BIPM

Report from the CCTF on Draft Resolution C

On the technical actions needed to ensure the continuity of UTC

July 2026

Contents

1. Introduction

The 27th CGPM in 2022 adopted Resolution 4[1] "On the use and future development of UTC" deciding that the maximum value for the difference |UT1-UTC| will be increased in, or before, 2035. It also requested that the CIPM consult with the ITU and other organizations that may be impacted by this decision and propose a new maximum value to ensure the continuity of UTC for at least a century. The CIPM was asked to prepare a draft resolution including these proposals for the 28th meeting of the CGPM (2026).

To fulfil these requirements, the CCTF created a dedicated Task Group[2] with representatives of UTC laboratories that are also involved in ITU and GNSS activities, the chairs of RMOs Technical Committees for Time and Frequency and the CCTF Liaison representatives from the IAU, IGS, IUGG, URSI and ITU.

The Task Group undertook several activities:

- Liaising with organizations impacted by this decision:
  - Astronomers and the IAU to assess the impact on their community by participating in some IAU meetings and working groups;
  - The IERS and experts in Earth rotation regarding the IERS's important role in determining and disseminating the value of UT1-UTC in a robust manner;
  - GNSS providers (at the UN International Committee on GNSS) to address the necessary updates in the navigation message when UT1-UTC is transmitted;
  - The ITU to address the necessary updates to the Radio Regulations, including the leap second procedure and the code to broadcast UT1-UTC[3]
- Collaborating with the different NMIs and RMOs to gather diverse perspectives and identify users and stakeholders in different countries, and their needs in timekeeping and the continuity of UTC.

2. Supporting the ITU-R World Radio Conference (WRC) 2023

The need to update the ITU Radio Regulations and the recommendations, including the procedure for the leap second, was debated in several ITU meetings. At the World Radio Conference in 2023, results from the collaboration with the BIPM and CCTF were expected. The Memorandum of Understanding (MoU) signed between ITU and BIPM[4], which clarified their respective responsibilities, along with the continuous collaboration that led to a special issue of the *ITU News*[5] and several joint sessions at the WRC preparatory meetings, were recognized. Thanks to the work of the NMIs and the Task Group members supporting their national ITU delegations, CGPM Resolution 4 (2022) was endorsed by Resolution 655 (Rev. WRC 2023)[6]. This ITU resolution also recommended a new maximum value for |UT1-UTC| larger than 100 seconds, with an application date possibly in 2035, and allowed time until 2040 for the update of terrestrial radio stations to broadcast the extended difference UT1-UTC, if

[1] https://www.bipm.org/en/cgpm-2022/resolution-4
[2] https://www.bipm.org/en/committees/cc/cctf/wg/cctf-tgutc
[3] https://www.itu.int/rec/R-REC-TF.460/en
[4] MoU between BIPM and ITU
[5] https://www.itu.int/en/itunews/Documents/2023/2023-02/2023_ITUNews02-en.pdf
[6] Final Acts WRC-23

needed. A survey carried out in 2025 by the CCTF showed that there are currently five countries still broadcasting UT1-UTC by terrestrial radio stations (Argentina, Canada[7], Russia, UK, USA). All these countries, except for Russia, will probably not update the code for UT1-UTC, considering this technology to be surpassed by other dissemination techniques. Meanwhile, the ITU-R WP7A, which is devoted to "Time signals and frequency standard emissions"[8], has agreed in March 2026 on how to update the code for this radio station service[9].

3. The extended tolerance

The Task Group analysed three options for the extended tolerance:

a. 1 minute to ensure UTC continuity for about one century;

b. 1 hour to ensure UTC continuity for about a millennium;

c. No fixed limit.

The main messages received from users and stakeholders was to minimize adjustments to UTC, possibly never again. Systems disseminating the value of UT1-UTC requested a known limit (excluding option c) to correctly allocate the number of bits for the service.

The Task Group also considered the importance of the social perception of the difference between solar time (based on UT1) and civil time (based on UTC). The civil time, which is based on time zones, can in some cases encompass more than one time zone, causing large differences (up to 3 hours) between local apparent solar time and legal time. Furthermore, the activation of daylight-saving time in some countries introduces a one-hour discontinuity.

After consulting NMIs, RMOs, and their users, the CCTF and the CIPM, the proposal is to extend the maximum value for the difference |UT1-UTC| to 3600 seconds (1 hour), ensuring the long-term continuity of UTC for several centuries.

Users of UT1 will be able to find the information of UT1-UTC in GNSS services (already updated to allow UT1-UTC > 1 second), internet services[10], and radio stations regulated by the ITU-R once the updated code is implemented, as agreed by Resolution 655 (Rev. WRC 2023).

