

Coordinated universal time and GLONASS

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Background (1)

2008 -2010

Working Party 7A (WP 7A) “Time signals and frequency standard emissions”, developed the draft revision of Recommendation ITU-R TF.460-6 “Standard frequency and time-signal emissions”, which was presented and submitted for approval in the ITU-R Study Group 7 (SG 7). This Draft proposes to define the Universal coordinated time (UTC) and the national coordinated time-scales as a continuous time-scale by eliminating the provision relating to leap seconds.



October 2010

While considering this issue at ITU-R SG7 the draft revision of Recommendation ITU-R TF.460-6 was not approved and SG7 decided to send this Document to the Radiocommunication Assembly 2012 (RA-12).



Background (2)

January 2012

At RA -12 after several statements of Administrations and Sector members supporting different views the Chairman stated that there are almost even balance between those administrations that are in favour of the draft revision of the Recommendation, those that are opposing it, and a third group of administrations, who indicated that as they had not participated actively during Study Group 7 and Working Party 7A meetings that more information is required to enable these administrations to form an opinion.

As a result RA-12 decided to address this issue in the RA-12 Report for World Radiocommunication Conference 2012 (WRC-12) to develop a new WRC-15 Agenda item.



Background (3)

February 2012

WRC-12 started a new study question on WRC-15 Agenda item 1.14: “to consider the feasibility of achieving a continuous reference time-scale, whether by the modification of coordinated universal time (UTC) or some other method, and take appropriate action, in accordance with Resolution 653 (WRC-12)”.



The proposed version of revision of Recommendation ITU-R TF. 460-6

Currently one of the possible methods of achieving a continuous time-scale proposed is to modify UTC's definition and revise Recommendation ITU-R TF.460-6 (Doc. 7/1005) accordingly.

Thus in accordance with the method given in revision of Recommendation ITU-R TF.460-6 it is proposed to end leap seconds in UTC whilst not changing the time scale name, i.e. it is proposed to change the content of UTC term and to keep the UTC name without changes. The proposed method has some significant disadvantages. The main ones are the following:

1. The problem related to required correction action is not solved.
2. The principle of backward compatibility with existing equipment is not addressed.



The problem related to required correction action is not solved

In the event of transition to a continuous time-scale it will still be necessary to transmit corrections which allow conversion of the continuous time scale into UT1 and UTC for solving several tasks based on the usage of the current UTC time-scale. In this respect failures caused by inadequate software or human factors are also retained and the risk of these failures could be increased.

In addition the difference between UT1 and the continuous time-scale and also between UTC and the continuous time-scale will increase and the consequences of failure due to such corrections could be significantly greater than the application of the current procedure described in the current version of Recommendation ITU-R TF.460-6.



The problem of backward compatibility

The problem of backward compatibility is related to the following: in case of implementation of the above mentioned proposal the backward compatibility principle will not be ensured i.e. some current equipment (for example, earth stations of non-GSO satellite systems, radio astronomy stations, radio-navigation systems and others) cannot operate in full mode without updates or replacements. Therefore it will be necessary to change or update the software and in some cases also the hardware operating these systems which will lead to significant costs. Moreover it will be necessary to modify legal and technical documents on both the international and national levels since many of them refer to the UTC time-scale as currently defined. This is due to the fact that all time measurements in normal life are performed using the UTC scale.



GLONASS system time

Currently the GLONASS radionavigation satellite system implements the time-scale with leap second in accordance with the international standards (Recommendation ITU-R TF.460-6).

The GLONASS time scale is periodically corrected to integer number of seconds simultaneously with the Coordinated universal time-scale (UTC) corrections that are performed according to the Bureau International des Poids et Mesures (BIPM) notification (leap second correction) under recommendation of the International Earth Rotation and Reference Systems Service (IERS). GLONASS-M satellites also transmit coefficients to determine the Universal Time UT1 and GPS correction to determine GPS time.



The impact of transition to the continuous time-scale to GLONASS system

For 30 years operation of GLONASS system implementing the time-scale with leap second in accordance with the international standards a large number of existing hardware and software has been adapted for insertion of leap seconds. In many cases this equipment completely excludes updating up to operation life date, for example, the spaceborne receivers. It should be noted that the guaranteed operation life of spacecrafts is more than 10 years and the GLONASS system shall keep the existing time-scale with leap second to ensure operation of this hardware.

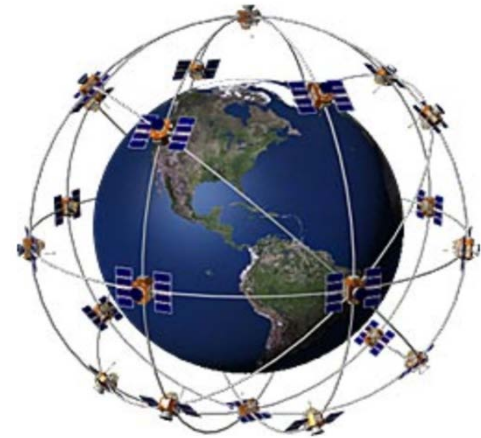
Taking into account the existing number of the GLONASS system navigation applications used in aviation, space and maritime the significant difficulties are expected in transition to the continuous time-scale in the GLONASS system if the existing time-scale with a leap second is not kept.



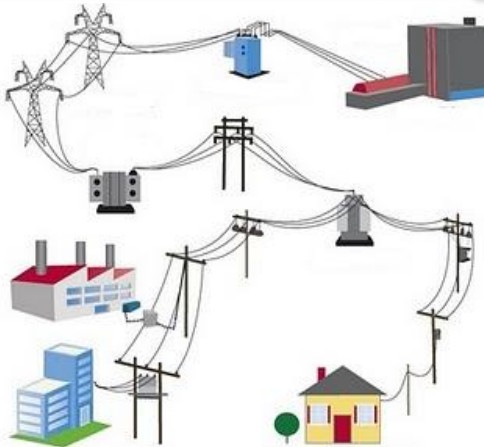
Relevance of the issue



Radio astronomy



Navigation



Energy



Telecommunication



Conclusions and proposals

It is proposed to consider other methods to satisfy WRC-15 agenda item 1.14 which can ensure backward compatibility, i.e. the existing equipment can operate in full mode of operation without updates and replacements.

Keeping the current UTC time-scale without changes and bringing into use the continuous time-scale on an equal basis with the current UTC time-scale can be proposed as one of the alternative methods.

Such decision allows to provide operation of the systems using the current UTC time-scale without any changes and costs and also allows to eliminate the problems related to corrections action i.e. in each case more suitable time-scale will be applied for a particular system.



Thank you for your attention!

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