

TIME SCALES AND NAVIGATION SYSTEMS

COLLOQUIUM ON UTC

26 May 2003

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GPS SYSTEM

The satellite transmitters are precisely synchronized to a common reference time known as “GPS Time” so that the relative error between different satellite signals is very small.

GPS Time an average of the signal phase output of the atomic clocks in the satellites and the ground control segment

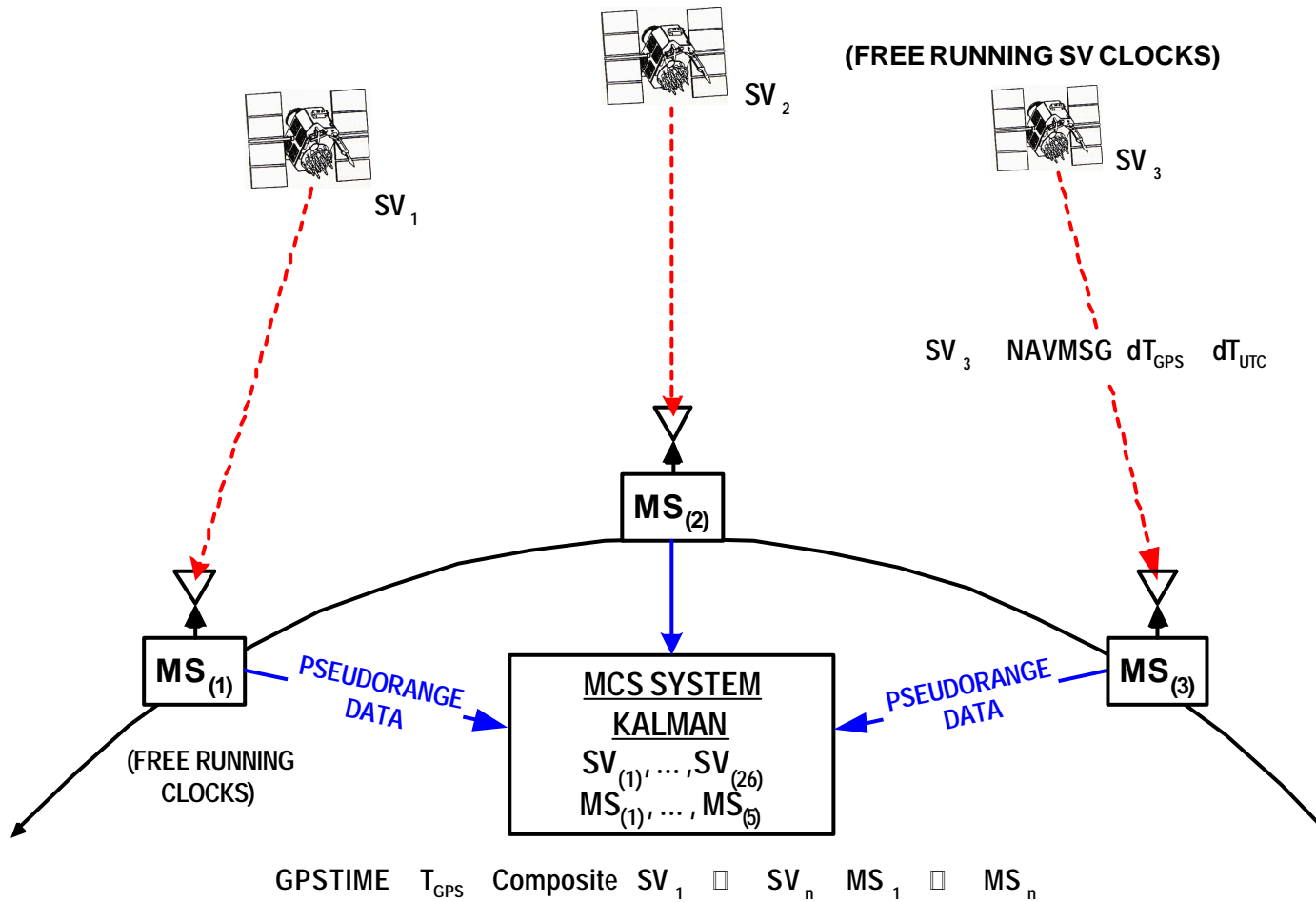
Coherent synchronized network with good short-term stability for time periods up to a few days

long-term accuracy and stability is accomplished by long term steering of GPS Time to within a microsecond of UTC (USNO)

