History of the Department of Standard Time and Frequency

The Department of Standard Time and Frequency (DSTF) was created in 1955 as one of the root departments of the then newly established IREE. The creation of DSTF was in connection with preceding research activities of Jiří Tolman (†1998) who later headed the DSTF for nineteen years (1955 to 1974). He won particular recognition in 1967 for devising a method of time scale comparisons via television synchronizing pulses. In the pre-GPS era the Tolman method was being employed by time laboratories throughout the world.

The DSTF started transmitting standard time and frequency via the OMA 50 kHz station as early as in 1957. In 1961 IREE moved to a new building at Kobylisy whose part was specially constructed for the purposes of time and frequency metrology. To illustrate the case, in order to ensure ultra stable environmental conditions for the quartz oscillators, which at that time were the only DSTF frequency standards, a special temperature controlled 14 m deep well was used.

In 1958 Mr. Tolman proposed that a maser should be constructed at IREE. Following his proposal the Laboratory of quantum electronics, later renamed to Department of Quantum Electronics (DQE), was created to carry out research in atomic frequency sources. Thus as early as in 1963 Viktor Trkal and his colleagues of DQE put in operation the first ammonia maser and the same year Jan Blabla of DQE developed a ruby laser. In 1964 a maser based on the isotope 15NH3 was made and the Stark effect splitting in maser was discovered. Later Mr.Tolman insisted that DQE should develop also a hydrogen maser but the Soviet invasion of Czechoslovakia in 1968 wrecked these plans. After the invasion the DQE was dissolved and the key physicists of DQE were compelled to leave the IREE for political reasons.

In 1969 the first industrial cesium clock, a HP5061A, was put in operation at DSTF. It is believed to be the first HP cesium clock ever in operation behind the iron curtain. In 1974 Mr. Tolman was replaced by Otokar Buzek as head of DSTF. In the 1970s the activities at DSTF were mainly directed to time and frequency transfer systems. In 1976 a slow time code using phase keying of the carrier was implemented into the OMA signal and later a series of OMA driven clocks and frequency standards were developed. In 1977 the Pragotron Company produced several experimental OMA-disciplined street clocks designed at DSTF which were put in operation in the streets of Prague. At that time the OMA system was able to provide millisecond accuracy to distances over 2000 km (experiments with OMA-driven clocks were made in Cairo, Egypt, and in Peninsula of Kola, Russia).

Until the mid 1980s the UTC(TP) time scale generated at DSTF was traceable to BIPM by means of the Tolman method using the TV link to the Physikalisch-Technische Bundesanstalt (PTB), Germany. In 1987 the TV comparisons were complemented by LORAN-C. One of the consequences of the political changes in Czechoslovakia in 1989 was the free access to western technology which resulted in overall modernization of the DSTF. Thus, for instance, since 1991 the common-view GPS time comparisons have started. It should be mentioned that the OMA-50 transmission was discontinued as of 1/1/1996 because of the lack of funds.

In 1996 Jan Čermák took over as head of DSTF because of Dr Buzek's retirement (Dr Buzek remained working at DSTF part time).

Of great importance for DSTF has been the collaboration with Czech Telecom (now Telefónica O2 Czech Republic). It started in 1992 as DSTF was asked to design a primary frequency reference source for Czech Telecom that was based on optimum employment of cesium clocks sited at Czech Telecom and DSTF. To ensure precision frequency transfer between DSTF and Czech Telecom, a special high-performance fiber optic link was installed. The link later served to study the time transfer stability of fiber optic systems.

For many years important collaboration has also been established with Czech Television (CTV). Since the mid 1970s the CTV studio in Prague was interconnected with DSTF by a microwave link that made it possible for CTV to disseminate the standard frequency. First it was in the form of 2.5 MHz bursts in the 21st line (until 1997) and later by means of black/burst synchronizing pulses referenced to standard frequency from DSTF. In order to further extend the TV standard frequency dissemination, a microwave link was installed also between DSTF and the NOVA Television studio in 1998 (the link was discontinued in 1999). In 1998 a project was launched at DSTF to study the negative effects on frequency transfer via TV synchronizing pulses due to digitizing the TV signal, use of satellite transmissions, and use of asynchronous transfer mode (ATM).

As the newly emerged Czech Republic, after the split of Czechoslovakia in 1992, started to build its own national metrological system (earlier the Czechoslovak official metrology including time and frequency was concentrated in Bratislava, Slovakia), it was only natural that IREE was asked to take responsibility for the National Time and Frequency Standard. As a result, considerable support for DSTF’s metrological activities has been provided by the institutions responsible for the National Metrological Systems which are the Office for Standards, Metrology and Testing (COSMT) and the Czech Metrology Institute (CMI). Currently, the part of the DSTF called Laboratory of the National Time and Frequency Standard complies with the CMI Quality System and is considered a CMI Associated Laboratory.

In 2002 a special laboratory was established for measurement of short-term frequency stability and phase noise.

In January 1, 2007 the IREE was renamed as Institute of Photonics and Electronics (IPE) to better reflect its research scope. At the same time the Department of Standard Time and Frequency (DSTF) was renamed as Time and Frequency Department (TFD). Current research scope in TFD is ultra-sensitive measurement of short-term frequency stability, precision time interval measurement, and performance of time comparisons via GNSS.