Seymour Cray

From Wikipedia, the free encyclopedia

|  |  |
| --- | --- |
| **Seymour Cray** | |
|  | |
| **Born** | Seymour Roger Cray September 28, 1925 [Chippewa Falls, Wisconsin](https://en.wikipedia.org/wiki/Chippewa_Falls,_Wisconsin), US |
| **Died** | October 5, 1996 (aged 71) [Colorado Springs, Colorado](https://en.wikipedia.org/wiki/Colorado_Springs,_Colorado), US |
| **Fields** | [Applied mathematician](https://en.wikipedia.org/wiki/Applied_mathematician), [computer scientist](https://en.wikipedia.org/wiki/Computer_science), and [electrical engineer](https://en.wikipedia.org/wiki/Electrical_engineering) |
| **Institutions** | [Engineering Research Associates](https://en.wikipedia.org/wiki/Engineering_Research_Associates) [Control Data Corporation](https://en.wikipedia.org/wiki/Control_Data_Corporation) [Cray Research](https://en.wikipedia.org/wiki/Cray_Research) [Cray Computer Corporation](https://en.wikipedia.org/wiki/Cray_Computer_Corporation) SRC Computers |
| [**Alma mater**](https://en.wikipedia.org/wiki/Alma_mater) | [University of Minnesota](https://en.wikipedia.org/wiki/University_of_Minnesota) |
| **Known for** | [Supercomputers](https://en.wikipedia.org/wiki/Supercomputer) |

**Seymour Roger Cray** (September 28, 1925[[1]](https://en.wikipedia.org/wiki/Seymour_Cray#cite_note-1) – October 5, 1996[[2]](https://en.wikipedia.org/wiki/Seymour_Cray#cite_note-Lazou-2)) was an American [electrical engineer](https://en.wikipedia.org/wiki/Electrical_engineer) and [supercomputer](https://en.wikipedia.org/wiki/Supercomputer) architect who designed a series of computers that were the fastest in the world for decades, and founded [Cray Research](https://en.wikipedia.org/wiki/Cray_Research) which built many of these machines. Called "the father of supercomputing,"[[2]](https://en.wikipedia.org/wiki/Seymour_Cray#cite_note-Lazou-2) Cray has been credited with creating the supercomputer industry.[[3]](https://en.wikipedia.org/wiki/Seymour_Cray#cite_note-3) [Joel S. Birnbaum](https://en.wikipedia.org/wiki/Joel_S._Birnbaum), then [chief technology officer](https://en.wikipedia.org/wiki/Chief_technology_officer) of [Hewlett-Packard](https://en.wikipedia.org/wiki/Hewlett-Packard), said of him: "It seems impossible to exaggerate the effect he had on the industry; many of the things that high performance computers now do routinely were at the farthest edge of credibility when Seymour envisioned them."[[4]](https://en.wikipedia.org/wiki/Seymour_Cray#cite_note-4)

**Contents**

  [hide]

* [1Early life](https://en.wikipedia.org/wiki/Seymour_Cray#Early_life)
* [2Career](https://en.wikipedia.org/wiki/Seymour_Cray#Career)
  + [2.1Engineering Research Associates](https://en.wikipedia.org/wiki/Seymour_Cray#Engineering_Research_Associates)
  + [2.2Control Data Corporation](https://en.wikipedia.org/wiki/Seymour_Cray#Control_Data_Corporation)
    - [2.2.1CDC's Chippewa Falls laboratory](https://en.wikipedia.org/wiki/Seymour_Cray#CDC.27s_Chippewa_Falls_laboratory)
  + [2.3Cray Research](https://en.wikipedia.org/wiki/Seymour_Cray#Cray_Research)
  + [2.4Cray Computer Corporation](https://en.wikipedia.org/wiki/Seymour_Cray#Cray_Computer_Corporation)
  + [2.5SRC Computers](https://en.wikipedia.org/wiki/Seymour_Cray#SRC_Computers)
* [3Technical approaches](https://en.wikipedia.org/wiki/Seymour_Cray#Technical_approaches)
* [4Personal life](https://en.wikipedia.org/wiki/Seymour_Cray#Personal_life)
* [5See also](https://en.wikipedia.org/wiki/Seymour_Cray#See_also)
* [6Notes](https://en.wikipedia.org/wiki/Seymour_Cray#Notes)
* [7References](https://en.wikipedia.org/wiki/Seymour_Cray#References)
* [8External links](https://en.wikipedia.org/wiki/Seymour_Cray#External_links)

Early life[[edit](https://en.wikipedia.org/w/index.php?title=Seymour_Cray&action=edit&section=1)]

Cray was born in 1925 in [Chippewa Falls, Wisconsin](https://en.wikipedia.org/wiki/Chippewa_Falls,_Wisconsin), to Seymour R. and Lillian Cray. His father was a [civil engineer](https://en.wikipedia.org/wiki/Civil_engineer) who fostered Cray's interest in science and engineering. As early as the age of ten he was able to build a device out of [Erector Set](https://en.wikipedia.org/wiki/Erector_Set) components that converted punched [paper tape](https://en.wikipedia.org/wiki/Paper_tape) into [Morse code](https://en.wikipedia.org/wiki/Morse_code) signals. The basement of the family home was given over to the young Cray as a "laboratory".[[5]](https://en.wikipedia.org/wiki/Seymour_Cray#cite_note-5)

Cray graduated from [Chippewa Falls High School](https://en.wikipedia.org/wiki/Chippewa_Falls_High_School) in 1943 before being [drafted](https://en.wikipedia.org/wiki/Conscription) for [World War II](https://en.wikipedia.org/wiki/World_War_II) as a radio operator. He saw action in [Europe](https://en.wikipedia.org/wiki/European_Theatre_of_World_War_II), and then moved to the [Pacific theatre](https://en.wikipedia.org/wiki/Asiatic-Pacific_Theater)where he worked on breaking [Japanese naval codes](https://en.wikipedia.org/wiki/Japanese_naval_codes). On his return to the [United States](https://en.wikipedia.org/wiki/United_States) he received a [B.Sc.](https://en.wikipedia.org/wiki/Bachelor_of_Science) in [Electrical Engineering](https://en.wikipedia.org/wiki/Electrical_Engineering) at the [University of Minnesota](https://en.wikipedia.org/wiki/University_of_Minnesota), graduating in 1949, followed by a [M.Sc.](https://en.wikipedia.org/wiki/Master_of_Science) in [applied mathematics](https://en.wikipedia.org/wiki/Applied_mathematics) in 1951.[[6]](https://en.wikipedia.org/wiki/Seymour_Cray#cite_note-6)

