Witness: Ralph T. Cheng

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Day 2 of 2 for this witness

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October 4, 2004

Direct Examination, resumed

HARRIS: Doctor, before we go into the last few slides of the Power Point presentation, I'm going to kind of go back and recap what we were discussing on Thursday afternoon. What you were showing, some of the first few slides of your presentation, would it be fair to say that the moon and the sun affect tides and tidal currents?

CHENG: Yes, sir.

HARRIS: Tidal currents?

CHENG: Yes, sir.

HARRIS: You were talking about how the tides rise and fall. The tide comes in and goes out roughly twice a day?

CHENG: Correct.

HARRIS: When the tide comes in, it comes in roughly twice a day. It doesn't come in equally?

CHENG: That's correct.

HARRIS: And same with when it goes out, the tide goes out roughly twice a day and doesn't go out equally?

CHENG: Correct.

HARRIS: When the tide does come in, so we refer to that's at high tide, it doesn't come in equally, so that there is one that's a high tide, and the other -- the other is the higher high tide?

CHENG: That's correct. One is called Higher High Tide, the other one is called the Lower High Tide.

HARRIS: And the same is roughly true when the tide goes out. Doesn't go out equally. So one is referred to as the Lower Tide, or the Lower Low Tide, and the other one is just like a Low Tide?

CHENG: Lower Low Tide and Higher Low Tide.

HARRIS: Kind of distinguishes which one is going out the most and which one is coming in the most.

CHENG: Yes.

HARRIS: When we were talking about the tides -- excuse me, talking about the currents. What you were telling us is that the deeper the water the faster the current?

CHENG: That is correct.

HARRIS: Then we moved into the area of the winds, and you were showing us the different types of wind or the types of waves. So to summarize this, wind produces waves on the water?

CHENG: That is correct.

HARRIS: And the wind producing these waves on the water can transmit the energy through the water down to the bottom on the side, you are talking about that causing erosion?

CHENG: That is correct.

HARRIS: That was the example you were giving us out there by the bridge when it turns looking like chocolate milk?

CHENG: Right.

HARRIS: The last slides we were into, we were talking about the summary of all this, is that the tides and the currents are very predictable?

CHENG: That is correct.

HARRIS: So when you factor in all of that information of the winds, the currents, and the tides, you are able to predict how movement of the water and things in the water occurs in the San Francisco Bay?

CHENG: Within a certain degree of accuracy, yes.

HARRIS: Now, I want to go forward and go back to the Power Point presentation a little bit, and start with this February of 2003. Were you contacted by someone from the Modesto Police Department seeking your expertise in the area of the San Francisco Bay?

CHENG: Yes.

HARRIS: And when the Modesto Police Department -- let me just ask was it Detective Phil Owen that you dealt with?

CHENG: Yes.

HARRIS: And another detective by the name of Dodge Hendee?

CHENG: Correct.

HARRIS: As these detectives would talk to you, did they provide you certain information, and kind of ask you to see if you could help them in terms of how things would move in The Bay?

CHENG: Yes, they did.

HARRIS: As part of the process of going through and helping them with their questions, did you have to go back and look at what the tides were, what the wind conditions were, those factors in different areas of The Bay?

CHENG: Yes, I had to.

HARRIS: Now, I want to go to the Power Point presentation.

CHENG: May I have that pointer back there.

JUDGE: You want the laser?

CHENG: Yeah, laser pointer. And also the lady probably should move her head.

HARRIS: All right, doctor, what we are looking at now is the next slide in the presentation. It says Tides and Wind Near Richmond. And can you describe for us what this particular slide in

the presentation is depicting?

CHENG: Like to apologize to the jurors. This particular slide might be a little bit scientific, but I think of great importance. Summarizes the waves and tidal condition near the Richmond area the day the wind was measured by Bay Area Air Quality Management District at Richmond, not far from the area of interest. The plot has three components. Three panels here, the horizontal axis, horizontal section is moving this way, represents the time. And the first panel here shows the wind direction. And, sorry, you cannot read it very much, very clearly. But bottom here is 0 degrees, 90 degrees, 375 -- and 275 and 360. Basically, it shows where the wind is coming from. And you can see now during the period of time, which is indicated on the bottom here, deliberately choose this as an example. We do have this data covering throughout the period of time. In fact, these data collections are ongoing, continuous. Cover the entire period of time. I used this particular slide as an example was now December -- centered on December 24th, one day before this area, called the timeline, the time mark for December 23rd, December 24th, 25th. So you can see the tide come two highs, two lows each day. And so the second panel indicates the wind speed measured in terms of meters per second. One meter per second is roughly two knots in common language. We way 10 knots, 15 knots. One meter is two knots per second -- two knots per hour. And here now we see that now, during period of time, December 24th in particularly around noontime, that the wind was very calm, very weak. Wandering around five or ten knots. Wind direction is not quite defined. You can see the randomness is not well defined, because weakness of the wind. Typically you don't see clear definition of the wind direction. In terms of the tides at that particular time, during December 24th at noontime, it is rising tide from the Higher Low Tide approaching the Higher High Tide, implying it's flooding water coming in from outside the ocean into The Bay.

HARRIS: Let me move toward the next side.

