

The Long and Short of It

10,000 Year Clock Needs Bearings that Run for 350 Million Cycles

Matthew Jaster, Senior Editor

In the future, a determined hiker will journey to a mountain in Western Texas and find the entrance to a remarkable engineering project.

Deep inside the mountain lies a clock—hundreds of feet tall—designed to run for a span of 10,000 years.

The 10,000 Year Clock project was conceived by Danny Hillis, a polymath inventor, computer engineer and designer that wanted to inform and enlighten people in the future about the manufacturing ingenuity of our past.

The goal was to build a clock in the middle of a mountain that would tick once a year, the century hand would advance once every 100 years and the cuckoo would show up on the millennium. Hillis and Stewart Brand launched a non-profit organization—the Long Now Foundation—to begin various prototypes of a clock that would essentially run for 10,000 years.

One of the key engineering hurdles in the project was determining what kind of bearings would be able to outlast most metals, rotate at very low speeds and require no lubrication. The Long Now Foundation basically needed a bearing that would work through 350 million cycles. The logical choice was ceramic bearings.

“Boca Bearings had a full range of bearings and sent some samples to the Long Now Foundation,” said Jason Flanzbaum, president at Boca Bearings. “Testing those samples revealed that those bearings were the only ones that could do 350 million cycles without lubrication, with high corrosion resistance and unparalleled working life and high efficiency.”

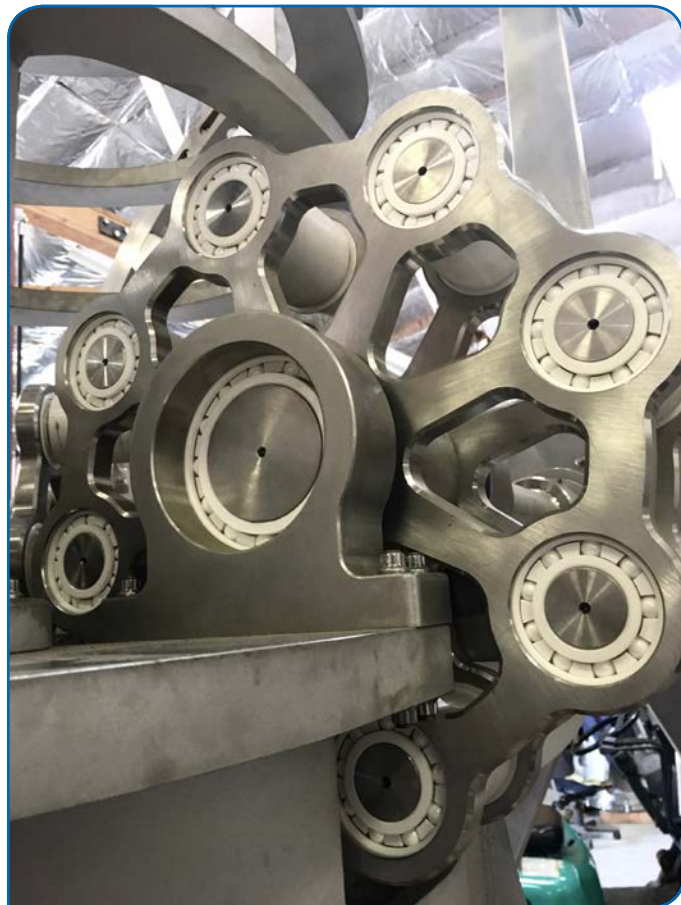
In order to accomplish this, Boca developed several cycle-testing setups to simulate the working life that the gears, springs and bearings will experience for 10,000 years.

“The Long Now Foundation decided to use ceramics because during the cycle testing only full ceramic bearings performed within the tolerance for the working life of the clock,” Flanzbaum said. “In addition, this option is the only one that does not require added lubrication, which is a must for a system that is going to run unattended for several decades. We have tested bearings through 350 million cycles with positive results that exceeded our expectations.”

The only way the clock will tell the correct time is with the assistance of visitors to the mountain. They can add energy to the clock’s storage system by winding up a capstan, in which a series of differentials turn three large pinion gears. These gears mesh with the three arms of the rack segments, which in turn connect the power system to the counterweight.

Flanzbaum was amazed at the thought and detail that have gone into the 10,000 Year Clock.

“Participating in a project like this allows us to develop long-term thinking. We are all here for a certain period of time and we have to make it count. What are we going to pass



The pinion gear that is part of the energy storage system.

on to future generations? The idea here is to inspire people and try to change the way they think about time; try to make them take advantage of it. Once in a while, we should take a moment to reflect about what we are doing in a long-term basis and ask ourselves, are we going in the right direction?” Flanzbaum said.

Though the completion date is not confirmed, construction has begun inside the mountain in Texas and the clock itself is being machined in California and Seattle. The 10,000 Year Clock might very well be the kind of massive project that helps link the technology of the past with the technology of the future.

“We should always be cognizant of the future to know where we’re headed and how exactly we’re getting there,” Flanzbaum added.

To learn more about the 10,000 Year Clock visit www.longnow.org or read our article about its backstory here: www.geartechology.com/issues/0709x/addendum.pdf. To learn more about Boca Bearings role in the project visit www.youtube.com/watch?v=M7eDpynPNYo. **PTE**