Career[[edit](https://en.wikipedia.org/w/index.php?title=Seymour_Cray&action=edit&section=2)]

**Engineering Research Associates**[[edit](https://en.wikipedia.org/w/index.php?title=Seymour_Cray&action=edit&section=3)]

In 1951, Cray joined [Engineering Research Associates](https://en.wikipedia.org/wiki/Engineering_Research_Associates) (ERA) in [Saint Paul, Minnesota](https://en.wikipedia.org/wiki/Saint_Paul,_Minnesota).[[7]](https://en.wikipedia.org/wiki/Seymour_Cray#cite_note-IEEECS-7) ERA had formed out of a former [United States Navy](https://en.wikipedia.org/wiki/United_States_Navy) laboratory that had built codebreaking machines, a tradition ERA carried on when such work was available. ERA was introduced to computer technology during one such effort, but in other times had worked on a wide variety of basic engineering as well.

Cray quickly came to be regarded as an expert on digital computer technology, especially following his design work on the [ERA 1103](https://en.wikipedia.org/wiki/ERA_1103), the first commercially successful scientific computer. His work with super computers won him the nickname "The Wizard of Chippewa Falls".[[7]](https://en.wikipedia.org/wiki/Seymour_Cray#cite_note-IEEECS-7) He remained at ERA when it was bought by [Remington Rand](https://en.wikipedia.org/wiki/Remington_Rand) and then [Sperry Corporation](https://en.wikipedia.org/wiki/Sperry_Corporation) in the early 1950s. At the newly formed [Sperry-Rand](https://en.wikipedia.org/wiki/Sperry_Corporation#Sperry_Rand), ERA became the "scientific computing" arm of their [UNIVAC](https://en.wikipedia.org/wiki/UNIVAC) division.

**Control Data Corporation**[[edit](https://en.wikipedia.org/w/index.php?title=Seymour_Cray&action=edit&section=4)]

When the scientific computing division was phased out in 1957, a number of employees left to form [Control Data Corporation](https://en.wikipedia.org/wiki/Control_Data_Corporation) (CDC). Cray wanted to follow immediately, but CDC's CEO, [William Norris](https://en.wikipedia.org/wiki/William_Norris_(CEO)), refused, as Cray was in the midst of completing a project for the Navy, with whom Norris was interested in maintaining a good relationship.[[*citation needed*](https://en.wikipedia.org/wiki/Wikipedia:Citation_needed)] The project, the [Naval Tactical Data System](https://en.wikipedia.org/wiki/Naval_Tactical_Data_System), was completed early the next year, whereupon Cray left for CDC as well.

By 1960 he had completed the design of the [CDC 1604](https://en.wikipedia.org/wiki/CDC_1604), an improved low-cost [ERA 1103](https://en.wikipedia.org/wiki/ERA_1103) that had impressive performance for its price range.[[*citation needed*](https://en.wikipedia.org/wiki/Wikipedia:Citation_needed)] Even as the CDC 1604 was starting to ship to customers in 1960, Cray had already moved on to designing other computers. He first worked on the design of an upgraded version (the [CDC 3000](https://en.wikipedia.org/wiki/CDC_3000) series), but company management wanted these machines targeted toward 'business and commercial' data processing for average customers. Cray did not enjoy working on such 'mundane' machines, constrained to design for low-cost construction, so CDC could sell lots of them. His desire was to *"produce the largest [fastest] computer in the world"*. So after some basic design work on the CDC 3000 series, he turned that over to others and went on to work on the [CDC 6600](https://en.wikipedia.org/wiki/CDC_6600). (But several unique features of the 6600 first start to appear in the 3000 series.)

Although in terms of hardware the 6600 was not on the leading edge, Cray invested considerable effort into the design of the machine in an attempt to enable it to run as fast as possible. Unlike most high-end projects, Cray realized that there was considerably more to performance than simple processor speed, that [I/O](https://en.wikipedia.org/wiki/Input/output) bandwidth had to be maximized as well in order to avoid "starving" the processor of data to crunch. As he later noted, *Anyone can build a fast CPU. The trick is to build a fast system.*[[7]](https://en.wikipedia.org/wiki/Seymour_Cray#cite_note-IEEECS-7)

The 6600 was the first commercial supercomputer, outperforming everything then available by a wide margin. While expensive, for those that needed the absolutely fastest computer available there was nothing else on the market that could compete. When other companies (namely [IBM](https://en.wikipedia.org/wiki/International_Business_Machines)) attempted to create machines with similar performance, they stumbled ([Stretch/IBM 7030](https://en.wikipedia.org/wiki/IBM_Stretch)). Indeed, the 6600 solved a critical design problem — "imprecise interrupts"[[8]](https://en.wikipedia.org/wiki/Seymour_Cray#cite_note-8) — that was largely responsible for IBM's failure. He did this by replacing I/O interrupts with a polled request issued by one of 10 so-called peripheral processors, which were built-in mini-computers that did all transfers in and out of the 6600's central memory. He then further increased the challenge in the later release the 5-fold faster [CDC 7600](https://en.wikipedia.org/wiki/CDC_7600).[[*citation needed*](https://en.wikipedia.org/wiki/Wikipedia:Citation_needed)]

In 1963, in a *Business Week* article announcing the CDC 6600, Seymour Cray clearly expressed an idea that is often misattributed to [Herb Grosch](https://en.wikipedia.org/wiki/Herb_Grosch) as so-called [Grosch's law](https://en.wikipedia.org/wiki/Grosch%27s_law):