CHENG: This is the graphical summary of what I just described, December 24th, 2002, at noon. We have -- we post a wind distribution web page on the web that the people can obtain. This represent the typical wind direction. As you can see now, the size of the arrows represent the magnitude of the wind here. The color scale represent by color bar from white to green, to light green yellow, brown and red. Red is exceeding 25 knots. Here now you can see the direction is roughly undefined. There is no fixed pattern. Arrows are mostly white. That is around this end, five, or less than five, knots per hour. And here you can see that, in this general -- which are representing the condition of the wind at that time of the day.

HARRIS: Did you also then go and take the same basic information for approximately the time that the bodies were found for Laci and Conner Peterson?

CHENG: I think that shows in the next slide. So this particular graphic -- again, I apologize again that is a little bit scientific; however, carried different meaning. Basic idea is first panel shows the wind direction. Second panel shows the wind speed in terms of meters per second. And third panel again the tide here. We talk about what -- the definition of Mean Low Low Water over here. In this particular graphics, I focused the timeframe. As I say, horizontal axis represents the time. That start from this arrow in noontime of April 11th, April 12th, April 13th. Here there were some exceedingly low tides. That was during the spring period of time. We discussed earlier a lot -- Thursday -- tides is going into Spring Tidal Phases, and Neap Tidal Phases. During the Spring Tide, the water level goes to the extremities. It is very high and very low. In fact now, as I say, the common reference datum reference to Mean Lower Low Water in this time period of time the tides even was so low that was below the Mean Lower Low Water. And the top panel here is really rather interesting during that period of time. The wind -- I also discussed that -- in the Bay Area has two typical patterns. During the winter seasons, there is no well-defined wind direction, unless there was a major storm coming through the area. And usually when the storm comes through the area, the storm front came from the south. So here, as you can see, during

this period of time, the wind direction is closely lined up with 180 degrees from north. That is -- now wind is coming from the south 180, degrees, opposite direction from the north. That's now throughout this period of time wind was typically coming from south, which is a usual pattern comparing to the summer prevailing wind direction in which that now wind came from the west. And here now, that's another unusual event. The second panel represents the wind speed. This height of the curve represent magnitude. Again, horizontal axis represents time. During this window of time, here is -- we see that now. In fact, personally I felt that since we ran that web page that day -- not connected to this particular discussion here -- I felt that was, wow, quite a wind event during that day. I really recall in my own mind, you can see now the scientific records showed us now during that particular period of time, in the morning, or starting from the midnight of the midnight April 11th, or early morning of April 12th, you can see wind exceeded 40 knots. 40 knots, wind exceeded. Also a sustained wind for long period of time, subsided slightly, but still continued on for another good twelve, eighteen hours with wind average around twenty knots per hour. So that is quite a magnitude of wind. And during that period of time, there was occurrence of a very low tide right after noon of April 12th.

HARRIS: And did you also do this graphically in the next slide?

CHENG: Yes, I did. So this is the graphic rendition of that particular wind event. You can see now all the arrows pointing, coming from the south. Again, now, I mentioned the color of the rendition of the arrows here represent the magnitude, white arrows I show in the previous slide that meaning wind was very weak from five, to ten, to fifteen. And you can see now areas here with nearly red colors represent the wind exceed 25 knots per hour.

HARRIS: I believe that's the last slide of your presentation. Go ahead and resume the lights. Doctor, as we go through this now, what we'll do, we'll use 215, the map behind you. When we get to that, I'll have you take the pointer and show us the different locations, and we'll go through this. Just to go back to the last part that you were talking about with this wind event that you were discussing, when you have a wind event like this event that was occurring on April 12th of 2003, that amount of wind, is that going to produce a significant amount of energy through the water?

CHENG: It will.

HARRIS: And, again, we talked about how the current, if it's deeper, goes faster. As water starts to move through these wind actions, do the waves go some place? Do they push up against the shore?

CHENG: Wind typically carries -- I believe in the previous slide I have shown last Thursday, wind creates two events. One generates the wave, and the wave produces so-called orbital motion the water mass actually is going to circular motion at the same time that the wind drift -- the wind, because of friction on the surface of the air-water interface, moves the water in the direction where the wind is going. That causes wind drift. Combination of these now produces not only the stirring motion near the bottom, and causes suspension of sediment in The Bay, when we get a color change just to chocolate color in the shallow area, in particular, where energy is easier to transmit to the bottom. In deeper part of the water, even with the same wind, the water depths here, the energy will not go to this depth. Therefore, it is important to recognize during the same wind conditions in the deeper area there is lesser effect than the shallower area, is much greater effect in stirring the bottom.

HARRIS: If we're talking about this, so we make sure I understand this clearly in my mind, you are talking about two distinct things that occur with the water because of the wind. So if he we were to put something on the surface of the water, and wind were to come back -- come across the line, if we were to blow on something on the top of a pond, it's going to move that object in the opposite direction to the wind?

CHENG: Is moving along with the wind.

HARRIS: So as we blow it, or the wind moves, that object would go on the surface?

CHENG: That's how the sailboat works.

HARRIS: And then with the second aspect of that is the movement of the water itself by the wind which is generating these waves, comes up and goes down, and that's that orbital motion that you are talking about?

CHENG: Yes.

HARRIS: And so as it goes down, the shallower the water, the more energy is transmitted to the bottom of the water?