4. The probability of a first negative leap second

In recent years, the Earth's rotation has accelerated, and the rotational Length of Day (LOD) has reached the duration of an atomic day. If the Earth acceleration continues, it could be necessary to remove one second, for the first time, instead of the usual addition of one second. This is called a negative leap second. Some papers studied this possibility [1,2,3], which is considered a risk of failure

[7] Canada dismissed the radio station CHU on June 2022

[8] https://www.itu.int/en/ITU-R/study-groups/rsg7/rwp7a/Pages/default.aspx

[9] Report on the meeting of Working Party 7A (Geneva, 2-6 March 2026) (restricted)

[10] Such as:

- IERS: https://datacenter.iers.org/data/latestVersion/bulletinA.txt
- NASA: https://cddis.nasa.gov/Data_and_Derived_Products/Other_products/IERS_EOPs.html
- VNIIFTRI: https://www.vniiftri.ru/en/about/departments/research-department-main-metrological-center-of-the-state-service-of-time-frequency-and-determinatio/
- NTSC: http://www.ut1.ntsc.ac.cn/

in the implementation. The CIPM asked the CCTF[11] to identify the best way forward for a timely application of CGPM Resolution 4 (2022).

The BIPM, together with the IERS, organized a workshop in 2025 with the world's experts on Earth rotation to evaluate the risk of a negative leap second. The group was able to list the most impactful reasons for the irregularities in Earth rotation and to distinguish between the well-understood causes that can be modelled by a suitable polynomial and the least-understood causes that must be modelled by a stochastic process. The stochastic approach was developed independently by three groups, leading to very similar results. A common model was agreed, validated on the previous centuries of the Earth's rotation measurements. It led to the estimation of a ~ 30 % probability of a negative leap second in the next 10 years, together with a ~ 50 % probability of a positive leap second.

The probability of a negative leap second is rapidly growing in the coming years, and to avoid any risk, UTC should be made continuous by 2027.

5. Statements from International Organizations, industrial users, and associations

The issue of a negative leap second, with 30 % probability, was discussed with the organizations concerned, such as ITU, IAU, URSI, IGS, GNSS providers, and IERS. It was presented in scientific and technical forums and to the users of the different countries by their NMIs. The RMOs also organized a survey. A clear and unambiguous message was to avoid any risk of a negative leap second, as the synchronization equipment has a high risk to fail in this new and never-tested situation. Industries stated that preparing for a negative leap second could be as demanding as preparation for the millennium Y2K bug.

The BIPM received feedback from several individual industries and formal statements from the ITU-T Standardization Sector (the branch that sets the standards for synchronizing telecommunication networks), the ITU-R Radiocommunication Sector (where the WP7A deals with the Time signals and frequency standard emissions), and from the IEEE Precision Networked Clock Synchronization Working Group - 1588 (which deals with the PTP synchronization protocol on the Internet). The IERS sent a support letter, committing to update its operational provision of and its announcement of leap seconds accordingly. These documents are in the Annex.

6. The CGPM 2026 draft resolution

Considering all the evaluations and the feedback received, draft resolution C proposes to the CGPM 2026 that:

- **Continuous UTC will become effective on 20 May 2027;**
- **The maximum value for the difference |UT1-UTC| will be 3600 seconds (1 hour), ensuring the long-term continuity of UTC for several centuries.**

[11] https://www.bipm.org/en/committees/ci/cipm/112-_1-2023

7. References

[1] Agnew, D.C. A global timekeeping problem postponed by global warming. *Nature* 628, 333–336 (2024). https://doi.org/10.1038/s41586-024-07170-0 and https://www.nature.com/articles/d41586-024-00850-x

[2] L. Zotov, C. Bizouard, C.K. Shum, C. Zhang, N. Sidorenkov, V. Yushkin, "Analysis of Earth's polar motion and length of day trends in comparison with estimates using second degree stokes coefficients from satellite gravimetry", Advances in Space Research 69, 308–318 (2022). https://doi.org/10.1016/j.asr.2021.09.010

[3] D. Matsakis, D. Mc Carthy, "Will We Have a Negative Leap Second?", Inside GNSS, March 2023, https://insidegnss.com/will-we-have-a-negative-leap-second/

Annex - Formal statements from ITU-T, ITU-R WP7A, IEEE-1588, IERS

INTERNATIONAL TELECOMMUNICATION UNION
TELECOMMUNICATION STANDARDIZATION SECTOR
STUDY PERIOD 2025-2028

SG15-LS71
STUDY GROUP 15
Original: English

Question(s): 13/15 Geneva, 13-24 October 2025

LS
(Ref.: TD96/WP3-Annex 3)

Source: ITU-T Study Group 15
Title: LS on information on the possibility of a negative leap second and request of information on its impact in ITU-T

LIAISON STATEMENT

For action to:	-
For information to:	BIPM, IEEE PNCS (P1588 WG)
Approval:	ITU-T SG15 meeting (Geneva, 24 October 2025)
Deadline:	-
Contact:	Stefano Ruffini Rapporteur Q13/15
Contact:	Lee Cosart Associate Rapporteur Q13/15
Abstract:	This liaison deals with information on the possibility of a negative leap second.

