Development and Applications of a Traceable Time-Transfer System

Michael J. Wouters, Peter T. H. Fisk, R. Bruce Warrington

National Measurement Institute, Sydney, Australia

Email: Michael.Wouters@measurement.gov.au

NMIA has been developing GPS common-view (GPSCV) time-transfer systems (TTS) since the late 1990s. At the time this development began, there were only a few commercial TTSs and there was a clear need for a low-cost system. While moderately-priced TTSs are now available, it has nonetheless proved advantageous to continue development of our own custom system because it has provided a flexible platform upon which to build integrated systems for timing applications beyond basic GPSCV.

The core of our system has always been an inexpensive, OEM GPS receiver. Initially we used the Motorola VP Oncore and when this ceased production, we moved to Topcon (later Javad) GPS receivers. The latter receiver was more versatile, and provided better timing performance, but eventually we adopted the Trimble Resolution T as our basic receiver, since these were much more economical.

Nearly all of the various incarnations of our TTS have used a single-frequency receiver without the capability of external referencing. Since RINEX-format observation data was not conveniently available, custom software was necessary to generate CGGTTS data files for time-transfer. Investment in software development is the flip-side of using low-cost receivers.

The initial application for our TTS was providing traceable frequency in calibration laboratories and we supplied a number of systems that are still used throughout Australia for maintaining a continuously traceable link to UTC(AUS). However, as time passed, this application diminished in relative importance, in favour of providing traceable time, often with relatively modest accuracy requirements, eg ±1 ms. Accordingly, our system evolved into a Network Time Protocol (NTP) server, with the basic traceability provided by the GPSCV core. In some applications, the NTP server does not provide time; instead it audits existing NTP infrastructure via NTP.

A formal reporting service has always been associated with supply of a TTS to a domestic customer. Data files from each TTS are uploaded each day, processed and reported upon, entirely automatically. Each month, a printed report is prepared for customers and then issued as a formal record of performance and traceability. Again, this process is mostly automated.

More recently, we have commenced a new phase of development. We are aiming to reduce the cost of the system significantly, to make some new applications economical, and also to introduce some new capabilities including: making use of new GNSS signals; a choice of internal oscillators; new time outputs; and auditing of time signals other than NTP.