Computers should obey a square law -- when the price doubles, you should get at least four times as much speed.[[9]](https://en.wikipedia.org/wiki/Seymour_Cray#cite_note-9)

**CDC's Chippewa Falls laboratory**[[edit](https://en.wikipedia.org/w/index.php?title=Seymour_Cray&action=edit&section=5)]

|  |  |
| --- | --- |
|  | This section includes a [list of references](https://en.wikipedia.org/wiki/Wikipedia:Citing_sources), related reading or [external links](https://en.wikipedia.org/wiki/Wikipedia:External_links), **but its sources remain unclear because it lacks**[**inline citations**](https://en.wikipedia.org/wiki/Wikipedia:Citing_sources#Inline_citations). Please help to [improve](https://en.wikipedia.org/wiki/Wikipedia:WikiProject_Fact_and_Reference_Check) this section by [introducing](https://en.wikipedia.org/wiki/Wikipedia:When_to_cite) more precise citations. *(May 2010)* *(*[*Learn how and when to remove this template message*](https://en.wikipedia.org/wiki/Help:Maintenance_template_removal)*)* |

During this period Cray had become increasingly annoyed at what he saw as interference from CDC management. Cray always demanded an absolutely quiet work environment with a minimum of management overhead, but as the company grew he found himself constantly interrupted by middle managers who — according to Cray — did little but gawk and use him as a sales tool by introducing him to prospective customers.

Cray decided that in order to continue development he would have to move from St. Paul, far enough that it would be too long a drive for a "quick visit" and long distance telephone charges would be just enough to deter most calls, yet close enough that real visits or board meetings could be attended without too much difficulty. After some debate, Norris backed him and set up a new laboratory on land Cray owned in his hometown of Chippewa Falls. Some of the reason for the move may also have to do with Cray's worries about an impending [nuclear war](https://en.wikipedia.org/wiki/Nuclear_warfare), which he felt made Minneapolis a serious safety concern. His house, built a few hundred yards from the new CDC laboratory, included a huge [bomb shelter](https://en.wikipedia.org/wiki/Fallout_shelter).

The new Chippewa Lab was set up in the middle of the 6600 project, although it does not seem to have delayed the project. After the 6600 shipped, the successor [CDC 7600](https://en.wikipedia.org/wiki/CDC_7600) system was the next product to be developed in Chippewa Falls, offering peak computational speeds of ten times the 6600. The failed follow-on to the 7600, the [CDC 8600](https://en.wikipedia.org/wiki/CDC_8600), was the project that finally ended his run of successes at CDC in 1972.

Although the 6600 and 7600 had been huge successes in the end, both projects had almost bankrupted the company while they were being designed. The 8600 was running into similar difficulties and Cray eventually decided that the only solution was to start over fresh. This time Norris was not willing to take the risk, and another project within the company, the [CDC STAR-100](https://en.wikipedia.org/wiki/CDC_STAR-100) seemed to be progressing more smoothly. Norris said he was willing to keep the project alive at a low level until the STAR was delivered, at which point full funding could be put into the 8600. Cray was unwilling to work under these conditions and left the company.

**Cray Research**[[edit](https://en.wikipedia.org/w/index.php?title=Seymour_Cray&action=edit&section=6)]

|  |  |
| --- | --- |
|  | This section includes a [list of references](https://en.wikipedia.org/wiki/Wikipedia:Citing_sources), but **its sources remain unclear** because it has **insufficient**[**inline citations**](https://en.wikipedia.org/wiki/Wikipedia:Citing_sources#Inline_citations). Please help to [improve](https://en.wikipedia.org/wiki/Wikipedia:WikiProject_Fact_and_Reference_Check) this section by [introducing](https://en.wikipedia.org/wiki/Wikipedia:When_to_cite) more precise citations. *(May 2010)* *(*[*Learn how and when to remove this template message*](https://en.wikipedia.org/wiki/Help:Maintenance_template_removal)*)* |

With a [Cray-1](https://en.wikipedia.org/wiki/Cray-1)

The split was fairly amicable, and when he started Cray Research in a new laboratory on the same Chippewa property a year later, Norris invested $300,000 in start-up money. Like CDC's organization, Cray R&D was based in Chippewa Falls and business headquarters were in Minneapolis. Unlike CDC, Cray's manufacturing was also in Chippewa Falls.

At first there was some question as to what exactly the new company should do. It did not seem that there would be any way for them to afford to develop a new computer, given that the now-large CDC had been unable to support more than one. When the President in charge of financing traveled to [Wall Street](https://en.wikipedia.org/wiki/Wall_Street) to look for [seed capital](https://en.wikipedia.org/wiki/Seed_capital), he was surprised to find that Cray's reputation was very well known. Far from struggling for some role to play in the market, the financial world was more than willing to provide Cray with all the money they would need to develop a new machine.

After several years of development, their first product was released in 1976 as the [Cray-1](https://en.wikipedia.org/wiki/Cray-1). As with earlier Cray designs, the Cray-1 made sure that the *entire* computer was fast, as opposed to just the processor. When it was released it easily beat almost every machine in terms of speed, including the STAR-100 that had beaten the 8600 for funding. The only machine able to perform on the same sort of level was the [ILLIAC IV](https://en.wikipedia.org/wiki/ILLIAC_IV), a specialized one-off machine that rarely operated near its maximum performance, except on very specific tasks. In general, the Cray-1 beat anything on the market by a wide margin.

Serial number 001 was "lent" to [Los Alamos](https://en.wikipedia.org/wiki/Los_Alamos_National_Laboratory) in 1976, and that summer the first full system was sold to the [National Center for Atmospheric Research](https://en.wikipedia.org/wiki/National_Center_for_Atmospheric_Research) for $8.8 million. The company's early estimates had suggested that they might sell a dozen such machines, based on sales of similar machines from the CDC era, so the price was set accordingly. Eventually, well over 80 Cray-1s were sold, and the company was a huge success financially.

