Consultative Committee for Time and Frequency

Sixteenth Session

(Sèvres, 1 and 2 April 2004)

**Report of the ROA TF Section
REAL INSTITUTO Y OBSERVATORIO DE LA ARMADA
July 2001 – March 2004**

Introduction

The activities for the period 2001-2004 have been mainly centred in the field of Time Transfer using different techniques: GPS and Two Way Satellite Time and Frequency Transfer (TWSTFT).

Clocks.

The UTC(ROA) time scale is generated by commercial caesium clocks. For the period of time from 2001 to 2004 the number of working clocks has been changing from a minimum of three to a maximum of five, depending on the maintenance of the ensemble and the substitution of the caesium tubes. The deviation of UTC(ROA) from UTC has been maintained between the limit values established by the recommendation of CCDS, 12th meeting (1993). The readings of the clock are done by a redundant system, (each one composed by a controlling computer, a switch and a TIC) in the minutes 00, 15, 30 and 45 of every hour. Data are available from the network and a web server produces pictures of the clock time differences respect to the time scale, that can be accessed visiting the internal Web page.

Quality System.

ROA's QS was presented to EUROMET QS-FORUM. ROA has followed the procedure indicated by QS-FORUM and the QS obtained the confidence after the Meeting held at Istambul in 3-4 September 2003. The CMC table for TF has been submitted to EUROMET.

Two Way Satellite Time and Frequency Transfer.

Most of the period of time that covers this report, TWTFT sessions were conducted three times per week. European stations (PTB, NPL, OCA, ROA, IEN and SP) used the first half of the hour for EU-EU links and the second half to compare to North-American stations (USNO and NIST). The operation of the station is fully automated using a controlling computer. The data of this comparison are used by BIPM to contribute to TAI.
A thunderbolt left the Ku-station out of operation from 24th of March to the 3rd of April 2002.
Since May 2003 the number of sessions per week increased to one per day and since January 2004 we are performing four sessions per day. This last change

offered us the chance to detect that the modem were timing the data one second late; the effect of this difference has been removed from the files since January 2004.

GPS Time Transfer

During this period of time ROA has been mainly focused in increasing the number of tracks per day that our TTR-5 and TTR-6 GPS receivers can do. We have attached a computer to both receivers and building an extended track schedule, we have successed in increasing the amount to get a mean of 84 track per day.[1]
ROA has established a GPS link using this method to calibrate a remote caesium clock having better results that using only the tracks contained in the traditional BIPM issued GPS schedule.

Time Scale Algorithm

Since summer 2002, a new Ensemble Time Scale based on the set of clocks at ROA has been realised [2]. This new scale denoted as TA(ROA) is computed every two hours, and optimised to obtain highest stability for an integration time of 20 days. This scale is the basis for the realisation of UTC(ROA) by a disciplined technique based on a linear predictor, moving average class of two points. UTC(ROA) is real time implemented from the most stable clock (master clock), by means of a frequency and phase offset generator. At this time, this new ensemble time scale has only an experimental and internal character, although in a short time will be the officially adopted at ROA.

Publications

[1].- Palacio J., Galindo, FJ, Lima JA., Extending the tracking schedule of a single channel GPS. 35th Annual Precise Time and Time Interval Applications and Planning Meeting, San Diego, CA.

[2] Galindo FJ., Palacio J., Post-processing ROA data clocks for optimal stability in the ensemble timescale, Metrologia, Vol 40 num 3 pp S237-244, Jun 2003.