MR. PRESTON: Dan Preston with IDC. I agree with Beth. Our goal was to come here as one of the late comers in the game and to demonstrate a delivery capability that was consistent with the needs of public safety and within the cost recovery, current cost recovery bounds and so on. We've seen a marked improvement in the technology and I reiterate what she says is, what we're really looking for is, let's make sure we clearly define the requirements for either network based or handset based, and let the markets decide, let the wireless carriers decide which brand they want to buy. Thank you.

MR. HATFIELD: Okay, thank you. I think we'll wrap up here and start our break at this point. And since we're breaking a little bit early, I think we can come back right at 3:15 sharp and start the discussion part of the agenda. Thank you.

(Whereupon, a short recess was taken.)

MR. HATFIELD: Okay, if we can get started again, please? If we can have our panelists gathered, we can get started, please? Okay, do we have everybody up front? If we can get started, we're now into the discussion phase of the round table, and what I'd like to do, we have a lot of people up here at the table. Now, what I'd like to do is start out by just going around the table and having each person just identify themselves and their affiliation and

then after that, we'll actually start then, beginning with a question from the Commission staff people upfront. And just arrived is Tom Sugrue, whom I'm sure most of you know is chief of our Wireless Telecommunications Bureau.

MR. SUGRUE: I'm Tom Sugrue from the Wireless Bureau.

MR. SCHLICHTING: I'm Jim Schlichting, deputy chief, Wireless Bureau.

MR. NETRO: I'm Ron Netro, engineering, the Policy Division.

MR. HANNA: I'm Joe Hanna with the City of Richardson and the President-Elect of APCO International.

MR. MILLER: I'm Bob Miller, technical issues director for NENA.

DR. BIRCHLER: Mark Birchler of Motorola Labs.

MR. CEDERVALL: Mats Cedervall from Ericsson Research.

MS. SILLANPAA: Anna Sillanpaa, Nokia.

MR. SMITH: Tony Smith from Nortel Networks.

MR. SOLIMAN: Samir Soliman, vice president of technology, QUALCOMM.

DR. HILSENRATH: Oliver Hilsenrath, U.S. Wireless.

MR. MALONEY: John Maloney, KSI.

MR. KAHAN: Dennis Kahan, SigmaOne.

MR. STILP: Lou Stilp, TruePosition.

MR. BELL: Walter Bell, SnapTrack.

MR. CHADHA: Kanwar Chadha, Sirf Technology.

MS. FRASCO: Beth Frasco, Aerial Communications.

MR. PRESTON: Dan Preston, IDC.

MR. SRINIVASIAH: Bhaskar Srinivasiah from GTE Wireless.

MR. RUDOKAS: Ron Rudokas, Western Wireless.

MR. O'LEARY: Eamon O'Leary, AT&T Wireless.

MR. NIXON: Jim Nixon, Omnipoint.

MR. MONTGOMERY: Bob Montgomery, Nextel.

MR. CHADNEY: Tony Chadney, AirTouch.

MR. ECKERT: Bob Eckert, FCC.

MR. KNAPP: Julius Knapp, FCC, Office of Engineering and Technology.

MR. HATFIELD: Okay, I'd like to start by thanking the additional people for attending and participating today. And I'll turn to my right in terms of first question. Jim, did you have a question, Tom, or did you want to start off?

MR. SUGRUE: Well, I'll just pass over to Jim, let me just say since I missed the first half and Dale may have done the thank you and all, but I'm just honored to be at a table with all this talent and intelligence. This is a great treat for us and look forward to learning something about these technologies, more about these technologies.

It would help me, particularly in this part of the

session, not to stimulate arguments or unconstructive dialogue, but one of the parts so people can -- if you hear something said that you think is just out of bounds, pick up on it, or isn't quite accurate. Because, one of the motivations for having this session was just in trying to sort out maybe the various claims as to how these technologies work and how they're working, and a fairly universal theme from some of the users -- I spoke to carriers in the public safety community, which is, to us, all the technology advocates are advocates and, to some extent, are overselling the current capabilities of their systems.

Now, technology advocates are advocates, we realize that. So where we're hearing these various different things and we're trying to get a better handle on it myself, so, again, thank you all for being here and I look forward to a stimulating afternoon.