CHENG: That is correct.

HARRIS: And if it's shallower so it can reach the bottom, the sediment, that can produce disturbing the sediment. And I believe in one of your slides you refer to it as erosion?

CHENG: That's correct.

HARRIS: Now, when you were asked to assist with the Modesto Police Department, so you gather this basic information. When they first came to you in February, Laci and Conner's bodies had not been found; is that your understanding?

CHENG: That's correct.

HARRIS: So when they were asking you to assist, when they basically were asking you can you tell us if we put something into the water where it might go?

CHENG: I told them I could try, based on the my best scientific education and best scientific data, yes.

HARRIS: And as the detectives were asking you different hypotheticals, how did you go about doing this? Did you run computer simulations for them?

CHENG: Yes, I did.

HARRIS: Briefly tell us how that works?

CHENG: Well, in order to reproduce -- reconstruct what had happened, the question wasn't how the tide and the currents. I reconstructed the tides and current in The Bay fairly easily within reasonable degree of accuracy. Uncertainty really comes -- we really did not know when and where the body was put in the water. Given that as the initial -- we call the initial condition, then you produce an answer where the body would wind up within a certain time. But it's the initial condition that is where the body started its travel in the bay, and location where it started traveling from The Bay, then you can get -- that particular initial condition is not precise, then we cannot do a precise prediction.

HARRIS: So from the lack of information that the detectives were able to provide you as to where this had occurred, this was somewhat just a scientific exercise at that point in time?

CHENG: That is correct.

HARRIS: Now, after the bodies were found -- moving forward in time after the bodies were found -- did the Modesto Police Department again contact you?

CHENG: They did.

HARRIS: And did they ask you, based on where the bodies were found, if you could go back and do this recreation from what you were talking about, the tides and the currents, and try and plot a path or a course where the bodies had come from?

CHENG: I told them following here I could try. However, it involves similar uncertainty. That is now, when the body was spotted on shore at certain time, it does not imply the body arrived there at that time. Now, we have a little bit better situation that is not -- we know precisely where the body landed. Comparing to the previous scenario, that we were guessing where the body started traveling and at what time. In this case here now, we -- our knowledge has improved. That is now -- the bodies, we know precisely where the body landed. And -- but we didn't know when the body precisely landed at that location. Therefore, in order to reconstruct where the body started moving from, certain position in The Bay, still involves some uncertainty.

HARRIS: That's because there is a -- there is a distinction in terms of what you were looking at when the bodies were found, versus when they actually reached shore?

CHENG: That's correct.

HARRIS: Now, in terms of -- we'll now start looking at 215. The detectives give you --

JUDGE: Doctor Cheng, would you use the pointer when -- not that one. This one. The one --

CHENG: Okay.

HARRIS: Doctor, what we were talking about is when the detectives give you the information of where Laci and Conner's bodies are recovered, that is an area in the Richmond area over there by Brooks Island. Do you -- is that on the map up there?

JUDGE: You can point that out to orient him.

CHENG: Yeah, over here.

HARRIS: That is Brooks Island.

CHENG: Brooks Island. This is Brooks Island over here. I think the -- if I remember, Laci's body was discovered at the Isabel Point. And I don't know the name of the -- Conner's body was found over here, what is the name associated with that?

HARRIS: Looking -- just use this here. It was right by this pipeline symbol?

CHENG: Right.

HARRIS: And so they gave you the locations of those bodies. The area where -- around that where the two bodies were at and in between Brooks Island, what is the generalized depth of that area?

CHENG: It's very, very shallow. I don't remember the exact numbers, but very, very shallow.

HARRIS: If you were to look at this particular map, does this have numbers in that area?

CHENG: Yes, it does. Let me take a look. It shows three or four feet in this -- three or four feet in this general area. Four or five feet, or six feet over in this general are

HARRIS: And if you look at the legend up there, is this -- the feet that we're talking about, this is that Lower Low Mean --

CHENG: Reference to Mean Lower Low Water.

HARRIS: Okay. So that the three or four, the four or five, five or six, in that generalized area, that's that Lower Low Mean?

CHENG: Well, for example, we just saw on the slide here during the very low tide the tide was negative. Let's say -- I don't remember the precise number on the chart. We can go back to that. Let's say chart and the tide was minus one foot. Then you look at the chart here, say three feet. The actual water depth at that particular time should be three minus, actual water two and a half feet. That's how we interpreted the --

GERAGOS: Depth is what?

CHENG: Well, if you look at a location of the three feet on the chart, it references to Mean Lower Low Water. At the Very Low Tide, we saw we have a negative .5 feet. Actual water depth would be 2.5 feet.

GERAGOS: Thank you.

HARRIS: So you go through, and you look at this particular area. You take the information that you have already shown us with the different charts and graphs up there, taking that basic information, were you able to plot a backtracking course as to where you believed that Laci and Conner had started from?

CHENG: Assuming the information is correct, I try my best, yes. We construct it is called a vector -- Progressive Vector Diagram, reconstruct where the body would have started traveling from.

HARRIS: Were you able to make this vector track?

CHENG: Yes, we did.

HARRIS: Can you explain to us how you would have went about doing that? Do you do it by hand? Did you use a computer? Describe the process.