Q13/15 thanks **BIPM** for the liaison *"Information on the possibility of a negative leap second and request of information on its impact in ITU-T*" (**TD94/3**). This was reviewed by the group at this meeting.
The group discussed the question related to resiliency and the potential impact of a negative leap second (with about a 30% probability of happening in the next 10 years). Some concerns have been expressed on this risk. This is an event that most likely has not been fully tested across all implementations, and recent test activities were mentioned, which showed with high probability that legacy systems would not handle negative leap seconds properly. A minimal probability that a leap second could occur in the near future will likely lead to large investments for the industry in order to reduce the impact on critical infrastructure such as mobile networks (where time synchronization is a prerequisite for the network to operate) or power networks. Investments required by "Year 2000" related projects, may provide some reference on the potential cost impacts.
As a result, Q13/15 recommends that the increased tolerance between UTC and UT1 (in that case future corrections of UTC are not expected to happen in the near future, i.e., for a hundred years or more) is implemented as soon as possible to remove any risk of the occurrence of a negative leap second, especially given the relatively short advance notification time (6 months). It is also worth highlighting that telecom applications typically require continuous timescale (see Appendix VI in ITU-T Rec. G.8271), and there is no need to know the UTC-UT1 difference.
During the discussion it was also noted that definition of new solutions to keep UTC close to UT1 involving changing frequency (and the duration of the second) could have a large impact on existing systems and timing protocol, and corrections with an integer number of seconds should be considered instead.

ITU-T SG15 looks forward to further cooperation with BIPM and IEEE P1588.

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PARIS, 2026-06-24

Summary of ITU-R Working Party 7A's activities during the study cycle after WRC-23, to implement Resolution 655 (Rev.WRC-23) highlighting the strengthened collaboration between ITU and BIPM

Resolution **655** (**WRC-15**) was successfully revised —thanks to the considerable efforts of regional telecommunication organizations (APT, ATU, CITEL, ASMG, CEPT, RCC) and strong support from the BIPM— during WRC-23, held in Dubaï in November-December 2023.

In accordance to *resolves* 2 of Resolution **655** (**Rev.WRC-23**) ITU-R cooperated with BIPM, CIPM and CGPM to define a new maximum value for the difference between UT1 and UTC that should be no less 100 s possibly, and on the date of implementation for continuous UTC, possibly in 2035. Furthermore, this resolution specified that the name UTC would remain unchanged for continuous UTC, and that a transition period for implementation should be established, allowing for the possibility to disseminate the increased difference between UT1 and UTC via radiocommunication system until 2035, but no later than 2040, in cases where existing equipment cannot be replaced earlier. In Resolution **4** on the use and future development of UTC, the 27th CGPM (2022) decided that the maximum value for the difference allowed between UT1 and UTC will be increased in, or before, 2035. The draft resolution C to the 28th CGPM (2026) proposes a maximum value of the difference between UT1 and UTC extended to one hour and the application date on 20 May 2027. These decisions have been made in close cooperation with several organizations including ITU-R.

Since WRC-23, Working Party 7A has met four times (March 2024 in Geneva, September 2024 in Almaty, and subsequently in March 2025 and March 2026 in Geneva), with regular attendance and participation by the BIPM. During this period, the following activities were successfully carried out:

1. Working Party 7A focused its efforts on the draft revision of Recommendation ITU-R **TF.460** on Standard frequency and time signal emissions to adapt it to a continuous UTC. Broad consensus emerged among delegates regarding most of the proposed improvements and additions, including the new annex on the DUT1 transmission code, that has been modified to cope with continuous UTC. This work will be completed in preparation for RA-27 and WRC-27;
2. Working Party 7A successfully finalized the revision of the Handbook on Selection and use of precise frequency and time systems—thereby addressing a "resolves" clause of Resolution **655** (**Rev.WRC-23**)—and this was unanimously approved by Study Group 7 at its meeting in March 2026;
3. The CCTF Task Group (TG) on Continuous UTC was established in 2023, as also mentioned in Resolution **655** (**Rev.WRC-23**). The Chair and UTC(k) experts participating in WP 7A activities as national delegates have contributed to the work of this TG to

date. Over the past years, no delegation to Working Party 7A has deemed it necessary to communicate with the TG through a liaison statement, demonstrating that no administration has expressed any concerns on this matter. These meetings enabled the TG to prepare a draft resolution on continuous UTC for CGPM 2026. This draft resolution on continuous UTC was the subject of a formal contribution from the BIPM, submitted to the meeting of Working Party 7A in March 2026, where the probability of a first negative leap second and its risks, were explained, leading to a quick implementation date for continuous UTC;

4. The BIPM actively participated in WRC-23 and strongly supported Resolution **655 (Rev. WRC-23)**; the BIPM has long participated regularly in, and made significant contributions to, the activities of Working Party 7A, and also to some preparatory meetings of the WRCs and prepared two special issues of ITU News Magazine in 2013 and 2023, respectively;
5. The Chair of Working Party 7A participated in all CCTF meetings, giving presentations on the activities of WP 7A, having been formally appointed by the Director of the BR to represent the ITU-R at these meetings. He also participated in the 2022 CGPM as part of the ITU-R delegation.