Follow-up success was not so easy. While he worked on the [Cray-2](https://en.wikipedia.org/wiki/Cray-2), other teams delivered the two-processor [Cray X-MP](https://en.wikipedia.org/wiki/Cray_X-MP), which was another huge success and later the four-processor X-MP. When the Cray-2 was finally released after six years of development it was only marginally faster than the X-MP, largely due to very fast and large main memory, and thus sold in much smaller numbers. The Cray-2 ran at 250 MHz with a very deep pipeline, making it harder to code for than the shorter pipe X-MP.

As the [Cray-3](https://en.wikipedia.org/wiki/Cray-3) project started, he found himself once again being "bothered" too much with day-to-day tasks. In order to concentrate on design, Cray left the CEO position of Cray Research in 1980 to become an independent contractor. In 1988 he moved the Cray 3 project from Chippewa Falls to a laboratory in [Colorado Springs, Colorado](https://en.wikipedia.org/wiki/Colorado_Springs,_Colorado).

In 1989, Cray was faced with a repeat of history when the Cray-3 started to run into difficulties. An upgrade of the X-MP using high-speed memory from the Cray-2 was under development and seemed to be making real progress, and once again management was faced with two projects and limited budgets. They eventually decided to take the safer route, releasing the new design as the [Cray Y-MP](https://en.wikipedia.org/wiki/Cray_Y-MP).

**Cray Computer Corporation**[[edit](https://en.wikipedia.org/w/index.php?title=Seymour_Cray&action=edit&section=7)]

Cray decided to spin off the Colorado Springs laboratory to form **Cray Computer Corporation**. This new entity took the Cray-3 project with them.[[10]](https://en.wikipedia.org/wiki/Seymour_Cray#cite_note-10)

The 500 MHz Cray-3 proved to be Cray's second major failure. In order to provide the tenfold increase in performance that he always demanded of his newest machines, Cray decided that the machine would have to be built using [gallium arsenide](https://en.wikipedia.org/wiki/Gallium_arsenide) semiconductors.[[11]](https://en.wikipedia.org/wiki/Seymour_Cray#cite_note-11) In the past Cray had always avoided using anything even near the [state of the art](https://en.wikipedia.org/wiki/State_of_the_art), preferring to use well-known solutions and designing a fast machine based on them. In this case, Cray was developing every part of the machine, even the chips inside it.[[12]](https://en.wikipedia.org/wiki/Seymour_Cray#cite_note-12)

Nevertheless, the team was able to get the machine working and delivered their first example at NCAR on May 24, 1993.[[13]](https://en.wikipedia.org/wiki/Seymour_Cray#cite_note-13)

The machine was still essentially a prototype, and the company was using the installation to debug the design.[[14]](https://en.wikipedia.org/wiki/Seymour_Cray#cite_note-14) By this time a number of [massively parallel](https://en.wikipedia.org/wiki/Massively_parallel) machines were coming into the market at price/performance ratios the Cray-3 could not touch. Cray responded through "brute force", starting design of the [Cray-4](https://en.wikipedia.org/wiki/Cray-4) which would run at 1 GHz and outpower these machines, regardless of price.

In 1995 there had been no further sales of the Cray-3, and the ending of the [Cold War](https://en.wikipedia.org/wiki/Cold_War) made it unlikely anyone would buy enough Cray-4s to offer a return on the development funds. The company ran out of money and filed for Chapter 11 [bankruptcy](https://en.wikipedia.org/wiki/Bankruptcy) March 24, 1995.[[15]](https://en.wikipedia.org/wiki/Seymour_Cray#cite_note-15)

**SRC Computers**[[edit](https://en.wikipedia.org/w/index.php?title=Seymour_Cray&action=edit&section=8)]

Cray had always resisted the [massively parallel](https://en.wikipedia.org/wiki/Massively_parallel) solution to high-speed computing, offering a variety of reasons that it would never work as well as one very fast processor. He famously quipped "If you were plowing a field, which would you rather use: Two strong oxen or 1024 chickens?" By the mid-1990s this argument was becoming increasingly difficult to justify, and modern [compiler](https://en.wikipedia.org/wiki/Compiler) technology made developing programs on such machines not much more difficult than their simpler counterparts.[[*citation needed*](https://en.wikipedia.org/wiki/Wikipedia:Citation_needed)]

Cray set up a new company, **SRC Computers**, and started the design of his own massively parallel machine. The new design concentrated on communications and memory performance, the bottleneck that hampered many parallel designs. Design had just started when Cray died suddenly as a result of a car accident. SRC Computers carried on development and now specializes in [reconfigurable computing](https://en.wikipedia.org/wiki/Reconfigurable_computing).

Technical approaches[[edit](https://en.wikipedia.org/w/index.php?title=Seymour_Cray&action=edit&section=9)]

Cray frequently cited two important aspects to his design philosophy: remove heat, and ensure that all signals that are supposed to arrive somewhere at the same time do indeed arrive at the same time.[[16]](https://en.wikipedia.org/wiki/Seymour_Cray#cite_note-16)

His computers were equipped with built-in cooling systems, extending ultimately to coolant channels cast into the mainframes and thermally coupled to metal plates within the circuit boards, and to systems immersed in coolants. In a story he told about himself, he realized early in his career that he should interlock the computers with the cooling systems so that the computers would not operate unless the cooling systems were operational. It did not originally occur to him to interlock in the other direction until a customer reported that localized power outages had shut down their computer, but left the cooling system running — so they arrived in the morning to find the machine encased in ice.

Cray addressed the problem of [skew](https://en.wikipedia.org/wiki/Clock_skew) by ensuring that every signal path in his later computers was the same electrical length, so that values that were to be acted upon at a particular time were indeed all valid values. When required, he would run the traces back and forth on the circuit boards until the desired length was achieved, and he employed [Maxwell's equations](https://en.wikipedia.org/wiki/Maxwell%27s_equations) in design of the boards to ensure that any radio frequency effects which altered the signal velocity and hence the electrical path length were accounted for.

