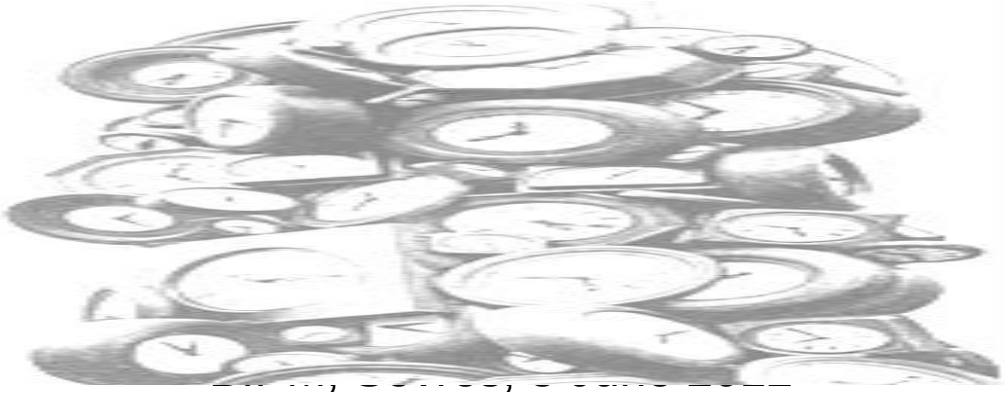
Programme of work and budget for 2013-2015

Plans for 2016-2019

Time Department

Elisa Felicitas Arias



Programme of work 2013-2015

- Continues with the activities in 2009-2012 *
- Assuring the frequency accuracy and stability of UTC
  - Multi-GNNS-system time links
  - Novel methods of time comparison
  - GNNS equipment delays, support from RMOs, NMIs
  - Revised clock weghting in EAL
- Traceability and access to UTC
  - CCTF.UTC-K (values of [UTC-UTC(k)] monthly, BIPM Circular T)
  - Rapid UTC (values of [UTCr-UTC(k)] weekly
- Highly accurate t&f transfer
  - Optical clock comparison
  - Use of SRS for the accuracy of TAI

Activities

- T-A1 Frequency stability and accuracy of TAI
- T-A2 Timescales dissemination in NMIs and other institutes
- T-A3 Underpinning of the accuracy of time links through characterization of delays in GNSS equipment in laboratories
- T-A4 Integration of secondary representations of the second in the accuracy improvement of TAI
- T-A5 Coordination activities
- T-A6 Internal Services

T-A1 Frequency stability and accuracy of TAI

- Improving the time transfer for clock comparison between participating laboratories;
- enhancing the two-way links, and establishing of a more robust multi-GNSS time links with Global Positioning System (GPS), Global Navigation Satellite System (GLONASS), the new Galileo GNSS system and with others as new systems emerge;
- revising the algorithms and developing associated software and to improve the frequency accuracy of TAI.

T-A2 Timescales dissemination in NMIs and other institutes

- Publication of
  - Values of [*UTC* - *UTC*(*k*)], monthly
  - Values of [*UTCr* - *UTC*(*k*)], weekly
  - TT(BIPM), yearly, and of its monthly predictions
  - Annual Report of Time Activities

- Maintenance of
  - Up-to-date ftp server with all relevant information on data, results, analysis related to the calculation of UTC
  - The Time Department Database

T-A3 Underpinning of the accuracy of time links through characterization of delays in GNSS equipment in laboratories

- maintaining the BIPM travelling standards for relative delay measurements and coordinating campaigns of measurements in NMIs and other participating laboratories;
- coordinating campaigns with Regional Metrology Organizations (RMOs), with their own travelling standards;
- linking RMO results with the BIPM comparisons;
- assessing the potential application of measurement of absolute delays in GNSS equipment, as output of research in the period 2009 to 2012.

T-A4 Integration of secondary representations of the second in the accuracy improvement of TAI

In view of the necessity of performing highly accurate time and frequency comparisons to exploit the full potential of the new SRS, which may provide the basis for a redefined second, the Time Department will continue to:

- support the joint activities of the CCTF and CCL in the evaluation of optical and other frequency standards as candidates for SRS and for the *mise en pratique* of the metre;
- contribute to studies, and to the CCTF activity, on time and frequency transfer techniques for highly accurate optical standards based on novel methods (optical fibres, microwave links to atomic clocks in space, time transfer through TW and laser ranging in T2L2, frequency combs) and determine the methods to be implemented for enabling the data of these frequency standards to contribute to TAI in order to improve its accuracy.

T-A5 Coordination and international liaison

- CCs, WGs, NMIs, RMOs
- International Telecommunications Union – Radiocommunication Sector (ITU-R);
- International Earth Rotation and Reference Systems Service (IERS);
- International GNSS Service (IGS);
- International Astronomical Union (IAU);
- International Committee for GNSS (ICG)
- Civil Global Positioning System Service Interface Committee (CGSIC)

Resources I-Staff

E. Felicitas Arias	director
Zhiheng Jiang	t.transfer
Wlodzdimierz Lewandowski (until 2014)	t.transfer, int. liaison
Gianna Panfilo	algorithms, primary frequency standards
Gérard Petit	t.transfer, frequency standards
Lennart Robertsson	freq. standards, f transfer BIPM projects
Aurélie Armegnies	assistant, calculation, software
Hawaï Konaté	technical support
Laurent Tisserand	technical support

Staff (permanent): director, 5 physicists, 1 assistant, 2 technicians

Guest workers or secondees:

- for the work on alternatives to the measuring of relative delays of GNSS equipment (co-financed BIPM-CNES);
- for studying links for time transfer, such as the microwave link in the frame of ACES, starting in 2015 and continuing in the following programme of work by one additional year.

Resources II-Expenditure (280 k€)

YEAR	TOTAL	MAJOR ITEMS	COST
2013	82 (45)	GNSS receivers (2)	30
2014	119 (82)	New Cs standard	70
2015	80 (43)	GNSS receiver (1)	35

Staff (DD included)

- 2013: 9; 1 post-doc co-financed with CNES (GNSS)
- 2014: 8 (1retirement); 1 post-doc co-financed with CNES (GNSS)
- 2015: 8; 1 post-doc co-financed (accurate t&f transfer)

Plans for 2016-2019

- Continues with the activities in 2013-2015
- Assuring the frequency accuracy and stability of UTC
  - Multi-GNNS-system time links
  - Novel methods of time comparison
  - GNNS equipment delays, support from RMOs, NMIs
  - New algorithm
- Traceability and access to UTC
  - CCTF.UTC-K (values of [UTC-UTC(k)] monthly, BIPM Circular T)
  - Rapid UTC (values of [UTCr-UTC(k)] weekly
- Highly accurate t&f transfer
  - Optical clock comparison
  - Use os SRS for the accuracy of TAI

Activities

- T-A1 Frequency stability and accuracy of TAI
- T-A2 Timescales dissemination in NMIs and other institutes
- T-A3 Underpinning of the accuracy of time links through characterization of delays in GNSS equipment in laboratories
- T-A4 Novel t&f transfer for clocks on Earth and space
  Secondary representations of the second in TAI
  Moving to a new definition to the second
- T-A5 Coordination activities
- T-A6 Internal Services