In light of the foregoing, the WP 7A considers that the collaboration established between the ITU-R and the BIPM has been significantly strengthened; this collaboration now operates within the framework of the Memorandum of Understanding signed between the ITU-R and the BIPM in 2020 regarding the respective areas of competence of each entity, as specified in a "recognizing" clause of Resolution **655 (Rev.WRC-23)**.

Dr Joseph Achkar
LNE-OP
Chair, ITU-R Working Party 7A

Liaison Statement on the future of Coordinated Universal Time

From: IEEE Precise Network Clock Synchronization (1588) working group

Contact:	Doug Arnold	Chair
	Rodney Cummings	Vice Chair
To:	BIPM Time Department	
Contact:	Patrizia Tavella	Director
CC:	ITU-T Q13/15	
	Stefano Ruffini	Rapporteur
	Lee Cosart	Associate Rapporteur

Date: 2025 April 02

Several new approaches for keeping UTC close to UT1 are under discussion for possible implementation in the future. We expect that the BIPM Time Department will be gathering feedback on this topic from industry, standards organizations and metrology labs and will advise the ITU-R on the cost and benefits of various options. We would like to contribute this liaison statement toward this end.

The IEEE 1588 standard defines the Precision Time Protocol (PTP) for distributing time in networks. It has become part of the world's critical infrastructure in telecommunications, power generation and distribution, financial systems, manufacturing, television production, defense, vehicles, aircraft, and data centers. Most of these deployments use UTC as the timescale, dictated either by legal regulations or technical standards. Network operators often do not upgrade equipment for a new version of PTP if the current timing system is operating with acceptable performance. So backward compatibility of PTP equipment is essential.

PTP distributes TAI plus an offset to determine UTC. The offset is expected to have an integer number of SI Seconds. Some use cases of PTP use the protocol to derive frequency or the duration of the SI second. This assumption is made in all editions of IEEE 1588. For this reason, any program for keeping UTC close to UT1 that involves changing the frequency, i.e. changing the duration of the second, would be incompatible with the deployed PTP-based timing infrastructure. We are aware that other technologies used in timing systems will also face similar problems.

We advise that any mechanism to keep UTC close to UT1 should foresee corrections that always consist of integer number of SI seconds, or that UTC corrections are postponed to far in the future.

International Earth Rotation and Reference Systems Service (IERS)

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(Chair)
Dr. Robert Heinkelmann
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2025-09-01

IERS feedback to CCTF

Dear Dr. Tavella,

From IERS point of view we do not see any advantage of having a 100 s or 120 s limit over the 3600 s limit. The difference of mean and apparent solar time, equation of time, alone is already +/- 900 s about. The extension of the individual time zones are the next fact that creates an effective difference of Sun's culmination moment and midday of zonal time. On top we have the activation and deactivation of daylight saving time in several countries. Users that need a precise solar time will use UT1, not UTC, regardless of its limit with respect to UTC. It causes the same amount of work for adaptation. But instead, choosing 100 s or 120 s might require again an adaptation in a relative short while; eventually even earlier than anticipated. Revising the limit again in a few decades could be seen as not serious / not reliable and would again cause work for the transition. Concluding for IERS, there is no advantage for the more restrictive limit.

On the other side, considering (i) the potential risks for society facing leap second insertion and in particular a potential negative one and (ii) the efforts of all the bodies involved in the creation of this resolution and the subsequent adaptation of all procedures, the IERS suggests to go for 3600 s and not less.

Hence, the IERS supports the adaptation of a leap hour between UT1 and UTC instead of the current leap second.

Dr. Robert Heinkelmann
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https://www.iers.org

Concerning the date of implementation, considering the risks, the IERS agrees with the proposal of advancing the application date to 2027-2028.

The IERS does not see the necessity of recommending revisiting this decision as part of the text of the resolution. All scientific resolutions are binding. But of course, if deemed necessary, they can be altered or updated.

Once a new process has been adopted for the UT1 – UTC relation, the IERS will take all necessary measures to change its operational provision of and its announcement of leap seconds accordingly.

With best regards,

Dr. Robert Heinkelmann
IERS Analysis Coordinator, on behalf of IERS

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