NIST TIME AND FREQUENCY BULLETIN
NIST IR 6665-02

No. 650 February 2012

This bulletin is published monthly. Address correspondence to:

Petrina C. Potts, Editor
Time and Frequency Division
National Institute of Standards and Technology
325 Broadway
Boulder, CO 8O3O5-3328
(3O3) 497-3295
Email: ppotts@boulder.nist.gov

U.S. DEPARTMENT OF COMMERCE, GARY LOCKE, Secretary
NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY, Patrick D. Gallagher, Director

1. GENERAL BACKGROUND INFORMATION

ACRONYMS AND ABBREVIATIONS USED IN THIS BULLETIN

ACTS - Automated Computer Time Service
BIPM - Bureau International des Poids et Mesures
CS - Cesium Standard
GPS - Global Positioning System
IERS - International Earth Rotation Service
LORAN - Long Range Navigation
MC - Master Clock
MJD - Modified Julian Date
NIST - National Institute of Standards and Technology
NOAA - National Oceanic and Atmospheric Administration
NVLAP - National Voluntary Laboratory Accreditation Program
SI - International System of Units
TA - Atomic Time
TAI - International Atomic Time
USNO - United States Naval Observatory
UTC - Coordinated Universal Time

ns - nanosecond
µs - microsecond
ms - millisecond
s - second
min - minute

2. TIME SCALE INFORMATION

The values listed below are based on data from the IERS, the USNO, and NIST. The UTC(USNO,MC) - UTC(NIST) values are averaged measurements from all available common-view GPS satellites (see bibliography on page 5). UTC - UTC(NIST) data are on page 3.

0000 HOURS COORDINATED UNIVERSAL TIME			
JAN 2012	MJD	UT1-UTC(NIST) (±5 ms)	UTC(USNO,MC) - UTC(NIST) (±20 ns)
5	55931	-423 ms	+4 ns*
12	55938	-429 ms	+2 ns
19	55945	-438 ms	+2 ns
26	55952	-444 ms	+2 ns

*Interpolated Value

The master clock pulses used by the WWV, WWVH, and WWVB time-code transmissions are referenced to the UTC(NIST) time scale. Occasionally, 1 s is added to the UTC time scale. This second is called a leap second. Its purpose is to keep the UTC time scale within ±0.9 s of the UT1 astronomical time scale, which changes slightly due to variations in the Earth's period of rotation.

NOTE: A positive leap second will be added at the end of June 2012.

Positive leap seconds, beginning at 23 h 59 min 60 s UTC and ending at 0 h 0 min 0 s UTC, were inserted in the UTC time scale on 30 June 1972, 1981-1983, 1985, 1992-1994, and 1997, and on 31 December 1972-1979, 1987, 1989, 1990,1995, 1998, 2005, and 2008.

The use of leap seconds ensures that UT1 - UTC will always be held within ±0.9 s. The current value of UT1 - UTC is called the DUT1 correction. DUT1 corrections are broadcast by WWV, WWVH, WWVB, and ACTS and are printed below. These corrections may be added to received UTC time signals in order to obtain UT1.

DUT1 = UT1 - UTC =

- 0.5 s beginning 0000 UTC 9 February 2012
- 0.4 s beginning 0000 UTC 4 November 2011
- 0.3 s beginning 0000 UTC 12 May 2011
- 0.2 s beginning 0000 UTC 06 January 2011
- 0.1 s beginning 0000 UTC 03 June 2010
+0.0 s beginning 0000 UTC 11 March 2010
+0.1 s beginning 0000 UTC 12 November 2009
+0.2 s beginning 0000 UTC 11 June 2009
+0.3 s beginning 0000 UTC 12 March 2009

The difference between UTC(NIST) and UTC has been within ±100 ns since July 6, 1994. The table below shows values of UTC - UTC(NIST) as supplied by the BIPM in their *Circular T* publication for the most recent 310-day period in which data are available. Data are given at ten-day intervals. Five-day interval data are available in *Circular T*.

0000 Hours Coordinated Universal Time		
DATE	**MJD**	**UTC-UTC(NIST) ns**
Dec 24, 2011	**55919**	**5.8**
Dec 14, 2011	**55909**	**5.6**
Dec 4, 2011	**55899**	**5.0**
Nov 24, 2011	**55889**	**3.0**
Nov. 14, 2011	**55879**	**4.4**
Nov. 4, 2011	**55869**	**6.5**
Oct. 25, 2011	**55859**	**8.5**
Oct. 15, 2011	**55849**	**9.6**
Oct. 5, 2011	**55839**	**10.8**
Sep. 25, 2011	**55829**	**10.6**
Sep. 15, 2011	**55819**	**10.3**
Sep. 5, 2011	**55809**	**9.3**
Aug. 26, 2011	**55799**	**8.8**
Aug. 16, 2011	**55789**	**6.9**
Aug. 6, 2011	**55779**	**5.9**
July 27, 2011	**55769**	**4.1**
July 17, 2011	**55759**	**4.3**
July 7, 2011	**55749**	**2.9**
June 27, 2011	**55739**	**2.1**
June 17, 2011	**55729**	**3.4**
June 7, 2011	**55719**	**4.6**
May 28, 2011	**55709**	**4.8**
May 18, 2011	**55699**	**6.5**
May 8, 2011	**55689**	**7.9**
Apr. 28, 2011	**55679**	**8.6**
Apr. 18, 2011	**55669**	**10.3**
Apr. 8, 2011	**55659**	**12**
Mar. 29, 2011	**55649**	**10.8**
Mar. 19, 2011	**55639**	**10.3**
Mar. 9, 2011	**55629**	**9.5**