MR. HATFIELD: Jim?

MR. SCHLICHTING: I figured a good first question might be whether the sort of other folks other than the panelists who have joined us around the table this afternoon are familiar with sort of alternative approaches like I know there was mention of a hybrid approach during the earlier session this afternoon. There was also a reference to another hybrid systems and the like, and figured that maybe

a good initial question would be from sort of anybody around the table as to whether there's any other systems that we ought to be putting on the table a short description and the like, for purposes of discussion?

MR. HATFIELD: Please identify yourself, since we're sending this out over the Internet?

MR. SOLIMAN: This is Samir Soliman from QUALCOMM. It has been pointed out that there are some drawbacks to both approaches, the network approach and the handset GPS assisted approach. But if you look at where each one of these technologies failed, they complement each other very well.

In areas where GPS has some problems, the network solution works very well. In areas where the network solution fails to deliver, GPS solutions works very well. QUALCOMM is promoting the hybrid approach, where we fuse measurement from the GPS constellation with measurement from the network side. By measurement from the network side, we mean forward link measurements done by the handset and reverse link measurements or uplink measurements done by the base station.

The three pieces of information, measurement from the GPS constellation, measurement from the phone, measurement from the base station, are fused together to be used the best possible measurement or best possible

position.

MR. HATFIELD: Thank you. I think one of the major issue areas we have to talk about is location accuracy and so, if it's okay, I think we'd like to focus our attention in that area for a few minutes.

MR. KNAPP: Thank you, Dale. One of the questions that I was wondering about as we heard the presentations is there were a lot of claims made about accuracy. To try to get a better understanding about the measurements of accuracy and whether those were taken under conditions of actual use or with the phone isolated. So as a starting point to some of the proponents, if you could just comment on how they obtain the accuracy information?

MR. MALONEY: I'll start. My name is John Maloney from KSI. All of the results that we published in the record over the years for 94-102 docket are just normal, cellular operations in the areas where we've been processing the signals. So nothing has been done to particularly, say, enhance the characteristics of the signals, no power spiking or anything of that nature. They're just normal operations. So that's the conditions under which we have operated.

MR. KNAPP: All the 600 millowatt handsets?

MR. MALONEY: Well, no, matter of fact, back in 1990 when we started, we were using three watts, whatever. The small little phones didn't come along till later, but

yes, all the recent results have been with six watt phones. They've been TDMA as well as amps. We're, as I mentioned earlier, still in the process of implementing CDMA, but others have done CDMA and perhaps they can comment.

MR. KAHAN: That is true. We also -- and for amps and it may go down to six millowatts, as opposed to 600 millowatts, and we're doing tracking there, as well. And I'm sure that the same is true for the network providers, which don't really need to change the phones to do their tests.

MR. HATFIELD: One question, one thing was inherent, I think, in Julius' question, was the handset used in sort of a normal position? You know, and that sort of thing, it wasn't set --

MR. KAHAN: Completely normal.

MR. MALONEY: I might offer that he mentioned six tenths watt or whatever. Turns out, when you use very old phones or on the amps, they can't powered below the lowest level power, so right now, even the phones that can go up to zero and one don't do it anymore. The systems are programmed not to command anything above level two. So we're all down at 6/10 watts nowadays.

MR. STILP: In addition to what the others had mentioned, TruePosition uses a fairly large number. In the case of Houston, for example, there are in excess of 600

what we call ground truth spots, spaced, perhaps, every couple tenths of a mile down roads. And so, when a location is made on a standard phone and everything that Dennis and John and Oliver said apply to us as well, we use standard phones in all kind of positions, it's then compared against -- that is, the location estimate is then compared against known ground truth to determine what the accuracy is.

MR. HATFIELD: Other comments?

MR. BELL: Yeah, in the report that we've released to the FCC, which contains all of the details of our test reports, we're very clear to specify the handset position as well as the type of antenna used. And in the Tampa test, we did a substantial number of the tests with those small prototype antennas that could be commercialized being held up in a normal usage situation up next to the head. We agree with you that that is a very important parameter to the test.

MR. HATFIELD: So let me make sure that everybody we've heard from so far then uses it in a sort of normal operating position, is that right? Is my understanding correct?

