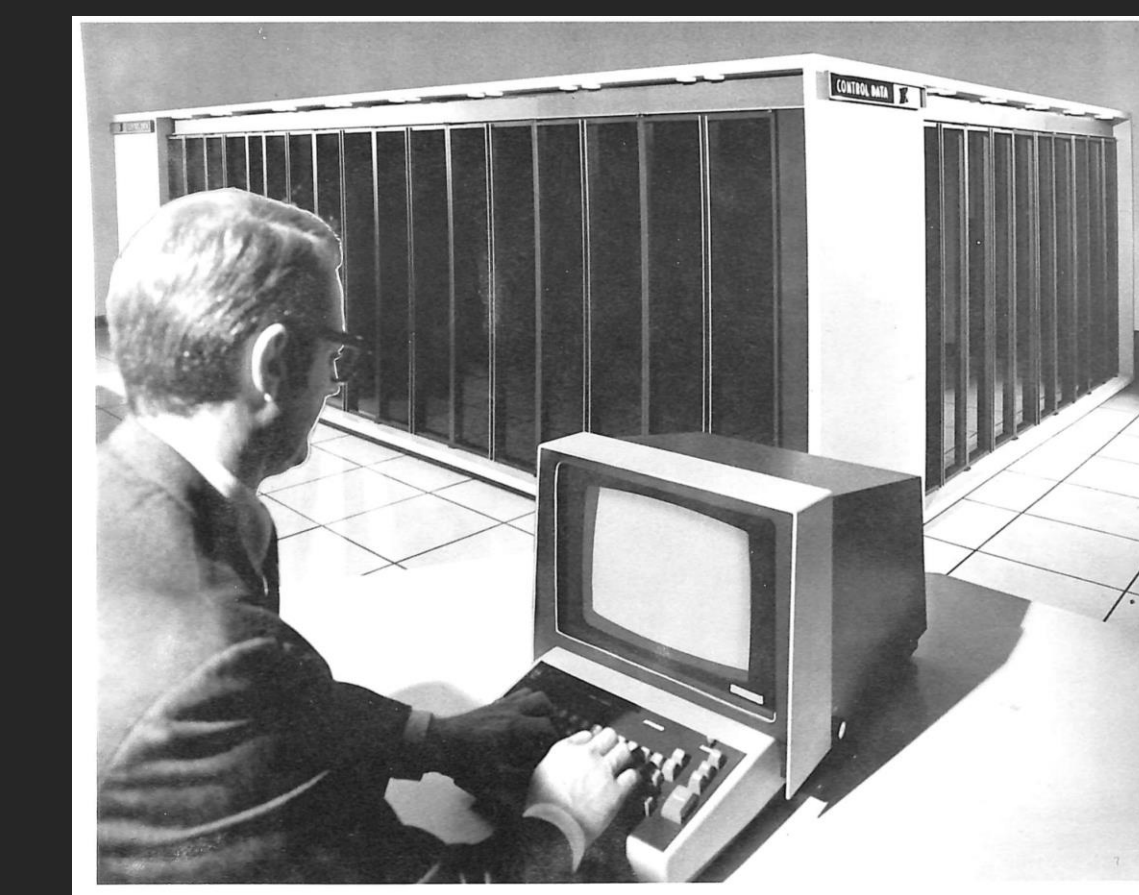
Mockup of the never-completed CDC 8600. Control Data's cancellation of the 8600 project spurred Seymour Cray to form his own company, and build his own supercomputer. The 8600's design inspiration on the Cray-1 is unmistakable. *Image CHM*

## No Other Options

Los Alamos had hoped to purchase the CDC 8600, but its cancellation meant that no sufficiently powerful supercomputers would soon be entering the market, except for the STAR-100. The AEC and Livermore successfully pressured Los Alamos to sign a contract for a 1974 delivery of a STAR. Livermore ordered two.

## The Fatal Flaw

In late 1973, Los Alamos ran tests on the nearly completed STAR, revealing that its architecture was heavily biased toward long-vectors, making the computer slow on anything but large vector datasets. Livermore's example codes, used to design the STAR's architecture, were not representative of either lab's workload, and were too easy a test to reveal the STAR's fatal flaw.



The CDC STAR-100 was the first commercially available "vector" supercomputer. *Image CBI*



The Cray-1 at Los Alamos, 1976. *Image LANL*

## Suddenly Seymour

Los Alamos negotiated out of the STAR contract, but CDC would not negotiate with Livermore over its two STARs. When Cray announced the Cray-1 in 1975, Livermore attempted to acquire SN-1, but, having just received two useless STARs, the US Congress would not allow Livermore to procure another untested computer. Without its own next-generation computer, Los Alamos was free to perform the historic Cray-1 evaluation.

## Conclusion

Los Alamos' Cray-1 evaluation gave CRI's first computer legitimacy, but without Livermore's part in the failure of the STAR-100, the accolades of introducing the Cray-1 to the world might not have belonged to Los Alamos.