RADIOCOMMUNICATION
STUDY GROUPS

International Telecommunication Union – Radiocommunication Sector (ITU-R)

18th Meeting of Consultative Committee for Time and Frequency

4-5 June 2009

Ron Beard
Chairman, ITU-R WP 7A
Broadcast Time and Frequency Services

U.S. Naval Research Laboratory
Washington, D.C.

RADIOCOMMUNICATION
STUDY GROUPS

ITU-R Study Group 7 Science Services

Working Party 7A Time Signals and Frequency Standard Emissions

Responsible for Standard Frequency and Time Signal (STFS) services, both terrestrial and satellite.

Scope includes the dissemination, reception and exchange of STFS services and coordination of these services, including satellite techniques, on a worldwide basis.

Goals are to develop and maintain ITU-R Recommendations in the TF Series and Handbooks relevant to SFTS activities, covering the fundamentals of the SFTS generation, measurements and data processing. These ITU-R Recommendations are of paramount importance to telecommunication administrations and industry, to which they are first directed. They also have important consequences for other fields, such as radio navigation, electric power generation, space technology, scientific and metrological activities and cover the following topics:

- **Terrestrial SFTS transmissions, including HF, VHF, UHF broadcasts; television broadcasts; microwave link; coaxial and optical cables;**
- **Space-based SFTS transmissions, including navigation satellites; communication satellites; meteorological satellites;**
- **Time and frequency technology, including frequency standards and clocks; measurement systems; performance characterization; time scales; time codes**

ITU-R CURRENT QUESTIONS

110/7	Time codes
111/7	Signal delays in antennas and other circuits and their calibration for high-accuracy time transfer
152/7	Standard frequencies and time signals from satellites
207/7	Time and frequency transfer using digital communication links
223/7	The role of differential GPS networks in timing applications
236/7	The future of the UTC time scale
238/7	Trusted time source for time stamp authority
239/7	Instrumentation time codes
244/7	Interference between standard frequency and time signal services operating between 20 and 90 kHz
245/7	Interference to the standard frequency and time signal service in the low-frequency band caused by noise from electrical sources
248/7	Timing Information from Global Navigation Satellite Systems (GNSS) and their augmentations
249/7	Time and frequency information from "enhanced" Long Range Aid to Navigation (eLORAN)
250/7	Application and improvement of two-way satellite time and frequency transfer (TWSTFT)

RADIOCOMMUNICATION
STUDY GROUPS

The Future of The UTC Time Scale

Question ITU-R 236/7

1. What are the requirements for globally-accepted time scales for use both in navigation and telecommunications systems, and for civil time-keeping?
    - Accuracy, Stability, Based on the SI Second
    - Uniformity, Accessibility
    - Reliability
    - Availability
    - Civil / National Timekeeping

2. What are the present and future requirements for the tolerance between UTC and UT1?
    - |UT1 – UTC| Tolerance of 0.9 seconds
    - Could a Greater Tolerance be Accommodated?

3. Does the current leap second procedure satisfy user needs, or should an alternative procedure be developed?
    - Availability of Leap Second Information for Users
    - Alternatives Used (Establishing System Independent Time)
    - Relationship of Telecom & NAVSAT System Internal Time to Time Scales

RECOMMENDATIONS

TF.374	Precise frequency and time-signal transmissions
TF.457	Use of the modified Julian date by the standard-frequency and time-signal services
TF.458	International comparisons of atomic time scales
TF.460	Standard-frequency and time-signal emissions
TF.486	Use of UTC frequency as reference in standard frequency and time signal emissions
TF.535	Use of the term UTC
TF.536	Time-scale notations
TF.538	Measures for random instabilities in frequency and time (phase)
TF.582	Time and frequency reference signal dissemination and coordination using satellite methods
TF.583	Time codes
TF.686	Glossary and definitions of time and frequency terms
TF.767	Use of global navigation satellite systems for high-accuracy time transfer
TF.768	Standard frequencies and time signals
TF.1010	Relativistic effects in a coordinate time system in the vicinity of the Earth
TF.1011	Systems, techniques and services for time and frequency transfer
TF.1153	The operational use of two-way satellite time and frequency transfer employing PN codes
TF.1552	Time scales for use by standard-frequency and time-signal services

RADIOCOMMUNICATION
STUDY GROUPS

ITU-R RECOMMENDATION TF.460-6
STANDARD-FREQUENCY AND TIME-SIGNAL EMISSIONS
(1970-1974-1978-1982-1986-1997-2002)

To maintain worldwide coordination of standard frequency and time signals

Disseminate standard frequency and time signals in conformity with the SI second

Continuing need for UT immediate availability to an uncertainty of 0.1 second

TAI - International reference timescale of atomic time based on SI second as realized on a rotating geoid. Continuous scale from origin 1 Jan 1958

UTC - Basis of coordinated dissemination of standard frequency and time signals. Corresponds exactly in rate with TAI but differs by integral number of seconds.

UTC scale adjusted by insertion or deletion of seconds to ensure agreement with UT1

DUT1 - Dissemination to include *predicted difference* UT1 – UTC (values given by IERS in integral multiples of 0.1 s)

Leaps Seconds may be introduced as the last second of a UTC month
December and June Preferred, March and September second choice

PROPOSAL TO WP7A

Modify UTC

- **Increase UT1 – UTC tolerance to Leap Hours**
  - **Effectively Freeze UTC in Parallel with TAI**
- **Discontinue Leap Seconds for UTC**
  - **Impact on currently defined broadcast values of DUT1**
  - **Broadcast service limitation for growing offset**
- **Discontinue DUT1 Broadcast**

UT1 Information with Greater Accuracy Available by Alternate Publication/Dissemination by IERS

Establish transition date/event/time

CURRENT STATUS

Preliminary Draft Recommendation TF.460-7 prepared by Working Party Oct 2007, revised April 2008, discussed October 2008

Draft Report of Activities and Documentation prepared in October 2008

Most significant outstanding issue being possible effective date

To be taken up again at Meeting in September 2009

If acceptable would be forwarded to Study Group for Formal Coordination and Approval