CHENG: It's a combination of the above. Basically we obtain the wind information, time series. We reconstruct, now, based on the U.S. Army Corps of Engineers Coastal Engineering Handbook, they give you certain formulas for certain given wind conditions. So how much actual water movement would be is not a windspeed- water movement here. And then you would reconstruct hour-by-hour here as if -- assuming the bodies started from here, you go backward rather than going forward here until certain -- to a certain time here. We -- of course, we assume that now the body would have started from Mean Lower Low Water. The reason we say that is now when the water depth is shallower, that is when the tidal condition was very low part of the water, that is the higher probability that energy will transmit to the bottom. Therefore, based on that, backtrack to that particular time that -- where the Mean Lower Low Water was negative, I assumed that was the location where the body is dislodged from what might be anchored to The Bay.

HARRIS: I want to go back through there. You -- go ahead, have a seat.

JUDGE: Do you want him to

Mark that on the chart?

HARRIS: Not yet. We have a separate map. Just to go back through this. If -- because you are talking about this storm, that -- was there one a few days before the bodies came ashore? If we're talking about the shallow areas in the map, that we are looking at on 215, what is the usual range of movement in those shallow areas?

CHENG: As I have actually said, the tidal current movement, without considering the wind, is directly proportionate to the water depths. In that particular area, the current seldomly exceeds twenty centimeters per second. Usually it's wandering around five or ten centimeters per second. The tide coming in and out twenty centimeter per second, translating to, as I mentioned, fifty centimeter per second, translates to a common terminology, one knot. Twenty centimeters means that, 0.4 knots of current.

HARRIS: I guess, put it in the further lay person's language, is that a lot of movement, very little movement?

CHENG: Very little movement.

HARRIS: So, generally, in that area is there enough energy for a body that's on the bottom to be moved?

CHENG: I don't think so.

HARRIS: As the storm comes in, you were talking about how it starts to propagate this energy to the bottom. That storm event, is that enough -- does it produce enough energy in the water to move a body?

CHENG: It does. I mean, again, it depends on whether the body is -- well, with it, it doesn't -- in other words, suppose the body is still again anchored here, it may not have enough energy to move it.

HARRIS: And if it's not anchored, if it's broken?

CHENG: Then it would have enough energy to move it, right.

HARRIS: Now, you go through the process of plotting this out, do you take and put this vector -- Reverse Vector that you do, and is it plotted out on a map?

CHENG: I think I did.

HARRIS: And, eventually, do the detectives take that vector and apply it to search grids so they could go out to the bay and conduct searches?

CHENG: That is correct. I think the purpose, when I was receiving -- received the request was that now they wanted to launch additional search for further evidences. They want to have the best chance of finding additional evidences. So my work was based on science and actual physical data observations to make a recommendation where is the best location to start their search.

HARRIS: Do you ultimately come up with that recommendation for them where they should search?

CHENG: Yes, I did.

HARRIS: Like to show you -- could I have something

Marked? Show you a document.

JUDGE: Mark that -- already have marked that already? Do you want to mark that next in order?

HARRIS: Yes.

JUDGE: 284. What does it purport to be?

HARRIS: It would be a grid map.

JUDGE: Drawn by the witness?

HARRIS: Doesn't appear to be drawn. There is drawings on --

JUDGE: Produced by the witness.

HARRIS: Doctor, let me show you 284, have you look at that.

CHENG: Yes.

HARRIS: And do you recognize this?

CHENG: Yes.

HARRIS: Does this appear to have the vector map that you were just describing, the line and the search area?

CHENG: It does.

HARRIS: Put this up on the screen. Looking at this particular document, 284, does this depict on this map -- let me just back up for a second. That is map of the same area that we have been looking at, 215?

CHENG: That is correct.

JUDGE: That's -- wait. Can you point out Brooks Island and Point Isabel on that? Can you do that, Doctor Cheng? Indicate where is Brooks Island.

CHENG: If I can see that chart clear, I think Brooks Island is right here.

JUDGE: Point Isabel?

CHENG: Point Isabel is here, I believe. Is that right? Somewhere here. Close enough.

HARRIS: From -- it's kind of -- let me just point some things out for you. Do you see the words on map -- on the map? There we go. Where it says Point Isabel.

CHENG: Let me see. Do that again, please.

HARRIS: You can barely see it with that laser. Do you see where it says Point Isabel?

CHENG: I think over here.

JUDGE: Do it the old fashioned way.

CHENG: Right there. Right.

HARRIS: All right. Do you also see that there is a -- right next to it, there is an arrow going up from the right, says "Laci Peterson Body"?

CHENG: Yes, I do.

HARRIS: And then we also see that there is a graphic that says "Baby Peterson Body", and it is a little bit more difficult to see. But there is an arrow that comes down, that is the square there?

CHENG: Yes.

HARRIS: That's the area that we were talking about on 215 up there?

CHENG: Yes.

HARRIS: Now, there is this line that comes down from the top, going through the middle of the documents. Do you recognize that particular line?

CHENG: Yes.

HARRIS: And what is that line?

CHENG: That was the -- what I call Progressive Vector Diagram that I constructed based on the wind drift.

HARRIS: Now, next to that particular line, there is little triangles or deltas that are there that have numbers. Could you describe for us what those are?

