

## CIVIL GPS SERVICE INTERFACE COMMITTEE MEETING

David Allan, Allan's Time: Good morning. This report will be very brief. I think we all know of the tremendous contribution that GPS has made to the time and frequency community. As of January of this year, an official memorandum of agreement was signed between the DoD and the DoT which effectively establishes it as a permanent service through the year 2005, to be used by DoT and the civilian sector. And so we have, as you might say, an opportunity to utilize this; and certainly it has been, but it is a matter of recognizing the tremendous momentum that exists in the civilian community, utilizing the service that GPS can provide.

The committee, CGSIC, is a civil GPS interface committee. It was set up specifically in agreement between DoD and DoT so that information can flow – it is really an information-flow organization – from the military to the civilian users, about the status of GPS. Within this CGSIC, there are three subcommittees. One is an international cooperative, pulling different nations together in terms of their political concerns, as well as utilization of the system. The other one is essentially differential GPS for position determination. The Coast Guard is one of the main drivers for this; they are very actively using differential GPS off the coast with information about the SA signal so that non-secure receivers can be navigated at about a 10-meter accuracy level at some hundreds of kilometers off the coast. And that is not a very active system.

The third committee is the Timing Subcommittee, and that is the one that I can report about as chair. Dr. Lewandowski cochairs that with me, and this slide shows the cover page for the last meeting, which was held in conjunction with the meeting just reported about the ION conference in Salt Lake City. We met two days prior to that conference and there is about a half inch of summary records of the minutes. If anybody wants to get those, you can access them from the Coast Guard. Specifically the Timing Subcommittee serves a variety of functions and organizations in a broad sense. The generation of international atomic time and UTC is critically dependent nowadays on GPS common view, as was reported yesterday. We also serve the international timing centers generally to make sure that they have as best information as we can give them from DoD about GPS performance. The Deep Space Network for JPL is integrally tied to GPS in the common-view mode. Direct access to GPS is becoming more and more utilized by the telecommunications industry; our committee is often represented by people from Telecom Solutions, from AT&T, and they are very active participants in this Timing Subcommittee.

The power industry has come on board in the last year or two. We heard an excellent paper yesterday on the utilization of GPS in BC Hydro and Power Authority. NIST has provided a global time service now for about a decade in which we use GPS common view to provide the very accurate time and frequency from the U.S. Frequency Standards Lab and Time Scale at Boulder, Colorado. In 1984, we set up a system at Arecibo. Other places as well are using GPS to time the very predictable millisecond pulsar timing signals of which now there are about a dozen such pulsars being studied. This has an incredibly high interest level. Those of you who follow physics know that Professor Taylor at Princeton just received the Nobel Prize for his work in this regard. This promises to be one of the potential candidates which may detect actual gravity waves and document their existence in a terrestrial sense.

There are other precise timing systems that I won't take time to go into. But anyway, this committee is quite active; and we feel it is service-oriented in providing a useful service because of the tremendous potential that GPS provides for the civil sector.

Let me just share a couple of results. Dr. Lewandowski presented some of the same things that he reported to you yesterday. We do comparisons with GLONASS, look at the accuracies of GPS, the effects of coordinates, the effects of the ephemeris ionosphere. I will not repeat those, as you saw those yesterday. The one thing that has been very useful in terms of telecom and the power industry and some of the civil users who don't want to do common-view is the realization that one can characterize the spectrum, as we showed last night, in a very simplistic way, using the  $\sigma - x(\tau)$ ; you probably can't read this very well, this is the square root of the time variance that we developed last night. This would be 10 ns, 100 ns. And we see this very typical behavior on all of the satellites. It kind of random walks away; there is a decorrelation time of the order of 300 seconds or so; and then it behaves normally tau to the one-half, which would be modeled by white phase modulation process. And once you develop this model and you can do similar to what Dr. Thomas showed yesterday, some averaging, and effectively average out most of the SA. From a theoretical point of view, it looks like you can average it out so that, in fact, it would be as good as if SA were not there.

So from a civil point of view, this is extremely useful. We studied it both across all the satellites and as a function of several passes. I showed this graph last night. This is over a sequential five-day period. This is the square root of TVAR, you see max at tau; and again, we peak up integration times at the order of 300 seconds. It changes slightly from day to day, but one can make a very nice model and mask for this and design algorithms appropriately.

So I think we have a very encouraging direction for the civilian users in this regard. We have a very active committee and it is fulfilling its purpose as a service organization. Thank you.