When asked what kind of CAD tools he used for the Cray-1, Cray said that he liked #3 pencils with [quad paper](https://en.wikipedia.org/wiki/Graph_paper) pads. Cray recommended using the backs of the pages so that the lines were not so dominant. When he was told that [Apple Computer](https://en.wikipedia.org/wiki/Apple_Computer) had just bought a Cray to help design the next [Apple Macintosh](https://en.wikipedia.org/wiki/Apple_Macintosh), Cray commented that he had just bought a Macintosh to design the next Cray.[[17]](https://en.wikipedia.org/wiki/Seymour_Cray#cite_note-17)

Personal life[[edit](https://en.wikipedia.org/w/index.php?title=Seymour_Cray&action=edit&section=10)]

Cray avoided publicity, and there are a number of unusual tales about his life away from work (termed "Rollwagenisms", from then-CEO of Cray Research, John A. Rollwagen). He enjoyed [skiing](https://en.wikipedia.org/wiki/Skiing), [wind surfing](https://en.wikipedia.org/wiki/Wind_surfing), [tennis](https://en.wikipedia.org/wiki/Tennis), and other sports. Another favorite pastime was digging a tunnel under his home; he attributed the secret of his success to "visits by [elves](https://en.wikipedia.org/wiki/Elf)" while he worked in the tunnel: "While I'm digging in the tunnel, the elves will often come to me with solutions to my problem."[[18]](https://en.wikipedia.org/wiki/Seymour_Cray#cite_note-pcw-elves-18)[[19]](https://en.wikipedia.org/wiki/Seymour_Cray#cite_note-time-elves-19)

Cray died on October 5, 1996, two weeks after his car was struck on the highway and rolled several times.[[20]](https://en.wikipedia.org/wiki/Seymour_Cray#cite_note-20)[[21]](https://en.wikipedia.org/wiki/Seymour_Cray#cite_note-21)

The [IEEE Computer Society](https://en.wikipedia.org/wiki/IEEE_Computer_Society)'s [Seymour Cray Computer Engineering Award](https://en.wikipedia.org/wiki/Seymour_Cray_Computer_Engineering_Award),[[22]](https://en.wikipedia.org/wiki/Seymour_Cray#cite_note-22) established in late 1997, recognizes innovative contributions to high performance computing systems exemplifying Cray's creative spirit.

See also[[edit](https://en.wikipedia.org/w/index.php?title=Seymour_Cray&action=edit&section=11)]

* [Charles Babbage Institute](https://en.wikipedia.org/wiki/Charles_Babbage_Institute)
* [Cray-3/SSS](https://en.wikipedia.org/wiki/Cray-3/SSS)
* [John Vincent Atanasoff](https://en.wikipedia.org/wiki/John_Vincent_Atanasoff)

Notes[[edit](https://en.wikipedia.org/w/index.php?title=Seymour_Cray&action=edit&section=12)]