MR. STILP: Yes, I get the distinction that ought to be made, that some frequencies like GPS are sensitive to how close one is to the body. At frequencies, which are at

much higher powers, transmitting at 600 millowatts, versus on the order of negative 140, negative 150 DPM for GPS. Once you're inside the vehicle, I think most people acknowledge there's approximately seven to ten, according to Dr. Birchler, there's approximately seven to ten DB loss in the car, almost no matter where the phone is in the car. That's about right?

DR. BIRCHLER: Generally.

MR. STILP: So you assume even less? So phone position has less meaning in network type of testing, quite honestly.

MR. BELL: I'm actually not sure I agree with that. I think attenuation is attenuation. RF is RF. GPS falls between the PCS band and the cellular band, so I believe the attenuation factors are similar. GPS -- it's true GPS signals are lower. They're actually below the noise floor and that's why we have such an advance signal processing approach to pull those out of noise. But attenuation is attenuation.

MR. HATFIELD: Yes, do you want to continue down the line?

MR. CHADHA: We haven't published any data to assist as yet, but some of our partners have done testing with GPS and handsets, and sort of standard environment, and I agree with Walt that attenuation is going to be there,

whether it's a GPS signal or wireless signal. In some cases, you know, you will have issues when you are indoors or inside a car, both signals are going to have some signals. But that's normal nature of the RF technology.

MR. HATFIELD: Was there a response, further comment?

DR. HILSENRATH: Just to further the issue of measurement and some additional comment that I have. Yes, wireless is actually looking at quite the substantial investment that was made in referencing test data. Maybe because of the fact that we're using calibration as part of our training on the system, this is particularly important.

We have made an investment of a mix of GPS, differential GPS dead reckoning and in some cases satellite differential, in order to make sure that we have the reference information we need in the cities, in the downtowns, where GPS, we found out that commercial GPS has major problems.

So we're using the reference that is very accurate and is also post-processed for the reference of our testing. I think that one of the major issues that refers to your question, Dale, of how the phone is being used, there's a fundamental difference between the network solutions and the GPS, in the sense that as long as your call arrives to the base station, typically a good network solution should be

able to locate it. It's the same channel.

The issue of if the call is attenuating five db's or 10 db or 15 db, as long as your call arrives to the base station, you should be able to be located.

In the GPS case, you're talking about two disjunct processes. One is your call that needs to get to the base station. Secondly, the GPS acquisition has to be right in order to be able to pass on the location to whatever service you're using. So we're talking about two different processes. I doubt that any of the network solutions are affected by the way the handset is being held or if it's on the passenger seat or held upright near the ear of the user.

It's important to identify that through GPS, we're introducing a separate, totally independent process with its own datalink and link budget problem.

MR. HATFIELD: Could you identify yourself? I'm sorry.

MR. SOLIMAN: Samir Soliman from QUALCOMM. To continue with the test -- we do testing in two of the user models. One of them, when the user holds the handset in a dialing position, because we expect to get the position before the call is set up, completely set up, and we also use the user model when the user holds the handset close t his ear, because we believe that there is impact between the body and the antenna.

In both situations, we noticed they raise a degradation due to the antenna, relative to the free space propagation, but distance signal processing that will be done on the GPS signal can enhance and help mitigate the degradation that goes by the antenna body interaction.

MR. HATFIELD: Yes.

MR. CROSTER: I'm Norm Croster, SnapTrack, and there was a statement just made that body blockage and other effects will have minimal effect on network overlay type operation. And I think the statement may possibly be true in my view for a single base station, such as what U.S. Wireless is proposing. But if you're talking about multiple base stations receiving a single signal, I think body blockage and location will, may very well or greatly deteriorate the signal levels at one or more of those base stations, thereby greatly reducing availability.

I'm not sure there's been a significant study in order to assess this, but it's pretty clear that as you're moving around, the, you know, the signal level in different directions -- unless -- signal level in different directions are going to vary perhaps very dramatically. So I mean, there really needs to be quite a bit of testing to, I think validate the claims that were just made.

Now, it may be the case that for the U.S. Wireless system, with a single receiver that, in fact, you can do a

position fix whenever you can get a, whenever you can get a communication in terms of the availability and the accuracy of that approach. That's a whole new set of circumstances that are quite different from the other triangulation approaches, so I think that statement was a little bit -- greatly overstated in terms of the ability of network systems to be able to handle degradations associated with body blockage or locations. I just don't think that can be supported in fact.