3. BROADCAST OUTAGES OVER FIVE MINUTES AND WWVB PHASE PERTURBATIONS

OUTAGES OF 5 MINUTES OR MORE						PHASE PERTURBATIONS 2 ms			
Station	Jan 2012	MJD	Began UTC	Ended UTC	Freq.	Jan 2012	MJD	Began UTC	End UTC
WWVB	01-15-12	55941	2204	2322	60kHz				
	1-20-12	55946	0625	0635	60kHz				
	1-20-12	55946	0725	0735	60kHz				
	1-23-12	55949	0625	0635	60kHz				
	1-23-12	55949	0725	0735	60kHz				
	1-24-12	55950	0625	0635	60kHz				
	1-24-12	55950	0725	0735	60kHz				
	1-25-12	55951	0625	0635	60kHz				
	1-25-12	55951	0725	0735	60kHz				
	1-26-12	55952	1115	1243	60kHz				
	1-28-12	55954	2237	2331	60kHz				
WWV									
WWVH									

4. NOTES ON NIST TIME SCALES AND PRIMARY STANDARDS

Primary frequency standards developed and operated by NIST are used to provide accuracy (rate) input to the BIPM. NIST-F1, a cold-atom cesium fountain frequency standard, has served as the U.S. primary standard of time and frequency since 1999. The uncertainty of NIST-F1 is currently about 3 parts in 10^{16}.

The AT1 scale is run in real-time by use of data from an ensemble of cesium standards and hydrogen masers. It is a free-running scale whose frequency is maintained as nearly constant as possible by choosing the optimum weight for each clock that contributes to the computation.

UTC(NIST) is generated as an offset from our real-time scale AT1. It is steered in frequency towards UTC by use of data published by the BIPM in its *Circular T*. Changes in the steering frequency will be made, if necessary, at 0000 UTC on the first day of the month, and occasionally at mid-month. A change in frequency is limited to no more than ±2 ns/day. The frequency of UTC(NIST) is kept as stable as possible at other times.

UTC is generated at the BIPM by use of a post-processed time-scale algorithm and is not available in real-time. The parameters that we use to generate UTC(NIST) in real-time are therefore based on an extrapolation of UTC from the most recent available data.

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5. UTC(NIST) – AT1 PARAMETERS

The table below lists parameters that are used to define UTC(NIST) with respect to our real-time scale AT1. To find the value of UTC(NIST) - AT1 at any time T (expressed as a Modified Julian Day, including a fraction if needed), the appropriate equation to use is the one for which the desired T is greater than or equal to the entry in the T_0 column and less than the entry in the last column. The values of x_{ls}, x, and y for that month are then used in the equation below to find the desired value. The parameters x and y represent the offsets in time and frequency, respectively, between UTC(NIST) and AT1; the parameter x_{ls} is the number of leap seconds applied to both UTC(NIST) and UTC, as specified by the IERS. Leap seconds are not applied to AT1.

UTC(NIST) - AT1 = x_{ls} + x + y*(T - T_0)					
Month	xls (s)	x (ns)	y (ns/d)	T0 (MJD)	Valid until 0000 on: (MJD)
Mar 12	-34	-373739.4	-37.8*	55987	56018
Feb 12	-34	-372643.2	-37.8	55958	55987*
Jan 12	-34	-371471.4	37.8	55927	55958
Dec 11	-34	-370293.4	-38.0	55896	55927
Nov 11	-34	-370027.4	-38.0	55889	55896
Nov 11	-34	-369158	-37.8	55866	55889†
Oct 11	-34	-368477.6	-37.8	55848	55866
Oct 11	-34	-367983.6	-38.0	55835	55848†
Sep 11	-34	-367185.6	-38.0	55814	55835
Sep 11	-34	-366841.8	-38.2	55805	55814†
Aug 11	-34	-365654.5	-38.3	55774	55805
Jul 11	-34	-364467.2	-38.3	55743	55774
Jun 11	-34	-363318.2	-38.3	55713	55743
May 11	-34	-362130.9	-38.3	55682	55713
Apr 11	-34	-361288.3	-38.3	55660	55682
Apr 11	-34	-360980.3	-38.5	55652	55660†
Mar 11	-34	-359786.8	-38.5	55621	55652
Feb 11	-34	-359286.3	-38.5	55608	55621
Feb 11	-34	-358707.3	-38.6	55593	55608†
Jan 11	-34	-357896.7	-38.6	55572	55593
Jan 11	-34	-357508.7	-38.8	55562	55572†
Dec 10	-34	-356305.9	-38.8	55531	55562

† Rate change in mid-month

***Provisional value**