* 1. [**Jump up^**](https://en.wikipedia.org/wiki/Seymour_Cray#cite_ref-1) [Seymour Cray Obituary by John Markoff](http://pages.cs.wisc.edu/~bezenek/cray.html)
  2. ^ [Jump up to:***a***](https://en.wikipedia.org/wiki/Seymour_Cray#cite_ref-Lazou_2-0) [***b***](https://en.wikipedia.org/wiki/Seymour_Cray#cite_ref-Lazou_2-1) [Obituary - Seymour Cray, Father of supercomputing](http://www.hoise.com/primeur/96/pr-96-oct/CL-PR-10-96-3.html)
  3. [**Jump up^**](https://en.wikipedia.org/wiki/Seymour_Cray#cite_ref-3) [*"Tribute to Seymour Cray"*](http://www.cgl.ucsf.edu/home/tef/cray/tribute.html)*. Retrieved 14 October 2014.*
  4. [**Jump up^**](https://en.wikipedia.org/wiki/Seymour_Cray#cite_ref-4) [*"Quote by Joel Birnbaum"*](http://research.microsoft.com/users/gbell/craytalk/sld078.htm)*. Retrieved 14 October 2014.*
  5. [**Jump up^**](https://en.wikipedia.org/wiki/Seymour_Cray#cite_ref-5) Murray (1997), pp. 46-47
  6. [**Jump up^**](https://en.wikipedia.org/wiki/Seymour_Cray#cite_ref-6) Murray (1997), pp. 47-48
  7. ^ [Jump up to:***a***](https://en.wikipedia.org/wiki/Seymour_Cray#cite_ref-IEEECS_7-0) [***b***](https://en.wikipedia.org/wiki/Seymour_Cray#cite_ref-IEEECS_7-1) [***c***](https://en.wikipedia.org/wiki/Seymour_Cray#cite_ref-IEEECS_7-2) [*"Tribute to Seymour Cray"*](http://www.webcitation.org/5pOwR2VJX)*. IEEE Computer Society. Archived from*[*the original*](http://www.computer.org/portal/web/awards/seymourbio)*on 2010-05-01.*
  8. [**Jump up^**](https://en.wikipedia.org/wiki/Seymour_Cray#cite_ref-8) *Smotherman, Mark (2010),*[*IBM Stretch (7030) — Aggressive Uniprocessor Parallelism*](http://people.cs.clemson.edu/~mark/stretch.html)*, retrieved 25 May 2013*
  9. [**Jump up^**](https://en.wikipedia.org/wiki/Seymour_Cray#cite_ref-9) "Computers get faster than ever", Business Week (31 August 1963): p. 28.
  10. [**Jump up^**](https://en.wikipedia.org/wiki/Seymour_Cray#cite_ref-10) [*Cray-3*](http://archive.computerhistory.org/resources/access/text/2010/02/102685990-05-01-acc.pdf)*(PDF). Cray Computer Corporation. August 1993. Retrieved 26 May 2017.*
  11. [**Jump up^**](https://en.wikipedia.org/wiki/Seymour_Cray#cite_ref-11) *Cray, Seymour.*[*"What's all this about Gallium Arsenide?"*](https://www.youtube.com/watch?v=xW7j2ipE2Ck)*. YouTube. Retrieved 26 May2017.*
  12. [**Jump up^**](https://en.wikipedia.org/wiki/Seymour_Cray#cite_ref-12) [*"Cray-3"*](https://www2.cisl.ucar.edu/supercomputer/graywolf)*. www2.cisl.ucar.edu. NCAR. Retrieved 26 May 2017.*
  13. [**Jump up^**](https://en.wikipedia.org/wiki/Seymour_Cray#cite_ref-13) *Watts, H.R. (1993).*[*"The future of GaAs in the CRAY-3 and CRAY-4 supercomputers"*](http://ieeexplore.ieee.org/document/394484/)*. Gallium Arsenide Integrated Circuit (GaAs IC) Symposium, 1993. Technical Digest 1993., 15th Annual.*[*doi*](https://en.wikipedia.org/wiki/Digital_object_identifier)*:*[*10.1109/GAAS.1993.394484*](https://doi.org/10.1109%2FGAAS.1993.394484)*. Retrieved 26 May 2017.*
  14. [**Jump up^**](https://en.wikipedia.org/wiki/Seymour_Cray#cite_ref-14) *Engel, Tom (26 May 2010).*[*"HPC at NCAR: Past, Present and Future"*](https://cug.org/5-publications/proceedings_attendee_lists/CUG10CD/pages/1-program/final_program/CUG10_Proceedings/pages/authors/11-15Wednesday/14A-CUG2010_Engel_HPC_at_NCAR_paper.pdf)*(PDF). Cray User's Group Proceedings: 1–13. Retrieved 26 May 2017.*
  15. [**Jump up^**](https://en.wikipedia.org/wiki/Seymour_Cray#cite_ref-15) [*"Case Details"*](https://www.unitedstatescourts.org/federal/cob/37203/)*. www.unitedstatescourts.org. Retrieved 26 May 2017.*
  16. [**Jump up^**](https://en.wikipedia.org/wiki/Seymour_Cray#cite_ref-16) Customer presentation by Seymour Cray, c1979
  17. [**Jump up^**](https://en.wikipedia.org/wiki/Seymour_Cray#cite_ref-17) According to [Jim Gray](https://en.wikipedia.org/wiki/Jim_Gray_(computer_scientist)) (quoted by [C. Gordon Bell](https://en.wikipedia.org/wiki/C._Gordon_Bell) in his ["Seymour Cray Perspective"](http://research.microsoft.com/users/gbell/craytalk/sld089.htm))
  18. [**Jump up^**](https://en.wikipedia.org/wiki/Seymour_Cray#cite_ref-pcw-elves_18-0) *Howard, Toby (February 1997).*[*"Seymour Cray - An Appreciation"*](http://www.cs.man.ac.uk/~toby/writing/PCW/cray.htm)*.*[*Personal Computer World*](https://en.wikipedia.org/wiki/Personal_Computer_World)*. Retrieved 18 March 2010.*
  19. [**Jump up^**](https://en.wikipedia.org/wiki/Seymour_Cray#cite_ref-time-elves_19-0) [*"Technology: Just Dig While You Work"*](http://www.time.com/time/magazine/article/0,9171,967095,00.html)*.*[*Time*](https://en.wikipedia.org/wiki/Time_(magazine))*.*[*Time Inc.*](https://en.wikipedia.org/wiki/Time_Inc.)*1988-03-28. Retrieved 18 March 2010.*
  20. [**Jump up^**](https://en.wikipedia.org/wiki/Seymour_Cray#cite_ref-20) [*"Computer pioneer Cray hurt"*](http://journaltimes.com/news/national/computer-pioneer-cray-hurt/article_b802aac0-81ed-5135-a041-a2126170a173.html)*. Retrieved 2016-08-01.*
  21. [**Jump up^**](https://en.wikipedia.org/wiki/Seymour_Cray#cite_ref-21) *Jason Pepper.*[*"Seymour Cray"*](http://ei.cs.vt.edu/~history/Cray.Pepper.html)*. Retrieved 2010-05-01.*
  22. [**Jump up^**](https://en.wikipedia.org/wiki/Seymour_Cray#cite_ref-22) [*"IEEE Computer Society Award List"*](http://awards.computer.org/ana/award/viewAwards.action)*. IEEE Computer Society. Retrieved 2010-05-01.*

References[[edit](https://en.wikipedia.org/w/index.php?title=Seymour_Cray&action=edit&section=13)]

* *Bell, Gordon (November 10, 1997).*[*"A Seymour Cray Perspective"*](http://research.microsoft.com/users/gbell/craytalk/sld001.htm)*. Microsoft Research.*
* *Howard, Toby (February 1997).*[*"Seymour Cray: An Appreciation"*](http://www.cs.man.ac.uk/aig/staff/toby/writing/PCW/cray.htm)*. Personal Computer World.*
* *Murray, Charles J. (1997). The Supermen: The Story of Seymour Cray and the Technical Wizards behind the Supercomputer. John Wiley & Sons.*[*ISBN*](https://en.wikipedia.org/wiki/International_Standard_Book_Number)[*0-471-04885-2*](https://en.wikipedia.org/wiki/Special:BookSources/0-471-04885-2)*.*
* *Pagelkopf, Don; et al. (1975).*[*"Reminiscences of computer architecture and computer design at Control Data Corporation"*](http://purl.umn.edu/104327)*. University of Minnesota Digital Conservancy.*[*Charles Babbage Institute*](https://en.wikipedia.org/wiki/Charles_Babbage_Institute)*.* Discussion topics include [Control Data Corporation](https://en.wikipedia.org/wiki/Control_Data_Corporation), [CDC 1604](https://en.wikipedia.org/wiki/CDC_1604), [CDC 6600](https://en.wikipedia.org/wiki/CDC_6600), [CDC 7600](https://en.wikipedia.org/wiki/CDC_7600), [CDC 8600](https://en.wikipedia.org/wiki/CDC_8600), [CDC STAR-100](https://en.wikipedia.org/wiki/CDC_STAR-100) and Seymour Cray.

