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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		
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	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
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			
FEB 2007	MJD	UT1-UTC(NIST) (±5 ms)	UTC(USNO,MC) - UTC(NIST) (±20 ns)
1	54132	001 ms	25 ns
8	54139	-010 ms	23 ns
15	54146	-017 ms	23 ns
22	54153	-026 ms	23 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 rotation.

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 timescale on 30 June 1972, 1981-1983, 1985, 1992, 1993, 1994, and 1997, and on 31 December 1972-1979, 1987, 1989, 1990,1995, 1998 and 2005.

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 =	-0.6 s beginning 0000 UTC 17 March 2005
	+0.3 s beginning 0000 UTC 01 January 2006
	+0.2 s beginning 0000 UTC 27 April 2006
	+0.1 s beginning 0000 UTC 28 September 2006
	+0.0 s beginning 0000 UTC 22 December 2006
	-0.1 s beginning 0000 UTC 15 March 2007

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 10 day intervals. Five day interval data are available in Circular T.

0000 Hours Coordinated Universal Time

DATE	MJD	UTC-UTC(NIST) ns
Jan. 29, 2007	54129	13.3
Jan. 19, 2007	54119	15.5
Jan. 09, 2007	54109	16.1
Dec. 30, 2006	54099	15.9
Dec. 20, 2006	54089	15.5
Dec. 10, 2006	54079	14.5
Nov. 30, 2006	54069	11.6
Nov. 20, 2006	54059	9.8
Nov. 10, 2006	54049	2.7
Oct. 31, 2006	54039	-4.9
Oct. 21, 2006	54029	-11.8
Oct. 11, 2006	54019	-14.3
Oct. 01, 2006	54009	-14.4
Sep. 21, 2006	53999	-13.0
Sep. 11, 2006	53989	-8.8
Sep. 01, 2006	53979	-5.4
Aug. 22, 2006	53969	-0.2
Aug. 12, 2006	53959	2.3
Aug. 02, 2006	53949	4.2
Jul. 23, 2006	53939	6.7
Jul. 13, 2006	53929	8.6
Jul. 03, 2006	53919	8.3
Jun. 23, 2006	53909	8.5
Jun. 13, 2006	53899	6.9
Jun. 03, 2006	53889	7.1
May 24, 2006	53879	6.6
May 14, 2005	53869	6.2
May 04, 2006	53859	7.0
Apr. 24, 2006	53849	6.2
Apr. 14, 2006	53839	6.0
Apr. 04, 2006	53829	6.2

3. PHASE DEVIATIONS FOR WWVB AND LORAN-C

WWVB - The values shown for WWVB are the time differences between the time markers of the UTC(NIST) time scale and the first positive-going zero voltage crossover measured at the transmitting antenna. The uncertainty of the individual measurements is ±0.5 μs. The values listed are for 1300 UTC.

LORAN-C - The values shown for Loran-C represent the daily accumulated phase shift. The phase shift is measured by comparing the output of a Loran receiver to the UTC(NIST) time scale for a period of 24 h. If data were not recorded on a particular day, the symbol (-) is printed. The stations monitored are Baudette, Minnesota (8970) and Boise City, Oklahoma (9610). The monitoring is done from the NIST laboratories in Boulder, Colorado.

Note: The values shown for Loran-C are in nanoseconds.

		UTC(NIST)-WWVB (60 kHz)	UTC(NIST) - LORAN PHASE (ns)	
DATE	MJD	ANTENNA PHASE (μs)	LORAN-C (BAUDETTE) (8970)	LORAN-C (BOISE CITY) (9610)
02/01/2007	54132	5. 65	-13	+15
02/02/2007	54133	5. 65	+3	-12
02/03/2007	54134	5. 65	-33	-18
02/04/2007	54135	5. 65	-12	-12
02/05/2007	54136	5. 65	-27	-46
02/06/2007	54137	5. 65	+5	-28
02/07/2007	54138	5. 65	+35	+30
02/08/2007	54139	5. 65	+56	-1
02/09/2007	54140	5. 65	-25	-2
02/10/2007	54141	5. 65	-40	-6
02/11/2007	54142	5. 65	+9	-10
02/12/2007	54143	5. 65	-16	+26
02/13/2007	54144	5. 65	-54	+43
02/14/2007	54145	5. 65	+50	-19
02/15/2007	54146	5. 65	+87	+8
02/16/2007	54147	5. 65	-74	-14
02/17/2007	54148	5. 65	+25	-16
02/18/2007	54149	5. 65	-10	+6
02/19/2007	54150	5. 65	-16	-14
02/20/2007	54151	5. 65	-32	+6
02/21/2007	54152	5. 65	+11	+2
02/22/2007	54153	5. 65	-14	+18
02/23/2007	54154	5. 65	+21	-2
02/24/2007	54155	5. 65	-1	-5
02/25/2007	54156	5. 65	+49	+10
02/26/2007	54157	5. 65	+49	-4
02/27/2007	54158	5. 65	-32	+11
02/28/2007	54159	5. 65	+124	+11

4. BROADCAST OUTAGES OVER FIVE MINUTES AND WWVB PHASE PERTURBATIONS

OUTAGES OF 5 MINUTES OR MORE							PHASE PERTURBATIONS 2 ms			
Station	FEB 2007	MJD	Began UTC	Ended UTC	Freq.		FEB 2007	MJD	Began UTC	End UTC
WWVB	2-16-07	54147	1302	1352	60 kHz					
WWV										
WWVH										

5. 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 time and frequency standard since 1999. The uncertainty of NIST-F1 is currently about 5 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 using 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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Table 7.1 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 offset in time and in 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.

Table 7.1

$$UTC(NIST) - AT1 = x_{ls} + x + y*(T - T_0)$$

Month	x_{ls} (s)	x (ns)	y (ns/d)	T_0 (MJD)	Valid until 0000 on: (MJD)
Apr 07	-33	-304951.6	-38.3*	54191	54221
Mar 07	-33	-303764.3	-38.3*	54160	54191*
Feb 07	-33	-302691.9	-38.3	54132	54160
Jan 07	-33	-302079.1	-38.3	54116	54132
Jan 07	-33	-301501.6	-38.5	54101	54116†
Dec 06	-33	-300847.1	-38.5	54084	54101
Dec 06	-33	-300303.9	-38.8	54070	54084†
Nov 06	-33	-299799.5	-38.8	54057	54070
Nov 06	-33	-299129.7	-39.4	54040	54057†
Oct 06	-33	-298459.9	-39.4	54023	54040
Oct 06	-33	-297916.7	-38.8	54009	54023†
Sep 06	-33	-297606.3	-38.8	54001	54009
Sep 06	-33	-296759.3	-38.5	53979	54001†
Aug 06	-33	-295565.8	-38.5	53948	53979
Jul 06	-33	-294911.3	-38.5	53931	53948
Jul 06	-33	-294368.80	-38.75	53917	53931†
Jun 06	-33	-293206.30	-38.75	53887	53917
May 06	-33	-292702.55	-38.75	53874	53887
May 06	-33	-292004.15	-38.8	53856	53874†
Apr 06	-33	-291422.15	-38.8	53841	53856
Apr 06	-33	-290837.9	-38.95	53826	53841†
Mar 06	-33	-289630.45	-38.95	53795	53826

† Rate change in mid-month
†† Rate change one day early
***Provisional value**