USNO eLoran Testing

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What is Loran (Long Range Navigation)?

What is eLoran?

- eLoran (Enhanced Long Range Navigation) is a ground based radio navigation system
  - Not a replacement of GPS but a complement/backup
  - Derived from the old Loran-C systems
    - With the addition of a data channel on the transmitted signal
    - In USA, old transmission stations from Loran-C systems are reused for eLoran testing
  - Relies on transmission stations and the difference between the signals from two stations
    - Grouped into chains – a single master station and secondary stations
    - Master station transmits first, followed by successive transmissions from each of the secondary stations of the chain
    - Master & secondary transmission sequence is repeated periodically
  - Each station emits precisely timed and shaped radio pulses centered at 100kHz
    - 8 pulses spaced 1000 microseconds apart
What is eLoran?

eLoran Testing

• Cooperative Research and Development Agreement (CRADA)
  – UrsaNav, Exelis, the Department of Homeland Security’s Science and Technology Directorate (DHS S), and the U.S. Coast Guard
    • Testing and demonstration at former LORAN-C sites

• 2 tests at USNO
  – Coordinated with UrsaNav
  – July 20-22, 2015
    • Presentation as part of D.C. Section ION meeting held at USNO
  – August 25-28, 2015
    • Wildwood 08/25 0900(EDT) through 08/28 1800(EDT)
    • Broadcasting as 8970 Master and Secondary
    – What is the achievable time transfer from UTC value?

• USNO has a TWSTT setup in Wildwood, NJ to support these tests
eLoran Testing at USNO

USNO Master Clock

1PPS

eLoran Receiver

1PPS

Time Interval Counter

1PPS

Data Collector

Raw data
1pps difference USNO MC vs eLoran

MJD

nanoseconds
1pps difference USNO MC vs eLoran
eLoran, TWSTT at Wildwood, NJ
utc(usno) – loran support unit(lsu) cesium
july 21 – aug 08, 2015
eLoran Testing at USNO

• Results to date indicate better than 50ns from UTC is achievable
  – Even with equipment that has not been maintained for 2-4 years
  – eLoran will work with previously installed Loran-C stations

• Further improvements can be achieved with application of different corrections transmitter steering towards UTC using TWSTT from USNO

• The quest for a system to complement GPS continues…