Photos: The 10,000 Year Clock

Photos by James Martin/CNET

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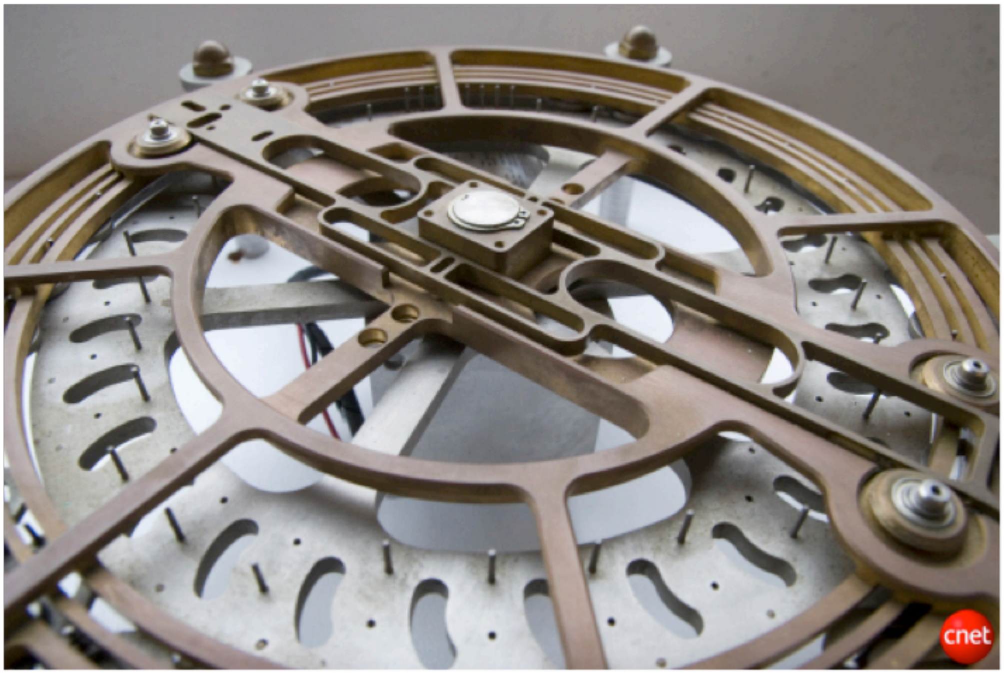
A multimillennial mechanical monument, the Long Now Foundation's 10,000 Year Clock is a work existing at the intersection of art, science, and engineering, and is a thinker's window into the past, present, and future of humanity itself.

Computer scientist Danny Hillis conceived of the 10,000 Year Clock project as a monument to long-term thinking. The design and development on the clock began in 1997 and has itself been a long-term and time-consuming process, already having generated an array of ideas and prototypes as well as mechanical and design patents. The designers hope that with a longer sense of time will come a more broad and long-term way of thinking, and a greater sense of what is possible in the future.

The Long Now Museum and Store, at Fort Mason Center in San Francisco, is free and open to the public.

Running under its own power, the clock is an experiment in art, science, and engineering. The six dials on the face of this machine will represent the year, century, horizons, sun position, lunar phase, and the stars of the night sky over a 10,000-year period. Likely to span multiple generations and evolutions in culture, the thinking and design put into the monument makes it a moving sculpture as beautiful as it is complex.

A 22-pound sphere of Tungsten, an incredibly dense and tough material, will be used for the pendulums of the clock. Because of its dense nature, a large mass can be formed into a small space, minimizing air drag and reducing energy loss. The high density of the Tugnsten is also important because it will prevent minute timing variation that may be caused by changes in the temperature, water vapor, and barometric pressure in other materials.

