

Report of the
Committee on GPS and GLONASS Time Transfer

1. Increased use of p-code and carrier phase data with RINEX output format
 - a. Software for conversion to BIPM time format available
 - b. Analysis typically uses 30-second measurements and converts to 13 minute "track"
 - i. Conversion cannot follow technical directives
 - ii. Difference from technical directives usually not significant
2. Analysis of combined phase and code data to compute solution for station clock
 - a. Comparison of different analysis software shows disagreements at level of about 0.1 ns even using the same data set. Some analyses show frequency offsets as well.
 - i. Rinex
 - ii. Bernese
 - iii. NRC Canada PPP
 - iv. ...
 - b. Discrepancies are especially significant for comparing primary frequency standards
3. Timing laboratories submit GPS measurement files to BIPM every day instead of once per month
 - a. File names include type of receiver and MJD of data
 - b. Increased overhead in handling 30X number of files
 - c. Data available to BIPM with much shorter delays
 - d. Preliminary estimates of $UTC(\text{lab}_1) - UTC(\text{lab}_2)$ available in near real time
4. Suggestions for future study
 - a. Take full advantage of rapid reports of GPS data by timing laboratories
 - i. Compute rapid and preliminary estimate of laboratory differences
 1. $UTC(\text{lab}_j) - UTC(\text{PTB})$
 2. This does not use clock data and is not a preliminary computation of UTC
 - ii. Detect errors and problems while they are still small
 - b. Replace 13-minute tracks and technical directives
 - i. Analysis using technical directives not necessary for multi-channel receivers
 - ii. Analysis not possible for geodetic-type receivers, 30 second data
 - iii. Track length of 13 minutes no longer necessary and too long for many purposes
 - iv. 4-minute advance converts multipath variation into systematic offset that is harder to evaluate
5. Suggestion for new technical directives

- a. Laboratory measures 30-second normal points
 - i. Output from geodetic receivers used as is
 - ii. Average 30 1 Hz measurements, assign time tag to midpoint
 - 1. hh:mm:15 to hh:mm:44, report as hh:mm:30
 - 2. hh:mm:45 to hh:mm+1:14, report as hh:mm+1:00
 - 3. least squares estimate of normal points or average removing outliers, ...
- b. Comparison with old 13-minute data uses least squares fit to normal points as at present
- c. Fully compatible with geodetic receivers and RINEX output
- d. Supports analysis using C code, P code, or carrier phase
- e. Simple averaging or decimating to use IGS products