CHENG: Those were the calculations of the movement between hour-to-hour movement based on the wind drift estimation formula.

HARRIS: Now, you were describing for us before the wind drift. That's where the force of the wind activity moves the water?

CHENG: That is correct.

HARRIS: And you were telling us about that, there is this mathematical formula. I won't put that slide back up there.

CHENG: Yes. As I say, the equation I used was based on the U.S. Army Corps of Engineers Coastal Engineering Handbook.

HARRIS: Now, as you go through this process of doing this vector, that's what we were starting to get into. Does the computer -- or do your calculations include the tidal currents, the wind, all of these different things that you have been talking about?

CHENG: Well, for this particular calculation, I think the tidal currents does not play any significant role, since tidal currents itself, et cetera, is weak. And throughout the period of time, tidal currents reverses to some degree, so tend to cancel out the net movement effect. So this calculation is solely based on the wind drift.

HARRIS: Let's -- what -- the tidal current tends to cancel out the movement effect. What does that mean?

CHENG: Well, just -- let's see, we start from the beginning of a flooding tide, that is no water coming in. If you have life jackets or something floating on the surface here, it will move a certain distance. Let's say, one or two kilometer in that area would -- in that area would probably not move that far. In the second half of the tide going into the ebbing phase, the water is leaving this bay, would go probably drift back to the -- leaving the area, going out of The Bay. Typically we'll find that if you drop something, even if any of you are, say, here, you drop a float in the water. If you sit there long enough, you will find the float drift away from you. However, in the second half of the tide, it typically almost returns to where the point it started.

HARRIS: In this lack of current movement is because the current is so weak in that particular area?

CHENG: It is. And also at the same point is, even in other than parts of The Bay, if you put the body in certain part of The Bay, tidal current is not symmetrical. Slows enough. So now the current might drift away, come back to the close proximity within a tidal cycle.

HARRIS: So as you are describing for us in 284, primarily your calculation is based on this wind drift?

CHENG: Correct. Because I concluded that now the tidal motion would not play a role in this case.

HARRIS: So the wind factor, is that sufficient force that we're talking about that was propagating the energy downward. That would be enough to move something toward the lower line?

CHENG: This is already the second phase here, that the first part of that is not the wind force. This is somehow breaking up the anchor from the body. Now, then the anchor doesn't -- may not hold, the body becomes a floating object. The wind drift will move the body. That's the calculation I'm doing on this chart.

HARRIS: With this particular time factor that we were talking about, the April 12th, April 13th, 2003 area, the direction of the wind is depicted with that vector chart that it's moving -- the wind is coming from the south and going somewhat to the north, to the northeast a little bit?

CHENG: Correct.

HARRIS: When you provide this information that we see up there to the Modesto Police Department, we see that there is a square -- there is a number of squares up there. It says the large square is one a quarter mile by one and three quarter mile. The small squares are roughly a quarter. Can you predict with any certainty within inches or feet where these bodies would have started from?

CHENG: No, I'm afraid not.

HARRIS: Why is that?

CHENG: Well, for two reasons here. That one of the most important reasons is that now we did not know the precise time, we have already talked about, the body started. In other words now, you told me that body landed at that particular point. But, for example, in this particular case, bodies were found here at -- I don't remember the time. Let's call that 3:00 p.m., but that was the sight time. That wasn't the time the body actually arrived. So without that information, I

cannot construct precisely where the body started traveling from.

HARRIS: Now, the fact that there is two bodies, and is that something that you have to look at as well?

CHENG: Yes, I did.

HARRIS: And explain to us that process.

CHENG: Well, obviously people may argue that the two bodies started from the same place, why they wound up in different locations. I need scientific -- I need scientific judgments to make an explanation to this observation.

HARRIS: And do you -- do you go through that process -- since we're talking about the wind, the size of the body or size of the mass that's subject to the wind on the surface make a difference?

CHENG: To some degree, yes, it does. And also the other possibilities here that the -- that you mentioned now, two different bodies here of different -- obviously very different sizes here. When they drift in water, they may behave differently.

HARRIS: Just to back up, kind of put this -- make sure, again, I am putting it in kind of layman's terms. If you use a different size sail, does that make difference of how fast your boat goes?

CHENG: It does.

HARRIS: So, again, whatever force that the wind could put on to an object can effect how it moves through the water?

CHENG: Yes.

HARRIS: You are talking about weight. Is weight another factor that plays into that?

CHENG: To some degree. But, as I say, in the second phase, the body has already started traveling. The wave motion only contributes to the net drift in terms of producing energy and forming the orbital motion. It will not contribute much to the net movement.

HARRIS: Ultimately you gave this to the Modesto Police Department for them to come up with their search plan that you were discussing. Based on what you have been talking about, the energy and the lack of speed, so to speak, of the currents in that particular shallow area, where do you think -- in your expert opinion, where do you think those bodies had to be to reach that particular place that they were at?

CHENG: I think, based on those estimates, and based on the actual observation of the wind and the scientific judgment, that's the location I recommended. As let me address that as the highest probability that might have started from. It's not a deterministic prediction, but it's a highest probability.

HARRIS: So looking --

JUDGE: Can you show us on the map where you think they came from?

CHENG: I mean the little inner square. I recommended that they search for starting from this particular point.

JUDGE: That's where you think maybe the bodies originated from?

