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NEWS! From the **NAVAL OBSERVATORY**

U.S. NAVAL OBSERVATORY

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FOR IMMEDIATE RELEASE

Fifteen years young – Rubidium Fountains continue service to the Navy’s Master Clock

WASHINGTON, D.C. – As of March 2026, the rubidium fountain clocks have met the benchmark of 15 years of continuous operation as part of the U.S. Naval Observatory’s Master Clock ensemble. Developed and built at the observatory, these clocks were originally brought online in 2011, and their integration as part of the Master Clock shortly after enabled the generation of a time-scale more precise than any other in the world, a standard that continues to be the case today.

From the internet on your laptop to the cell phone you hold in your hand, chances are you are on the receiving end of a time signal with origins from the U.S. Naval Observatory’s Master Clock. While users all around the world use products and services that rely on time generated at the observatory, the U.S. Naval Observatory’s Master Clock serves as the official time standard for the Department of War, across all branches of the U.S. Military.

“The fountains are an incredible piece of technology and play a critical role in the observatory’s time services,” says Steve Peil, Chief Scientist of the Naval Observatory’s Precise Time Department. The Precise Time Department oversees the operation of the observatory’s Master Clock in Washington, D.C. and its Alternate Master Clock located in Colorado Springs.

Peil, who was part of the research and development group for the rubidium fountains back in the early 2000's, notes, "the performance of these clocks over the last 15 years has well-exceeded our expectations. They have continued their steady operations, even with events like the earthquake we had in August 2011, which occurred not long after the clocks were first integrated. That is a testament to the talent of our staff from development, to production and operations."

The Naval Observatory has a long history of timekeeping, dating all the way back to 1845 with the installation of a Time Ball at its original location in the Foggy Bottom area of Washington D.C. When the observatory moved to its current location just north of Georgetown in 1893, dissemination of time via the Time Ball continued until 1936. Customers today receive time from the Naval Observatory through a variety of methods like GPS and Network Time Protocol (NTP), and can still call in to the Master Clock's Voice Announcer system at (202) 762-1401 or (202) 762-1069 to hear the pre-recorded voice of actor and voice artist Frank Covington, who relays the time in both Coordinated Universal Time and Eastern Time.

With the rubidium fountains, the Master Clock's generated time scale allows for precise timing better than a nanosecond (10^{-9} seconds or 0.000000001 seconds). By applying a little math to the speed of light (3×10^8 meters per second squared), that precision can be translated to a physical distance of about a third of a meter. But even this level of precision is only another step towards the higher accuracy that the Naval Observatory and other atomic clock developers around the world seek in order to resolve finer intervals of measurement.

Peil and two other scientists at USNO, Thomas Akin and Joel Whalen, recently published a paper on the long-term performance of the rubidium fountains titled "100-ns-level timing holdover after 12 years for rubidium atomic fountains." The paper was published in August 2025

by APS Journals, a publication produced by The American Physical Society. In it, they discuss the long-term timing performance of the rubidium fountain clocks, the value of their ability to provide continuous timing and holdover between calibration events, and the impact of these contributions to international timescales providing service to customers all around the world, every day.

To read “100-ns-level timing holdover after 12 years for rubidium atomic fountains,” go to <https://journals.aps.org/prapplied/abstract/10.1103/61yv-31tl>, or on arXiv at <https://arxiv.org/html/2508.13140v1>.



Above: Photo of two Rubidium Fountains, USNO.

About the U.S. Naval Observatory

The United States Naval Observatory is an Echelon-IV operational command reporting to the Commander, Naval Meteorology and Oceanography Command. Its headquarters is located in Washington, D.C., with field activities located at the Naval Observatory Flagstaff Station in Flagstaff, AZ, and the USNO Alternate Master Clock located at Schriever Space Force Base near Colorado Springs, CO. The U.S. Naval Observatory provides a wide range of astronomical data and products essential for accurate navigation and the support of communications on Earth and in space.

For more information on the U.S. Naval Observatory and its mission, go to <https://www.cnmoc.usff.navy.mil/usno/>.