Fine correction of individual satellite measurements through the data message for precise final correction of the measurements to UTC(USNO)

Without the monitoring and corrections to UTC (USNO), GPS Time could run at almost any rate and offset

GPS OPERATION



“GPS TIME”

Consistency and relative synchronization between GPS satellites is essential for precise navigation

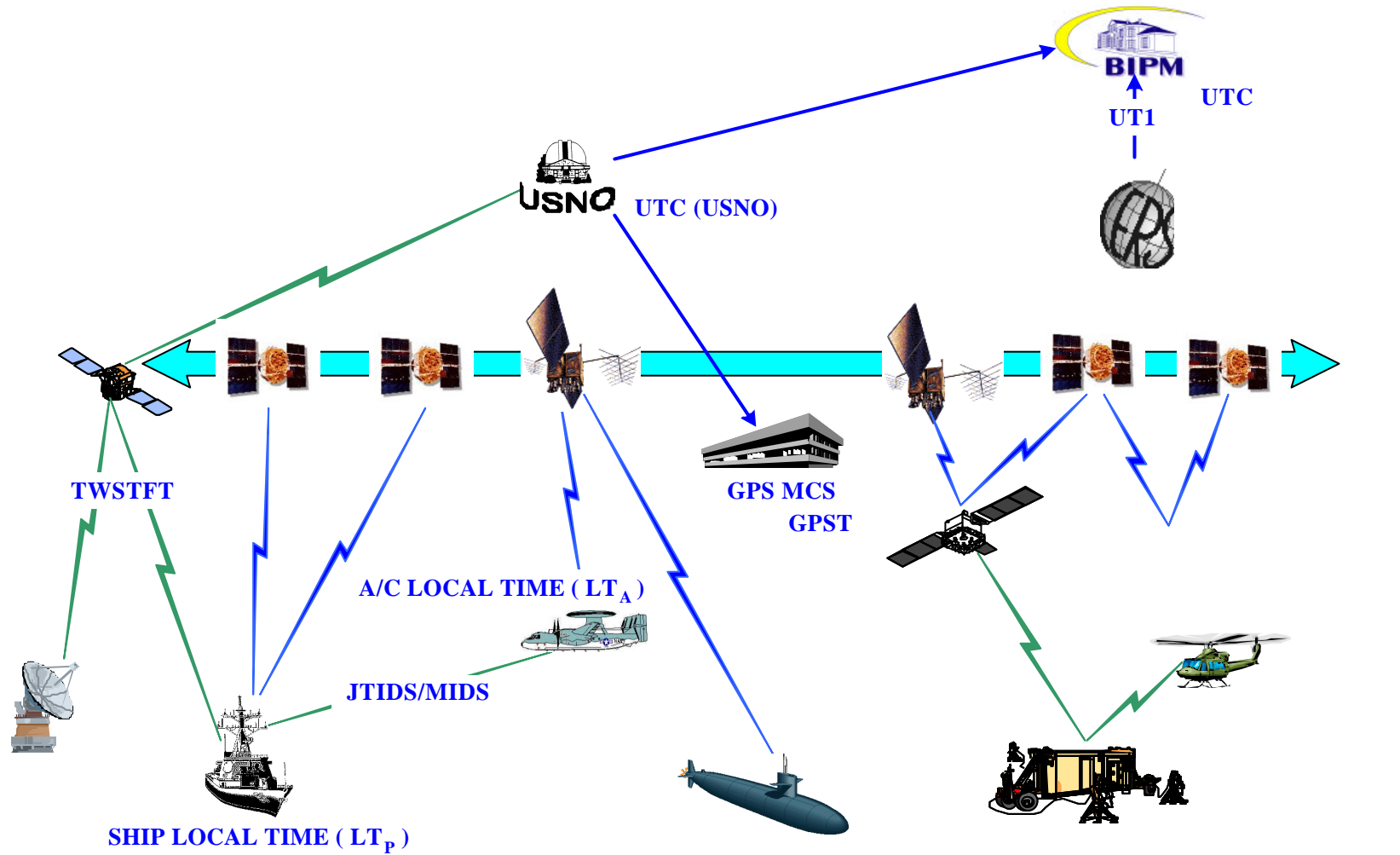
Formulated as System Synchronization Time