CHENG: Yeah.

HARRIS: Now, relating that over to the map, 215, that particular location that's somewhere, if we were to triangulate somewhere between Brooks Island and the Berkeley Marina and where the bodies are indicated?

CHENG: I think put in simple terms, it's lying right in the middle distance between Berkeley Marina and Brooks Island, roughly.

HARRIS: If we were to -- looking again to using 215, we see there is a portion of that particular map where there is, in the middle of the water areas, white and instead of light blue representing the water. Are those the deeper channels that you are referring to?

CHENG: Yes. These maybe give navigation channels in the deeper part here. They color white the shallow area so you have immediate view this. General area is very shallow. They have actual numbers printed on the charts.

HARRIS: The deeper water, as we have discussed, the currents there are faster. So does it have a different energy property of movement than that the shallow areas that we have been talking about?

CHENG: Oh, yeah. Much different. Here in this area here, tidal current typically moves at exceeding two knots, three knots. That is maybe 150 centimeters per second. 20 centimeters per second over here.

HARRIS: If something were to end up in those deep water areas, where ultimately does that go?

CHENG: I think we did some simulations in early phase of the study, that Modesto Police Department recommended that, let's assume the body were lowered into The Bay at this location, that we use the computer simulation. In the end we find either body was washed into the Pacific ocean, or some cases here, the body went behind this Angel Island here, the long island here, had wind up over behind Angel Island again. As the current comes through here behind Angel Island, just like a wake region. When you are on a boat, behind the boat there is an area where water moves slower, so we call a wake. Sort like a wake region behind the island here. The current again slowed down. So, therefore, now the simulation showed that that body started moving here, wind up into the central bay, and somehow wind up at higher probability -- let me stress that body could be landed behind Angel Island if that was the case. And also there were some situations here where the body went over to the Pacific ocean.

HARRIS: Based on the simulations that you were doing for the Modesto Police Department, if the bodies were to go into those deeper parts, they would head toward the Golden Gate Bridge. They don't end up head up to the Berkeley Flat area?

CHENG: No, no way.

HARRIS: If the body started in that Berkeley Flat area, it would take some unusual wind event to produce enough energy to push them on to the shore, as you found?

CHENG: That's what we discussed, yes.

HARRIS: Go ahead and resume your seat. People have no other questions.

Cross Examination by Mark Geragos

GERAGOS: Good morning, doctor. When you were -- first time that they came to you was in February?

CHENG: Yes.

GERAGOS: And when they came in February, they asked you to make some -- to draw some conclusions; is that correct?

CHENG: I don't think so. They didn't ask me to draw any conclusions. They asked me to help to search for Laci's body.

GERAGOS: Right. Well, the one thing that I think I was asking you was, Mr. Harris just finished asking you, you said they gave you some ideas as to where they thought that the body might have been placed in the water; is that correct?

CHENG: That's correct.

GERAGOS: Okay. And was that in February?

CHENG: That was in February, right.

GERAGOS: Okay. And could you point, or could you write on the map with red pen where they suggested that they thought the body may have been placed in the water?

JUDGE: Put an "X", Doctor Cheng. And draw a line to the margin and it put C1. Just put an X. Okay. Do you want to put just draw a line out to the margin?

CHENG: Somewhere over here.

GERAGOS: Okay and was that over off of the tip of Brooks Island?

CHENG: That's correct.

GERAGOS: Okay. Now, when they had you do -- when they suggested that, that's a very shallow area, correct?

CHENG: That's on the edge of a shallow and deep area

GERAGOS: Okay. When you say the shallow area, that's classified there as a shoals, or something like that, is what you used?

CHENG: No. Shoals is sometimes referred to even at low tide, the land at the bottom may be exposed. The shallow is loosely defined. I think it may be one meter, two meters water depth considered shallow.

GERAGOS: Now, specifically when you told -- or when they told you look at this area right here, you have a computer simulation that you do, correct in?

CHENG: Correct.

GERAGOS: Okay. And your computer simulation told you that the bodies would come out into the labeled here

CHENG: Channel.

GERAGOS: The channel, correct?

CHENG: Uh-huh.

GERAGOS: And you told them that -- and I assume that's why they ended up. These are -- if I tell you search areas, this is areas that they went in and searched?

CHENG: I didn't know that, yes.

GERAGOS: Okay. So that didn't work, then they -- how many different computer simulations did you run?

CHENG: Well, that's just basically that's the scenario in that time.

GERAGOS: Okay.

CHENG: But, you know, in the different -- for example, just move the particle tracking, move the particle, make it less personal. Particles a little bit closer to the shore, and a bit out from the shore, so forth, here.

GERAGOS: Okay. Then this was obviously February, the body had not been found. Then they come back to you after the body had been found, correct?

CHENG: Correct.

GERAGOS: And when they come back when the bodies had been found, they asked you to do this analysis that's up here; is that correct?

CHENG: Uh-huh, that is correct.

GERAGOS: Okay. When they asked you -- can I borrow your pointer for a second?

CHENG: The red button here.

GERAGOS: Thank you. And specifically when they asked you to do this, you, at that point, had the locations where the baby is found, and you got the location where Laci is found, and then you do some analysis, and you come up with this section right here with some GPS coordinates, correct?