External links[[edit](https://en.wikipedia.org/w/index.php?title=Seymour_Cray&action=edit&section=14)]

* [Seymour Cray Oral History](http://www.cwheroes.org/archives/histories/Cray.pdf)
* Quotations related to [Seymour Cray](https://en.wikiquote.org/wiki/Special:Search/Seymour_Cray) at Wikiquote
* [An Imaginary Tour of a Biological Computer (Why Computer Professionals and Molecular Biologists Should Start Collaborating): Remarks of Seymour Cray to the Shannon Center for Advanced Studies, University of Virginia, May 30, 1996](http://americanhistory.si.edu/comphist/montic/cray.htm)

|  |  |
| --- | --- |
| [**Authority control**](https://en.wikipedia.org/wiki/Help:Authority_control) | * [WorldCat Identities](https://www.worldcat.org/identities/containsVIAFID/72205525) * [VIAF](https://en.wikipedia.org/wiki/Virtual_International_Authority_File): [72205525](https://viaf.org/viaf/72205525) * [LCCN](https://en.wikipedia.org/wiki/Library_of_Congress_Control_Number): [n96083562](http://id.loc.gov/authorities/names/n96083562) * [GND](https://en.wikipedia.org/wiki/Integrated_Authority_File): [119503867](http://d-nb.info/gnd/119503867) * [NDL](https://en.wikipedia.org/wiki/National_Diet_Library): [00720489](https://id.ndl.go.jp/auth/ndlna/00720489) |

[Categories](https://en.wikipedia.org/wiki/Help:Category):

* [American electrical engineers](https://en.wikipedia.org/wiki/Category:American_electrical_engineers)
* [American technology company founders](https://en.wikipedia.org/wiki/Category:American_technology_company_founders)
* [Computer designers](https://en.wikipedia.org/wiki/Category:Computer_designers)
* [1925 births](https://en.wikipedia.org/wiki/Category:1925_births)
* [1996 deaths](https://en.wikipedia.org/wiki/Category:1996_deaths)
* [Cray](https://en.wikipedia.org/wiki/Category:Cray)
* [Cray employees](https://en.wikipedia.org/wiki/Category:Cray_employees)
* [Control Data Corporation](https://en.wikipedia.org/wiki/Category:Control_Data_Corporation)
* [Howard N. Potts Medal recipients](https://en.wikipedia.org/wiki/Category:Howard_N._Potts_Medal_recipients)
* [People from Chippewa Falls, Wisconsin](https://en.wikipedia.org/wiki/Category:People_from_Chippewa_Falls,_Wisconsin)
* [Road incident deaths in Colorado](https://en.wikipedia.org/wiki/Category:Road_incident_deaths_in_Colorado)
* [University of Minnesota alumni](https://en.wikipedia.org/wiki/Category:University_of_Minnesota_alumni)

Navigation menu

* Not logged in
* [Talk](https://en.wikipedia.org/wiki/Special:MyTalk)
* [Contributions](https://en.wikipedia.org/wiki/Special:MyContributions)
* [Create account](https://en.wikipedia.org/w/index.php?title=Special:CreateAccount&returnto=Seymour+Cray)
* [Log in](https://en.wikipedia.org/w/index.php?title=Special:UserLogin&returnto=Seymour+Cray)
* [Article](https://en.wikipedia.org/wiki/Seymour_Cray)
* [Talk](https://en.wikipedia.org/wiki/Talk:Seymour_Cray)
* [Read](https://en.wikipedia.org/wiki/Seymour_Cray)
* [Edit](https://en.wikipedia.org/w/index.php?title=Seymour_Cray&action=edit)
* [View history](https://en.wikipedia.org/w/index.php?title=Seymour_Cray&action=history)

**Search**

Top of Form



Bottom of Form

* [Main page](https://en.wikipedia.org/wiki/Main_Page)
* [Contents](https://en.wikipedia.org/wiki/Portal:Contents)
* [Featured content](https://en.wikipedia.org/wiki/Portal:Featured_content)
* [Current events](https://en.wikipedia.org/wiki/Portal:Current_events)
* [Random article](https://en.wikipedia.org/wiki/Special:Random)
* [Donate to Wikipedia](https://donate.wikimedia.org/wiki/Special:FundraiserRedirector?utm_source=donate&utm_medium=sidebar&utm_campaign=C13_en.wikipedia.org&uselang=en)
* [Wikipedia store](https://shop.wikimedia.org/)

Interaction

* [Help](https://en.wikipedia.org/wiki/Help:Contents)
* [About Wikipedia](https://en.wikipedia.org/wiki/Wikipedia:About)
* [Community portal](https://en.wikipedia.org/wiki/Wikipedia:Community_portal)
* [Recent changes](https://en.wikipedia.org/wiki/Special:RecentChanges)
* [Contact page](https://en.wikipedia.org/wiki/Wikipedia:Contact_us)

Tools

* [What links here](https://en.wikipedia.org/wiki/Special:WhatLinksHere/Seymour_Cray)
* [Related changes](https://en.wikipedia.org/wiki/Special:RecentChangesLinked/Seymour_Cray)
* [Upload file](https://en.wikipedia.org/wiki/Wikipedia:File_Upload_Wizard)
* [Special pages](https://en.wikipedia.org/wiki/Special:SpecialPages)
* [Permanent link](https://en.wikipedia.org/w/index.php?title=Seymour_Cray&oldid=790597046)
* [Page information](https://en.wikipedia.org/w/index.php?title=Seymour_Cray&action=info)
* [Wikidata item](https://www.wikidata.org/wiki/Special:EntityPage/Q92765)
* [Cite this page](https://en.wikipedia.org/w/index.php?title=Special:CiteThisPage&page=Seymour_Cray&id=790597046)

