

# NIST Seminar at NGA/GPS Division

## March 28 – 29, 2007

### Day 1 - Wednesday, March 28, 2007:

8:00am: [David Howe](#) - Precision time and frequency characterizations and measurements  
Noise types (instabilities) from the environment and aging electronics  
Sampling time, “ $\tau$ ”

How to measure, prepare, and analyze time data  
Data analysis of clocks and oscillators

9:40am: *Break*

10:00am: [David Howe](#) - Descriptions and assessments of clocks and oscillators  
Tutorial on quantum mechanics, atomic states...  
Cesium, rubidium, hydrogen masers and how they work  
What yields good stability? What causes poor stability?

10:50am: *Break*

11:00am: [Judah Levine](#) - Where does time originate and how does NGA relate to its origination?  
Time scales  
Implementation of time scales  
Kalman filter

12:00 – 1:00pm: *Lunch*

1:10pm: [Judah Levine](#) -How time is disseminated (time transfer methods) and compared (Circular-T)

1:50pm: [Judah Levine](#) -Time agencies and their users  
NIST to -> whom  
USNO to -> whom  
BIPM to -> whom

To whom are we (NGA) traceable to?

What is meant by clock ‘steering’?

3:00pm: *Break*

3:15pm: [Judah Levine](#) -Description of GPS and how it functions  
Navigation solution  
Time solution

What’s wrong with using GPS as a time standard?  
“UTC(GPS)” pros and cons

5:00pm: *Close*

**Day 2 - Thursday, March 29, 2007:**

8:30am: **David Howe** - The Clocks of Today and Tomorrow  
Fountains and optical  
Laboratory vs. fielded (ground based and space based)  
Large vs. small

9:45am: *Break*

10:00am: **Judah Levine** -GPS-receiver 'clocks': ground based vs. space based

How is electronics 'hooked-up' for optimum timing, i.e., receiver, AoG's, cabling, antennas, connections to clocks, etc...

How to measure, prepare, and analyze time data  
Data analysis of GPS-time from receiver(s) vs. UTC

12:00 – 1:00pm: *Lunch*

1:15pm: Open session topics, to be determined

3:00pm: *Break*