MR. STILP: Lou Stilp from TruePosition. I'm not sure how long you want this debate to continue, but I can tell you that there has been extensive amount of testing -- something on the order of four to five million location records is not insignificant.

In calculating a location solution, TruePosition is one example of a system. It goes out to as many as 190 different antennas in the system, in which to sample signals and find out which antennas had the best view of where the caller was. And so, even if some of what Mr. Croster said were true and that the blockage would cause lack of signal at one particular antenna, there are certainly a very large selection of additional antennas from which to choose from, to make every location solution possible.

MR. HATFIELD: Juli, do you want to follow up? Sorry --

MR. ECKERT: I'd like to draw attention -- Bob Eckert here with OET. I'd like to draw attention to the comments on yield and I'd like to hear, actually, we didn't hear from Mr. Preston or Ms. Frasco on whether their tests are done in real situations? And so, it's this yield that I'm concerned about.

Mr. Chadha talked about operating in a hot mode, and if that affects yield as opposed to accuracy, then it matters, it seems to me, whether you're in real situations or test situations.

MS. FRASCO: Well, again, because E-OTD is somewhat different from our better handset based technologies in that it doesn't use GPS, the debate that we've been having over exact locations of the handset during test methods are not quite as critical. Because, it's what's happening in the uplink and downlink are pretty bidirectional.

But I can't say that the test results and the trials that other manufacturers that I know of did you use handsets in real user environments and real user situations and used commercial-type handsets.

MR. PRESTON: Dan Preston from IDC. In the trial in Seattle, we made about 20,000 calls and these were from very real locations, buildings, in buildings, tunnels, under forced canopy. The antenna placement was exterior from the

device. That was done very deliberately.

One of the issues that we looked at early on was trying to capture variables in the system. We found that the mapping systems available -- even the good mapping systems available -- had error up to 400 feet. We went in and did differential GPS drives, centerline drives and corrected Seattle, Mercer Island, Northbend and so on. And in an attempt to reduce all of the error in the system, what we found at the end of the test, what we didn't want, was somebody saying we really like the GPS solution, but you're 404 feet off to the northwest all the time, and that's because the maps weren't good.

The benchmarks that we went to were GPS differentially corrected to two centimeters and we used these 92 benchmarks in downtown Seattle, so the results we got were pure results. Since the trial, we have tested a product from a company out of England called Symetricom. I think the gentleman from SnapTrack also tried it. I believe it's a product that is evolving and will have -- the issue is called SAR, Selective Absorption Rates on tissue, and this one apparently has some of the best characteristics. Again, I think the gentlemen from SnapTrack have tested it more extensively than us.

For us, the point was that the technology was evolving to catch up to some of the need.

MR. HATFIELD: I'm not sure you responded to Bob's question regarding yield. Could you do that?

MR. PRESTON: The yield, with respect to the number of calls?

MR. ECKERT: Yes, the percentage where you got a position fix?

MR. PRESTON: Oh, 100 percent of the calls obtained the position fix. Ninety-four percent of the calls were within the 410, 125 meters. We reported to you all of the, there were 470 locations that were controlled and we reported to the FCC, to King County Public Safety, all of the data. We didn't throw out the top 10 percent nor did we average it back. We felt that the best way to present the data.

MR. HATFIELD: Can we get some other comments on this question of yield? Yes?

MR. SOLIMAN: Samir Soliman from QUALCOMM. I'd like to make a comment regarding accuracy. First, the communication signal being used for both cellular and PCS are designed for a two-way communication system, not designed for ranging. Ranging signals needs to have a sharp edge in time in order to complete exact position. Having a sharp edge in time means huge band width that really goes against designing a communication system. And there is some from the mental, theoretical limits on how accurate you can

get with any designed communication system. The band width that is designed so that the signal does not interfere with the co-channels limit how accurate you can get with any existing communication signal.

MR. HATFIELD: Others?

MR. CHADHA: This is Kanwar Chadha, Sirf Technology. Some of the tests we have done in open environment, typically, we get about 95 percent of the time what we call 3D fix, which means we are seeing four satellites or more. And yield is typically between 99 and 100 percent, but this is an open canyon environment. The yield will be affected when you go indoors, and that's a function of how indoors you go.