CHENG: That is correct.

GERAGOS: You do that based upon a couple of -- a lot of assumptions; isn't that correct?

CHENG: Based on assumptions and scientific data.

GERAGOS: Okay. And you -- specifically didn't you tell the officers that there were many variables to took for in some -- you could not factor in, so this would not be a scientific project; is that what you told them?

CHENG: I don't remember the exact words. But, on the other hand, all scientific investigations start with an assumption.

GERAGOS: Okay. I'm going to show you what's been Bates Marked stamped 16836. This is a report by Detective Owen. Could you read that just to yourself, that sentence there that I have got yellow highlighted?

CHENG: Yeah.

GERAGOS: Okay. Does that refresh your recollection as to what you told the officers?

CHENG: Yeah.

GERAGOS: Okay. You told them there were many variables to factor in. Some you could not factor in. So this would not be a scientific project, but a best estimate; is that correct?

CHENG: That is correct. And matter of how you define scientific projects. That's the definition of degree of preciseness.

GERAGOS: Did you also tell them that it was difficult to do what they were asking you to do? I think specifically what you were telling Mr. Harris is because you don't know when the bodies were found, correct?

CHENG: Correct.

GERAGOS: You know when they are found. You don't know when they actually got there, correct?

CHENG: That is correct.

GERAGOS: And you were also told to assume that the bodies had been anchored or weighted -- at least Laci's had, correct?

CHENG: Correct.

GERAGOS: You were told -- you assumed it had been weighted with four or five eight-pound anchors, correct?

CHENG: Correct.

GERAGOS: You were also told to consider the scenario that chicken wire was used; is that correct?

CHENG: I think that once was mentioned, but wasn't emphasized.

GERAGOS: Did they specifically give you any other -- they gave you information did they not, about Laci's size?

CHENG: Yes, they did.

GERAGOS: Okay. And specifically they said they wanted to see if they could determine the area where the bodies had been placed in the water under their theory that there were anchors, correct?

CHENG: Correct.

GERAGOS: And so that they cold go and search for the anchors, right?

CHENG: That was the second phase. The first phase they wanted to search for the body.

GERAGOS: Okay.

CHENG: So I don't know when the -- refer to the February period the first phase.

GERAGOS: I'll call it the May period; is that correct? In the May --

CHENG: May?

GERAGOS: Yes.

CHENG: Yes.

GERAGOS: That's the second period?

CHENG: No. Second phase they did not even -- the body had had already broken away from the anchor.

GERAGOS: If there was anchors?

CHENG: If they were anchors.

GERAGOS: Because you -- they told you to assume there were anchors. That's what they wanted to search for.

CHENG: My part here, the anchor doesn't play any role in the second phase because, now, I mean it wasn't for me to determine whether the anchor is attached to the body or not. We have already assumed the body is already floating loose.

GERAGOS: If the body was floating loose, wouldn't the -- and what is the Mean Low Tide on those days?

CHENG: I thought we showed that. We discussed that.

GERAGOS: How many feet? How many feet?

CHENG: Mean Lower Tide.

GERAGOS: Yeah.

CHENG: At that time I mean I think there was one tide was negative.

GERAGOS: Right. So it would have been two to three feet?

CHENG: Total range, you will need to tell me what you like to know, the tidal range.

GERAGOS: I'm asking you specifically --

CHENG: Yeah.

GERAGOS: If your theory is correct, then the bodies were floating in this area, looks to me like it says five and six throughout all of here, three and four in here, correct?

CHENG: Correct.

GERAGOS: So did it's negative one, then you can just take one foot off of the depth there, correct?

CHENG: That is correct.

GERAGOS: Okay. Now, you said the -- specifically that when you came up with this analysis, you then sent an email to the officers; isn't that correct?

CHENG: Correct.

GERAGOS: Okay. And in the e-mail that you sent to the officers, you told them that, therefore, you recommend this location as a starting point for looking for the weight and the anchors; isn't that what you say?

CHENG: Yes, I did.

GERAGOS: Okay.

CHENG: As I say now, that's based on my best judgment, the highest probability.

GERAGOS: Right. So -- but that's what you were trying to determine; isn't that correct?

CHENG: Correct. Okay. I was trying to determine --

GERAGOS: You were trying to construct a diagram that would show you the best estimate of what you said was the separation location, correct?

CHENG: Correct.

GERAGOS: Okay. And you said that the facts were consistent with the baby being found. However, following the same exercise, you cannot reproduce the trajectories of Laci's body?

CHENG: That is correct.

GERAGOS: Okay.

CHENG: However, there are other paragraphs following that too.

GERAGOS: I'm going to get to that. Specifically the other paragraph after that says that there could be several explanations, right?

CHENG: Yeah.

GERAGOS: Well, but what you didn't tell Mr. Harris, they didn't ask you on direct was that when you did this exercise, you couldn't come up with the trajectory of Laci's body, correct?

CHENG: He didn't ask me. I didn't say.

GERAGOS: Right. I know he didn't ask you that. Now, you said there could be several explanations, right?

CHENG: Correct.

GERAGOS: Okay. And you said that since Laci's body was bulkier than the infant, it could I have been stuck on the bay bottom, right?

CHENG: Correct.

GERAGOS: Well, that explanation would mean that the body was not floating around, wouldn't it?

