



# NEWS! From the NAVAL OBSERVATORY

U.S. NAVAL OBSERVATORY

3450 MASSACHUSETTS AVE., NW

WASHINGTON, DC 20392-5420

## U.S. Naval Observatory Press Release

Geoff Chester  
U.S. Naval Observatory Public Affairs Office  
(202) 762-1438  
geoff.chester@navy.mil

Information Contact:  
Dr. Demetrios Matsakis  
Chief Scientist for Time Services  
U.S. Naval Observatory, Washington, DC  
(202) 762-1837  
demetrios.matsakis@usno.navy.mil

For Immediate Release, July 6, 2016

### **2016 will be one second longer**

WASHINGTON, DC -- On December 31, 2016, a “leap second” will be added to the world’s clocks at 23 hours, 59 minutes and 59 seconds Coordinated Universal Time (UTC). This corresponds to 6:59:59 pm Eastern Standard Time, when the extra second will be inserted at the U.S. Naval Observatory’s Master Clock Facility in Washington, DC.

Historically, time was based on the mean rotation of the Earth relative to celestial bodies and the second was defined in this reference frame. However, the invention of atomic clocks defined a much more precise “atomic” timescale and a second that is independent of Earth’s rotation. In 1970, international agreements established a procedure to maintain a relationship between Coordinated Universal Time (UTC) and UT1, a measure of the Earth's rotation angle in space. The International Earth Rotation and Reference Systems Service (IERS) is the organization which monitors the difference in the two time scales and calls for leap seconds to be inserted in or removed from UTC when necessary to keep them within 0.9 seconds of each other. In order to create UTC, a secondary timescale, International Atomic Time (TAI), is first generated; it consists of UTC without leap seconds. When the system was instituted in 1972, the difference between TAI and UTC was determined to be 10 seconds. Since 1972, 26 additional leap seconds have been added at intervals varying from six months to seven years, with the most recent being inserted on June 30, 2015. After the insertion of the leap second in December, the cumulative difference between UTC and TAI will be 37 seconds.

Confusion sometimes arises over the misconception that the occasional insertion of leap seconds every few years indicates that the Earth should stop rotating within a few millennia. This is because some mistake leap seconds to be a measure of the rate at which the Earth is slowing. The one-second increments are, however, indications of the accumulated difference in time between the two systems.

The decision as to when to add a leap second is determined by the IERS, for which the USNO serves as the Rapid Service/Prediction Center. Measurements show that the Earth, on average, runs slow compared to atomic time, at about 1.5 to 2 milliseconds per day. These data are generated by the USNO using the technique of Very Long Baseline Interferometry (VLBI). VLBI measures the rotation of the Earth by observing the apparent positions of distant objects near the edge of the observable universe. These observations show that after roughly 500 to 750 days, the difference between Earth rotation time and atomic time would be about one second. Instead of allowing this to happen a leap second is inserted to bring the two time-scales closer together. We can easily change the time of an atomic clock, but it is not possible to alter the Earth's rotational speed to match the atomic clocks.

The U.S. Naval Observatory is charged with the responsibility for the precise determination and dissemination of time for the Department of Defense and maintains DoD's Master Clock. The U.S. Naval Observatory, together with the National Institute of Standards and Technology (NIST), determines time for the United States. Modern electronic navigation and communications systems depend increasingly on the dissemination of precise time through such mechanisms as the Internet-based Network Time Protocol (NTP) and the satellite-based Global Positioning System (GPS).

The U.S. Naval Observatory is the largest single contributor (at approximately 30 percent of the weighted average) to the international timescale UTC, which is computed in Paris, France, at the International Bureau of Weights and Measures. This international prominence in atomic timekeeping is due to the large number of atomic clocks operated by the Observatory and the fidelity to which they are measured and maintained. Moreover, the U.S. Naval Observatory's principal role in keeping track of changes in the "Earth clock" (i.e., Earth rotation) and its dissemination of this information as the Rapid Service/Prediction Center for the IERS attests to the fact that globally, as well as nationally, the U.S. Naval Observatory remains the leader in precise time.

Information concerning the U.S. Naval Observatory, its mission, history, and programs is available from our World Wide Web site at <http://www.usno.navy.mil/USNO>.