And I think one of the things we have to keep in mind is trying to guarantee 100 percent yield with a wireless environment is, to a certain extent, dreaming. I mean, I have a cell phone here and it says, "No service." So I mean, yield is a function of how strong the signal is, where you are in the building and how good the coverage is. Sometimes you will see GPS may get the location, but the wireless link is not there. So we have to look at the statistics of where those emergency calls are really made with a wireless phone. They're not inside buildings, typically. They're more outside, and GPS is a pretty reliable technology, most of the time.

MR. HATFIELD: Yes, some more comments?

DR. BIRCHLER: Mark Birchler from Motorola. A couple of points. I think one important thing to keep in mind when we're talking about yield for E-911 is we should be talking about probability of location coverage, given that we have voice coverage. In other words, it doesn't do you much good to have location if you don't have connectivity to the wireless system, so it should be a conditional type of parameter.

The second thing is that I think we can all agree that there's no location system that's going to give 100 percent yield. As it was pointed out in this room, there's no cellular coverage, if a site was added that gave us voice coverage in this room, that you'd have to add two or three more sites to get, perhaps, location coverage.

Now, I understand that location technology can be far more sensitive than the voice systems, also, so you have to factor that in. But we shouldn't imagine that any location technology is going to be capable of 100 percent yield, and this does affect, given the RNS definition, could impact the ability of the industry to comply with field location and accuracy.

MR. HATFIELD: Let's continue around, please?

MR. RUDOKAS: Ron Rudokas from Western Wireless. I guess I'd like to try to address this issue of yield and

accuracy from a slightly different point of view. As an operator -- and, I might add, the only rural operator that's here, we like to think of the world from the standpoint of our customer, and our customer in this case would probably have the perception that if he can make a phone call, he can be located.

So if I look at what's going on here and I believe that all the people at this table are honest individuals, we have no solution or we all have solutions, there are many solutions to this problem, one way or the other. But it looks like every one of these solutions has a lot of caveats from the standpoint of calibration, use of multiple sites, problems with in building coverage, costs, rooming and new handsets.

So the issue, I think, is to kind of look at the intent of the E-911 ruling and what it was supposed to do for our customers or for the population in general. So I'd like to focus on the ruling and the way the operators would comply with the ruling and ask two questions along that standpoint. And one of the questions for me when I look at what's going on here, I do not have a way of knowing whether or not I have actually complied to either the intent or the letter of the E-911 ruling. There's really not enough definition in the ruling for me to understand if I've met my goal.

The other one is, even if I have met my goal to comply with the ruling on some particular test day, what happens to me as an operator on some subsequent day when issues such as self-site maintenance, flood, or maybe a lot of calls from an area that is previously unrecognized as a bad service area make it impossible to meet that particular specification that particular day? And I'll be happy to hear anybody's response.

MR. HATFIELD: Any further comment on this particular issue of compliance?

MR. PRESTON: Dan Preston with IDC. One of the things we did do at King County's request was to drive through, basically, a single tower covered corridor, which is I-90 up out of Seattle, to what's called Snoqualmie Summit. And what we saw in this tracking exercise, basically we had only one tower coverage. In fact, I think in some cases we had almost no coverage at the top of the summit, but we were able to make the call.

But we were able to generate, or, in this case, yield data, location data, for that, oh, probably, 35 mile trek. The county over from us is a rural county like this gentleman speaks to. And he says 95 percent of his calls come from the top of Snoqualmie Summit, east out into the prairie. And he thinks he's got only single tower coverage the entire way.

A GPS or a handset based solution supports those sorts of rural needs very well, and that's a large part of America.

MR. RUDOKAS: I'd like to respond to that particular comment. Although we are, indeed, a rural carrier, one of the things, my guess is that your rural carrier that you were dealing with has the same issue, is that we have the same sorts of demands for our service as an urban carrier, and we do end up using a lot of repeaters and enhancers to provide coverage inside a building, shopping malls, mine shafts, tunnels, that sort of thing.

So what I guess I'm trying to focus on is a little bit of addressing the issues of this mandate in the FCC ruling which doesn't specify that we all be driving around in vehicles. Because, indeed, we have people who use their phones in buildings, although not in this building, apparently.

