

2016 Timing Subcommittee Report

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Portland, Oregon

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Summary of September 12th meeting

- ✓ 9 presentations
- ✓ Session lasted almost four hours
- ✓ Many questions from audience and a high level of audience participation and interest

Reports from each of the four U. S. timing laboratories that contribute to Coordinated Universal Time (UTC)

- ✓ Naval Research Laboratory (NRL) report
 - presented by Francine Vannicola
- ✓ United States Naval Observatory (USNO) report
 - presented by Stephen Mitchell
- ✓ National Institute of Standards and Technology (NIST) report
 - presented by Michael Lombardi
- ✓ John Hopkins Applied Physics Lab (APL) report
 - presented by Jeffrey Garstecki

Two reports from manufacturers of GPS disciplined frequency and time standards

- ✓ Jeff Gust of the Fluke Corporation
 - Described how GPS disciplined oscillators (GPSDOs) serve as the frequency standard in most calibration laboratories in the United States.
 - Described how calibration laboratories use GPSDOs to establish metrological traceability to the International System (SI) units.

- ✓ Bruce Penrod of EndRun Technologies
 - Described a new GPS disciplined product that has many safeguards in place to guard against the use of bad data in the GPS broadcast, such as the error in the UTC offset parameter that occurred on January 26, 2016.
 - The new product also has a new algorithm for modelling the ionosphere that provides performance comparable to a dual-frequency (L1/L2) receiver, even though it is based on a single-frequency (L1) receiver.

A report was given on the use of GPS Time in the electric power industry

- ✓ Presented by Alison Silverstein of the North American SynchroPhasor Initiative (NASPI)
 - Described how the total loss of GPS would be a huge inconvenience for the electric power grid and would cause the grid to run much less efficiently, but the power grid would not fail without GPS.
 - Noted that there are now 3,000 phasor measurement units (PMUs) synchronized to GPS time deployed in North American power grids.
 - Provided some examples of power disturbances caused when leap seconds occur.

Other reports included:

- ✓ Information about Rapid UTC (UTC_r) and time transfer over fiber optics was submitted by the subcommittee's chair Wlodek Lewandowski of the Polish Central Office of Measures (GUM) in Poland.
- ✓ Demetrios Matsakis of USNO presented about how GPS precise point positioning (PPP) has been used to test the theory of relativity and to make some of the most accurate relativistic measurements made thus far.

These topics were discussed from various perspectives in several of the presentations

- ✓ The 13-microsecond GPS timing error of January 26, 2016.
- ✓ GPS receiver failures related to the week 1024 rollover problem.
- ✓ The insertion of leap seconds.
- ✓ GPS vulnerabilities and their affect on timing systems.