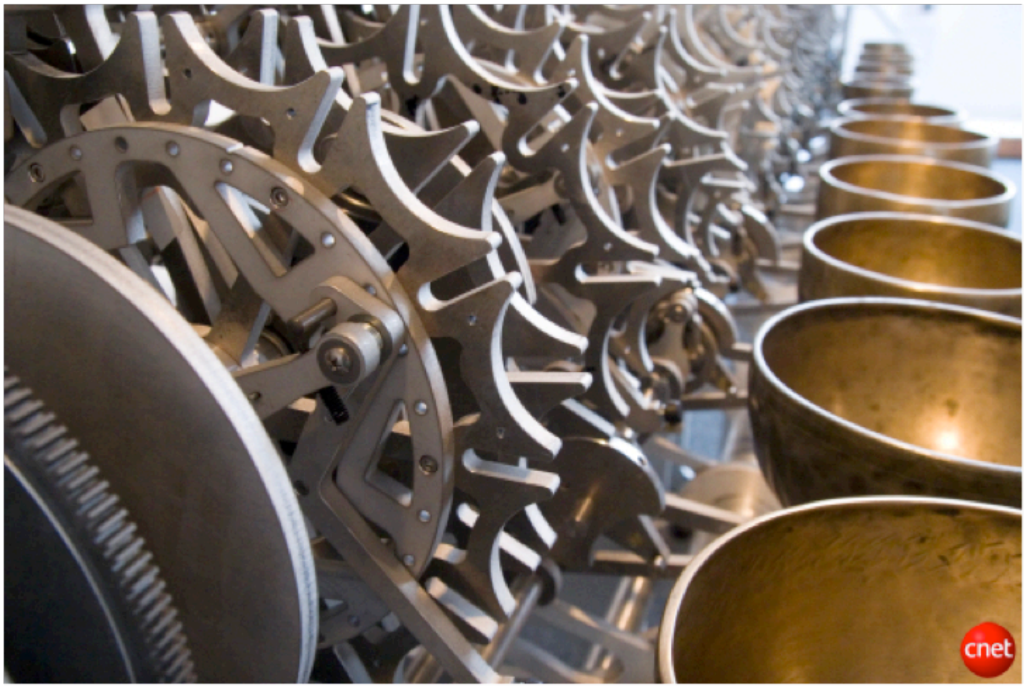


Using binary notation, 26 movable bit levers inside each bit serial adder convert the swing from the pendulum into a visible notation on the clock. Although there is no projected date of completion for the project, the first prototype is currently on display in the Making the Modern World exhibit at the Science Museum in London.

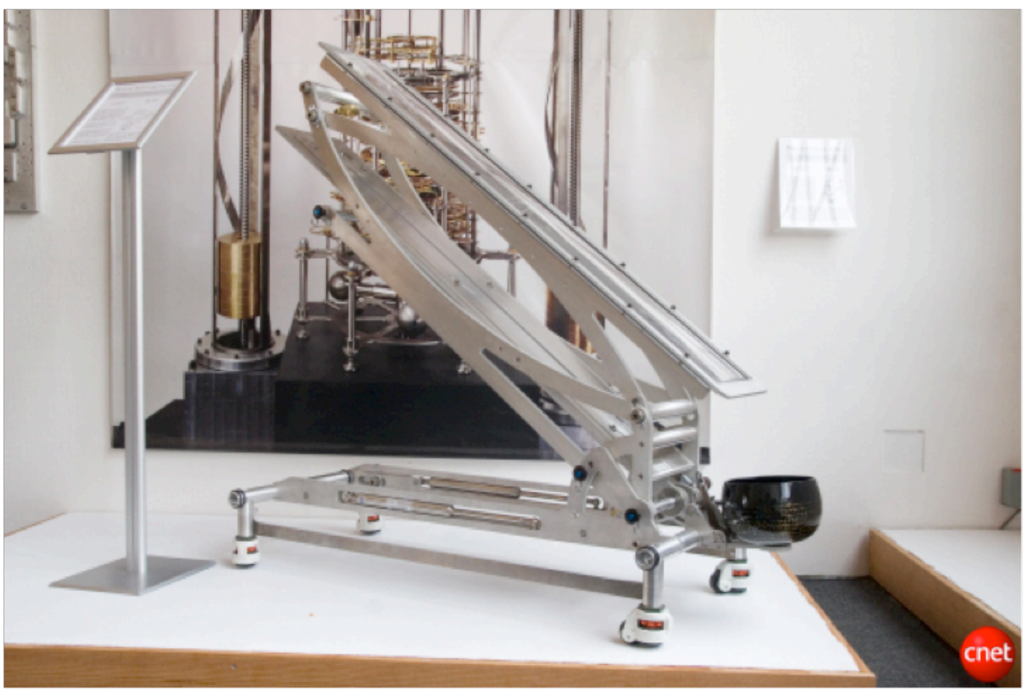
The bit serial adder system was chosen over a normal gear system because of the number of gears it takes to make the clock's calculations. The computer-like mechanical bit pin binary array is more accurate and causes less friction over the clock's long life.