(Laughter.)

MR. RUDOKAS: But there is a fair amount of that kind of an issue that we need to deal with, which makes GPS very difficult. But there's some orthogonality here in terms of solutions.

MR. STILP: Lou Stilp, TruePosition. I'm not sure Mr. Eckert's question is being fully answered, at least from where I sit here. Yield, in particular for handset

solutions, is very tied to the antenna. Motorola published a paper that I think everyone has seen or is familiar with, last summer, that showed a very wide performance when it came to the type of antenna and where it was integrated into the phone. And the Tampa results, and I can only go off of the ex partes that are public here, that that's an inclusion even out of Tampa, is that small, handset ties antenna performance was comparable to larger GPS antennas only under open sky conditions.

And when one goes through the results, there is clearly a very wide variance in what percentage of location attempts were actually successful, based upon what kind of antenna was plugged into the phone. And again, most of the testing -- Mr. Preston just mentioned that in Seattle, the antenna was external, and we believe a lot of testing in Tampa, the antenna was external. So you really have to tie yield to the antenna. And again, I would suggest we need to think about what kind of phones people are going to buy and how those antennas are going to work in there when we talk about yield.

MR. BELL: I need to respond to that, because that's directed at SnapTrack and Motorola. Is this on? Hello?

First, let me say that my colleague from TruePosition widely quoted this paper from Motorola that is

now over a year old. There have been filings made that correct that, and I would direct the attention of the FCC to those filings.

Let me see if I can clarify this picture about sensitivity and antennas. It is certainly true that sensitivity is everything relative to GPS, because that's really what drives the ability to let GPS work in indoor settings and in urban canyons that it originally was not designed for. That's really why we've gone to the SnapTrack, was to apply high sensitivity techniques.

Thanks to some really good inventions by Dr. Croster and a lot of hard work, we've been able to achieve already a 20 db -- that's 20 db, not two db, but a 20 db improvement in sensitivity over conventional GPS. Now, clearly, you have to give some of that up for antenna performance and other factors associated with integrating this technology in the handsets.

The error budget, or the budget we set to give that up was three db when we originally laid out the technology. Now, currently, that's running about six db. It varies with the different small antennas and it's been coming down from where we started with, which was maybe eight or nine db. But we are still working toward, with handset manufacturers and antenna manufacturers, improving the performance so we can reach this three db budget.

Now, in addition, we are continuing our work on higher sensitivity and we've already laid out a program to give us six or seven db more and I think several of the other speakers have talked about GPS is really advancing what you see now. It's not the ultimate in performance.

So we're working from both ends to deal with some reduction in performance of antennas in enhanced integration. We're working it from both sides, both improving our sensitivity and getting the antenna performance tuned up as much as it possibly can be.

MR. HATFIELD: Can we come back over here? You've been very patient.

MR. CHADNEY: Yes, Tony Chadney from AirTouch Communications and I have three questions relating to accuracy and the conditions under which they were taken.

The first one I'll start off with is related to this business of the type of environment in which the tests are made. And from what I'm hearing here, there are issues of whether this will perform well in a rural environment or, if it does well in the rural environment, is it going to perform in an urban environment well, and vice versa?

And the CDG recognize this, starting about a year ago, and formed a test group to location forum and part of that location forum was a test group. This test group was to lay out conditions under which measurements should be

taken for all types of solutions, whether they be network based solutions or handset based solutions. The idea was that it would try and stress each one of these types of solutions, in other words, find the worst case of conditions where these solutions were going to perform.

And there is now at least a very comprehensive document that was developed primarily that's been used in the SnapTrack trials. And the Tampa results that were referred to did follow that particular test plan. And it's interesting to note some of the comments that are being made about the deficiencies of the results from that particular test program.

What I would ask from the people who have network overlay solutions and again, when we put together this test plan, we did try and think of particular environments where we were really going to stress their systems and we were talking about environments close to cell sites, for those who have two site solutions and three site solutions.

Can I ask each one of the network overlay providers whether they will be producing a set of results that conforms to that particular test plan. Or, if there is such a document right now, and as I said, this is a very comprehensive document. It goes through and addresses in building specifically as a category. So what is the yield and the accuracy for in buildings alone? What is the