Print/export

* [Create a book](https://en.wikipedia.org/w/index.php?title=Special:Book&bookcmd=book_creator&referer=Seymour+Cray)
* [Download as PDF](https://en.wikipedia.org/w/index.php?title=Special:ElectronPdf&page=Seymour+Cray&action=show-selection-screen&coll-download-url=%2Fw%2Findex.php%3Ftitle%3DSpecial%3ABook%26bookcmd%3Drender_article%26arttitle%3DSeymour%2BCray%26returnto%3DSeymour%2BCray%26oldid%3D790597046%26writer%3Drdf2latex)
* [Printable version](https://en.wikipedia.org/w/index.php?title=Seymour_Cray&printable=yes)

In other projects

* [Wikiquote](https://en.wikiquote.org/wiki/Seymour_Cray)

Languages

* [العربية](https://ar.wikipedia.org/wiki/%D8%B3%D9%8A%D9%85%D9%88%D8%B1_%D9%83%D8%B1%D8%A7%D9%8A)
* [Asturianu](https://ast.wikipedia.org/wiki/Seymour_Cray)
* [Azərbaycanca](https://az.wikipedia.org/wiki/Seymur_Krey)
* [Bosanski](https://bs.wikipedia.org/wiki/Seymour_Cray)
* [Català](https://ca.wikipedia.org/wiki/Seymour_Cray)
* [Čeština](https://cs.wikipedia.org/wiki/Seymour_Cray)
* [Dansk](https://da.wikipedia.org/wiki/Seymour_R._Cray)
* [Deutsch](https://de.wikipedia.org/wiki/Seymour_Cray)
* [Español](https://es.wikipedia.org/wiki/Seymour_Cray)
* [Euskara](https://eu.wikipedia.org/wiki/Seymour_Cray)
* [فارسی](https://fa.wikipedia.org/wiki/%D8%B3%DB%8C%D9%85%D9%88%D8%B1_%DA%A9%D8%B1%DB%8C)
* [Français](https://fr.wikipedia.org/wiki/Seymour_Cray)
* [Hrvatski](https://hr.wikipedia.org/wiki/Seymour_Cray)
* [Italiano](https://it.wikipedia.org/wiki/Seymour_Cray)
* [עברית](https://he.wikipedia.org/wiki/%D7%A1%D7%99%D7%9E%D7%95%D7%A8_%D7%A7%D7%A8%D7%99%D7%99)
* [Malagasy](https://mg.wikipedia.org/wiki/Seymour_Cray)
* [മലയാളം](https://ml.wikipedia.org/wiki/%E0%B4%B8%E0%B5%86%E0%B4%AF%E0%B5%8D%E0%B4%AE%E0%B5%82%E0%B5%BC_%E0%B4%95%E0%B5%8D%E0%B4%B0%E0%B5%87)
* [मराठी](https://mr.wikipedia.org/wiki/%E0%A4%B8%E0%A5%87%E0%A4%AE%E0%A5%82%E0%A4%B0_%E0%A4%95%E0%A5%8D%E0%A4%B0%E0%A5%87)
* [Монгол](https://mn.wikipedia.org/wiki/%D0%A1%D1%8D%D0%B9%D0%BC%D1%83%D1%80_%D0%9A%D1%80%D1%8D%D0%B9)
* [Nederlands](https://nl.wikipedia.org/wiki/Seymour_Cray)
* [日本語](https://ja.wikipedia.org/wiki/%E3%82%B7%E3%83%BC%E3%83%A2%E3%82%A2%E3%83%BB%E3%82%AF%E3%83%AC%E3%82%A4)
* [Norsk](https://no.wikipedia.org/wiki/Seymour_R._Cray)
* [Polski](https://pl.wikipedia.org/wiki/Seymour_Cray)
* [Português](https://pt.wikipedia.org/wiki/Seymour_Cray)
* [Русский](https://ru.wikipedia.org/wiki/%D0%9A%D1%80%D1%8D%D0%B9,_%D0%A1%D0%B5%D0%B9%D0%BC%D1%83%D1%80)
* [Shqip](https://sq.wikipedia.org/wiki/Seymour_Cray)
* [Српски / srpski](https://sr.wikipedia.org/wiki/Simor_Krej)
* [Suomi](https://fi.wikipedia.org/wiki/Seymour_Cray)
* [Svenska](https://sv.wikipedia.org/wiki/Seymour_Cray)
* [Türkçe](https://tr.wikipedia.org/wiki/Seymour_Cray)
* [Українська](https://uk.wikipedia.org/wiki/%D0%A1%D0%B5%D0%B9%D0%BC%D1%83%D1%80_%D0%9A%D1%80%D0%B5%D0%B9)
* [Winaray](https://war.wikipedia.org/wiki/Seymour_Cray)

[Edit links](https://www.wikidata.org/wiki/Special:EntityPage/Q92765#sitelinks-wikipedia)

* This page was last edited on 14 July 2017, at 20:00.
* Text is available under the [Creative Commons Attribution-ShareAlike License](https://en.wikipedia.org/wiki/Wikipedia:Text_of_Creative_Commons_Attribution-ShareAlike_3.0_Unported_License); additional terms may apply. By using this site, you agree to the [Terms of Use](https://wikimediafoundation.org/wiki/Terms_of_Use) and [Privacy Policy](https://wikimediafoundation.org/wiki/Privacy_policy). Wikipedia® is a registered trademark of the [Wikimedia Foundation, Inc.](https://www.wikimediafoundation.org/), a non-profit organization.
* [Privacy policy](https://wikimediafoundation.org/wiki/Privacy_policy)
* [About Wikipedia](https://en.wikipedia.org/wiki/Wikipedia:About)
* [Disclaimers](https://en.wikipedia.org/wiki/Wikipedia:General_disclaimer)
* [Contact Wikipedia](https://en.wikipedia.org/wiki/Wikipedia:Contact_us)
* [Developers](https://www.mediawiki.org/wiki/Special:MyLanguage/How_to_contribute)
* [Cookie statement](https://wikimediafoundation.org/wiki/Cookie_statement)
* [Mobile view](https://en.m.wikipedia.org/w/index.php?title=Seymour_Cray&mobileaction=toggle_view_mobile)