Below the planetary display, each bit serial adder controls one element of the display, the orrery, each of them corresponding to calculate that planet's orbit. The orrery is a spin-off project and the result of brainstorming for the clock, and was completed in 2005.

Due to the elliptical orbit of Earth, variations in the absolute time kept by the pendulum and solar time can vary by as much as +/- 15 minutes each year. The Equation of Time Cam measures the difference in these two times and recalibrates the clock, while also correcting for the Earth's axis wobble and 1 second per century decrease in speed.



Using a progressive algorithm, large star-shaped plates, called Geneva Wheels, running down the center of the clock will generate a different bell ringing order for each day of the next 10,000 years.

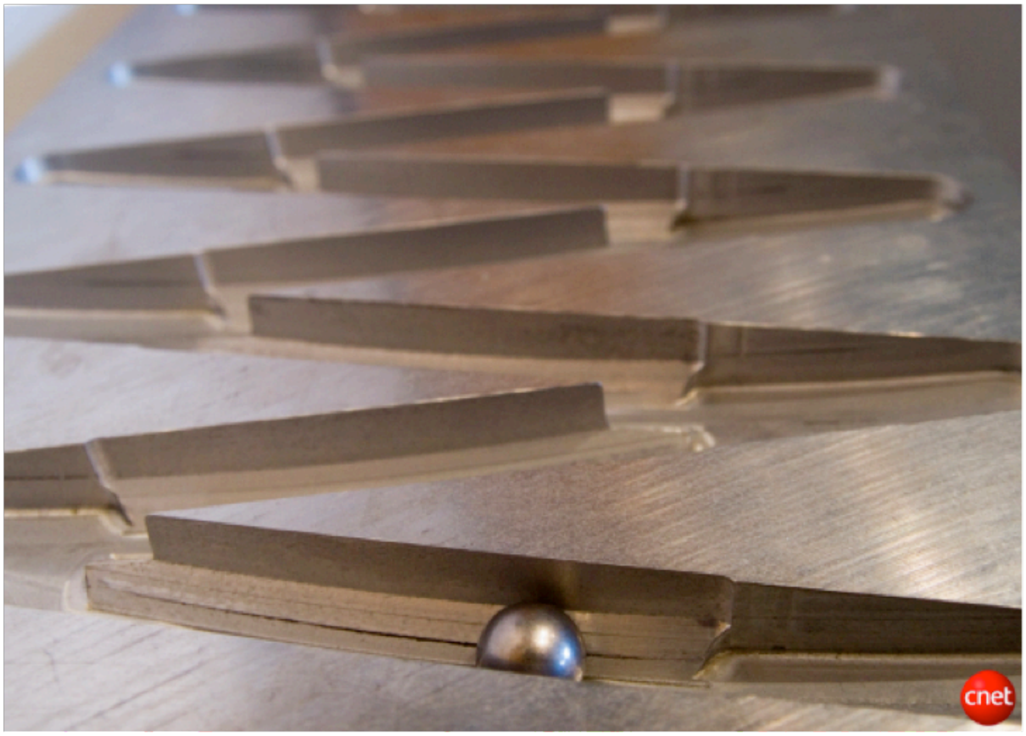


Sunlight striking a wire will allow this solar synchronizer to make minute adjustments and realign the clock's absolute time pendulum with true solar time.

The sunlight shining through the glass lens at precisely noon is focused onto the nickel-titanium wire below which contracts when heated by the sun syncing the clock's absolute time pendulum with true solar time.

This small scale model of the clock shows the plans for the stair in relation to what is planned to eventually be the 60-foot clock tower.

Power for the clock will come from two huge helical weight drives on the sides of the clock. While the mechanical principles behind these are hundreds of years old, the Long Now Foundation patented a rewind system to be used in the clock. When wound to the top, the nut inside the brass weights contributes a spinning force on the center ball screw.



As the clock is developed, many different mechanical devices are being explored for their accuracy and longevity. This zig-zag ball-roll timer was patented by William Cosgrove in 1808, but its design proved too inaccurate for use in the clock due to small variations in angle and friction. Engineers at the Long Now Foundation explored this device as a possible alternative to the pendulum design, and attempted to improve upon it by giving the zig-zagged grooves a curved path for the ball to travel.

If all goes according to plan, these gears will power the chiming device that will be heard ringing 75 miles southeast of Ely, Nev., on a mountain top, in a bristlecone pine forest near Great Basin National Park. That's where the Long Now Foundation is planning to build its 10,000 Year Clock tucked inside white limestone cliffs.