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U.S. Department of Commerce
Wilbur L. Ross, Jr., Secretary

National Institute of Standards and Technology
Walter Copan, NIST Director and Under Secretary of Commerce for Standards and Technology

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1. GENERAL BACKGROUND INFORMATION

ACRONYMS AND ABBREVIATIONS USED IN THIS BULLETIN

ACTS	- Automated Computer Time Service		
BIPM	- Bureau International des Poids et Mesures		
GPS	- Global Positioning System		
IERS	- International Earth Rotation Service		
MC	- Master Clock		
MJD	- Modified Julian Date		
NIST	- National Institute of Standards and Technology	ns	- nanosecond
SI	- International System of Units	μs	- microsecond
TA	- Atomic Time	ms	- millisecond
TAI	- International Atomic Time	s	- second
USNO	- United States Naval Observatory	min	- minute
UT1	- Universal Time (Astronomical)		
UTC	- Coordinated Universal Time		

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			
Aug 2018	MJD	UT1-UTC(NIST) (±5 ms)	UTC(USNO,MC) - UTC(NIST) (±20 ns)
2	58332	69 ms	-2.3 ns
9	58339	68 ms	-1.7 ns
16	58346	65 ms	-1.2 ns
23	58353	64 ms	-2.3 ns
30	58360	64 ms	-1.7 ns

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: No leap second will be added at the end of December 2018.

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, 1997, 2012, 2015 and on 31 December 1972-1979, 1987, 1989, 1990,1995, 1998, 2005, 2008, 2016.

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 the received UTC time signals in order to obtain UT1.

DUT1 = UT1 - UTC =

+0.0 s beginning 0000 UTC 21 September 2018
+0.1 s beginning 0000 UTC 15 March 2018
+0.2 s beginning 0000 UTC 30 November 2017
+0.3 s beginning 0000 UTC 29 June 2017
+0.4 s beginning 0000 UTC 30 March 2017
+0.5 s beginning 0000 UTC 26 January 2017
+0.6 s beginning 0000 UTC 01 January 2017
-0.4 s beginning 0000 UTC 17 November 2016
-0.3 s beginning 0000 UTC 01 September 2016
-0.1 s beginning 0000 UTC 24 March 2016

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**
Aug. 29, 2018	**58359**	**0.1**
Aug. 19, 2018	**58349**	**0.2**
Aug. 9, 2018	**58339**	**-0.5**
Jul. 30, 2018	**58329**	**-1.0**
Jul. 20, 2018	**58319**	**-0.4**
Jul. 10, 2018	**58309**	**0.3**
Jun. 30, 2018	**58299**	**1.5**
Jun. 20, 2018	**58289**	**1.7**
Jun. 10, 2018	**58379**	**2.4**
May 31, 2018	**58269**	**2.7**
May 21, 2018	**58259**	**0.1**
May 11, 2018	**58249**	**-2.2**
May. 1, 2018	**58239**	**-4.0**
Apr. 21, 2018	**58229**	**-1.5**
Apr. 11, 2018	**58219**	**0.1**
Apr. 1, 2018	**58209**	**1.2**
Mar. 22, 2018	**58199**	**-0.7**
Mar. 12, 2018	**58189**	**-2.9**
Mar. 2, 2018	**58179**	**-2.6**
Feb. 20, 2018	**58169**	**-1.0**
Feb. 10, 2018	**58159**	**0.1**
Jan. 31, 2018	**58149**	**-0.3**
Jan. 21, 2018	**58139**	**-0.9**
Jan. 11, 2018	**58129**	**0.1**
Jan. 1, 2018	**58119**	**-0.8**
Dec. 22, 2017	**58109**	**-0.3**
Dec. 12, 2017	**58099**	**1.4**
Dec. 2, 2017	**58089**	**0.4**
Nov. 22, 2017	**58079**	**-0.8**
Nov. 12, 2017	**58069**	**-0.1**
Nov. 2, 2017	**58059**	**0.9**
Oct. 23, 2017	**58049**	**-0.3**
Oct. 13, 2017	**58039**	**-0.3**
Oct. 3, 2017	**58029**	**0.6**

3. BROADCAST OUTAGES OVER FIVE MINUTES AND WWVB PHASE PERTURBATIONS

OUTAGES OF 5 MINUTES OR MORE						PHASE PERTURBATIONS 2 ms			
Station	Aug 2018	MJD	Began UTC	Ended UTC	Freq.	Aug 2018	MJD	Began UTC	End UTC
WWVB	None					None			
WWV	None					None			
WWVH	None					None			

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 and to provide the best possible realization of the SI second. NIST-F1 and NIST F-2, cold-atom cesium fountain frequency standards, have served as the U.S. primary standards of time and frequency since 1999. The uncertainty of NIST-F2 is currently about 1 part 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 Date, 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	x_{ls} (s)	x (ns)	y (ns/d)	T_0 (MJD)	Valid until 0000 on: (MJD)
Oct 18	-37	-463520.05	-36.80*	58392	58423
Sep 18	-37	-462857.65	-36.80	58374	58392*
Sep 18	-37	-462411.25	-37.20	58362	58374†
Aug 18	-37	-462336.85	-37.20	58360	58362
Aug 18	-37	-461260.95	-37.10	58331	58360†
Jul 18	-37	-461038.35	-37.10	58325	58331
Jul 18	-37	-460113.35	-37.00	58300	58325†
Jun 18	-37	-459003.35	-37.0	58270	58300
May 18	-37	-458966.35	-37.0	58269	58270
May 18	-37	-457921.95	-37.30	58241	58269†
May 18	-37	-457848.35	-36.8	58239	58241†
Apr 18	-37	-456744.35	-36.8	58209	58239
Mar 18	-37	-456744.35	-36.8	58207	58209
Mar 18	-37	-456114.25	-37.10	58192	58207†
Mar 18	-37	-455635.85	-36.80	58179	58192†
Mar 18	-37	-455599.25	-36.60	58178	58179†
Feb 18	-37	-455086.85	-36.60	58164	58178
Feb 18	-37	-454570.25	-36.90	58150	58164†
Jan 18	-37	-454311.95	-36.90	58143	58150
Jan 18	-37	-453796.75	-36.8	58129	58143†
Jan 18	-37	-453427.25	-36.95	58119	58129†
Dec 17	-37	-453316.4	-36.95	58116	58119
Dec 17	-37	-452765.15	-36.75	58101	58116†
Dec 17	-37	-452284.15	-37.00	58088	58101†
Nov 17	-37	-451988.15	-37.00	58080	58088
Nov 17	-37	-451215.35	-36.80	58059	58080†
Nov 17	-37	-451178.25	-37.10	58058	58059†
Oct 17	-37	-450695.95	-37.10	58045	58058
Oct 17	-37	-450029.95	-37	58027	58045†
Sep 17	-37	449659.95	-37.00	58017	58027
Sep 17	-37	448915.95	-37.20	57997	58017†
Aug 17	-37	448619.95	-37.1	57989	57997
Aug 17	-37	448360.85	-36.9	57982	57989†