Generated and Maintained Independently

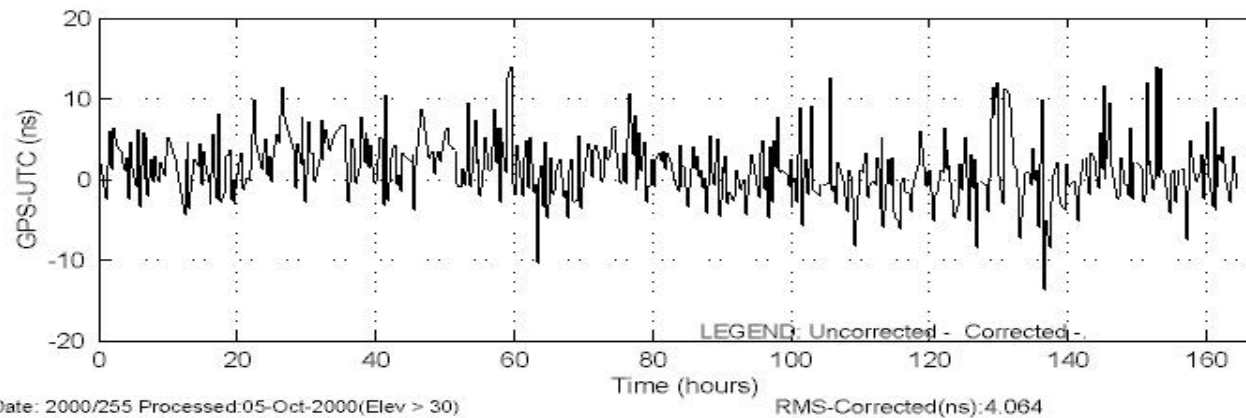
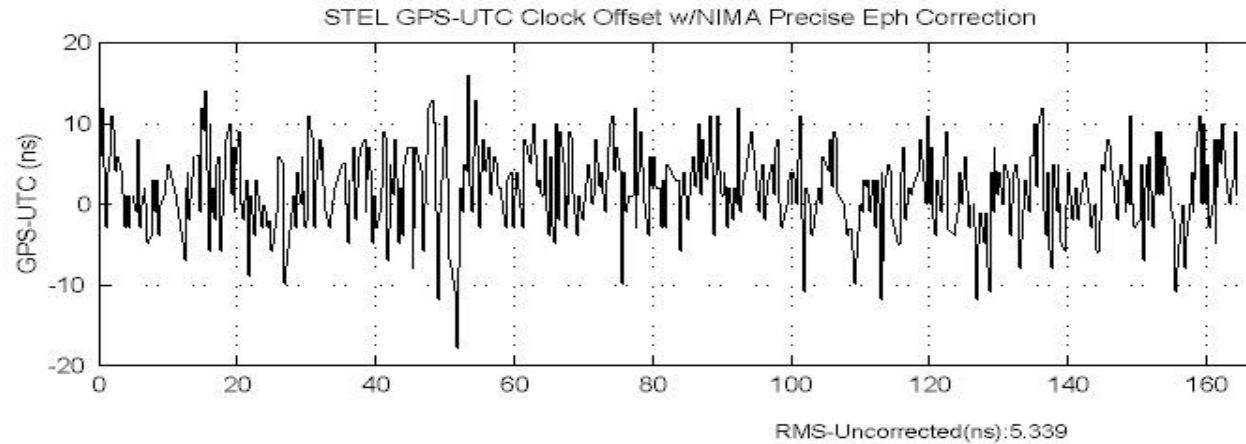
Result of synchronizing the atomic clocks within the GPS system amongst themselves, both physically, by tuning (changing the frequency of the clock), and through software (by providing a correction term to be applied by the user)

Operation as a Time Scale

NAVIGATION and TIME



GPS-UTC(USNO) with 15-min filtering: 25% Improvement (preliminary)



Log Date: 2000/255 Processed:05-Oct-2000(Elev > 30)

“HYPOTHETICAL GPS TIME SCALE”

Remove those clocks in spacecraft that are steered to maintain a stable navigation system;

Continual comparison those clocks in spacecraft and on the ground that would contribute to the timescale, record and report the measurements to the BIPM;

Insure that the clocks being used are of comparable performance to those being utilized by the BIPM in the formation of UTC if the GPS is to make a relevant contribution to the process;

Develop a timescale algorithm, subject to review for the calculation of the timescale;

Provide clock inter-comparison configuration, measurement data and operating conditions, changes, tuning and any adjustments to the clocks and data to the BIPM on a regular basis; and

Participate in regular time transfer comparisons of the master, or output clock representing the timescale with other laboratories.

FUTURE CAPABILITY