CHENG: Well, I'm not -- I'm not the expert in that area here. I don't know how the body is behaving in water.

GERAGOS: And, specifically, you have never done anything like this before, have you?

CHENG: I have done some similar studies of particle tracking, but not body.

GERAGOS: Not bodies. How big are particles that you track when you have done those similar studies, what are we talking about?

CHENG: I mean just representative scientific particles, for example, you put a float in the water. But something weighted down, drifting like.

GERAGOS: You have never done any study in San Francisco Bay that has anything to do with bodies or things of that size, correct?

CHENG: That is correct.

GERAGOS: Okay. Basically, what the U.S. Geological Service does is -- I went up on the website. You do many great things.

CHENG: Thanks.

GERAGOS: Basically out there to look at contaminants in the bay and tidal studies, and currents, and things like that nature, correct?

CHENG: Well, scientific investigation here. You don't really need to reproduce precisely what you have had done. Actually, the parallels between science, you do one thing, you can extend your knowledge to the other.

GERAGOS: Right. But you said in this, the next paragraph that you wanted me to get to, that you said this brings up an important note, that the procedures used in these estimates invoke large uncertainties, correct?

CHENG: That is correct.

GERAGOS: And the large uncertainties in the wind data and times for that area, correct?

CHENG: Well, all of these things, by using the word uncertainty. The matters are relative. That now since, of course, obviously we cannot measure wind right at the spot, wind was measured some distance away. Therefore, that's what I'm referring to.

GERAGOS: Maybe I could ask that Mr. Harris, if you would, could you give me the slide where you had the wind data? Remember that? Talking about the slide we looked at that had the three pieces of data on it.

CHENG: Right.

GERAGOS: Okay. Okay?

CHENG: Correct.

GERAGOS: Now, when they showed this, when Mr. Harris showed this, at least if I understand your e-mail correct, that the wind data that you are talking about is not for that specific area that's on the map, right?

CHENG: That is correct. However, though, that's just -- as I mentioned, that's just matter of disclaimer. The wind in that location where your finger is would not be that different from the where the wind was measured.

GERAGOS: Well, let's take a look at that for -- Mr. Harris, that other slide with the wind the arrows on it. Now, if I'm not -- if you said it's not that different, where my finger was on the map, this is over here, correct?

CHENG: Not correct.

GERAGOS: Where was it, here?

CHENG: Closer. Go up. This is South Bay. Go up, up, up, up, up. To the left. Okay somewhere over here.

GERAGOS: That's an arrow that looks like what color?

CHENG: I'll call that 10 to 15.

GERAGOS: What's over here red, and the --

CHENG: That's about 25 knots.

GERAGOS: Okay. So really big wind -- big wind over here, and that appeared to me, at least, to -- looks like it's over land; is that correct?

CHENG: That is over Livermore area, yes.

GERAGOS: How far away is that from the Berkeley Marina?

CHENG: About fifteen miles. The wind was measured right at the Richmond station. May I use the pointer to point out where the wind was measured?

GERAGOS: Well, but I'm asking you, in your e-mail you say there are large uncertainties in the wind data for the area and the times, correct?

CHENG: That's what I said in the e-mail, yes.

GERAGOS: And winds were estimated from nearby measurements?

CHENG: Right.

GERAGOS: Then you also put wave conditions were uncertain, right?

CHENG: We never measured the wind. Wind was estimated from the equation based on the wind speed and distance.

GERAGOS: And the wind-generated drifts, things that you are trying to talk about, were all estimated based on theoretical studies at a different site?

CHENG: That's the handbook. That is not derived -- the handbook from Army Corps of Engineers doesn't mean that not every time you go study, you have to repeat the same exercise over and over again. So the theory established at one location can be applied to other places. That's what I'm referring to in trying to be precise.

GERAGOS: And do you study -- you said also that the error bars -- you know what an error bar means? Measure of air, right?

CHENG: Correct.

GERAGOS: Means how far off you could be on all of this?

CHENG: Yes.

GERAGOS: You said in this estimate could be substantial; is that correct?

CHENG: That is correct.

GERAGOS: Error bars.

CHENG: However, it's also -- again, may I remind you that only a relative matter here. I think the error bar is large. As you said, that is not -- I told you that now that area I have pointed out cannot be interpreted as precise since there is an error bar.

Court Reporter: Are you saying arrow bar or error bar?

CHENG: Error bar. E-r-r-o-r.

GERAGOS: Better than you than me, Laron. If I understand correct, the error -- or your final conclusion is that basically all of this is largely uncertain, correct?

CHENG: That is not correct.

GERAGOS: Well, you said it invokes large uncertainties?

CHENG: Well, let me give you have this.

GERAGOS: Let me just ask you the question. What does, "It invokes large uncertainties" mean?

CHENG: Large uncertainty. That is not precise. Not a hundred percent. Nothing is a hundred percent.

GERAGOS: When you say it's a problem, what did you call -- it says probability, but not deterministic?

CHENG: That's correct.

GERAGOS: Okay. What does deterministic --

CHENG: That it's precise.

GERAGOS: That's precise. It's just not precise?

CHENG: That's correct.

GERAGOS: Is that a fair way to characterize it?

CHENG: Uh-huh.

GERAGOS: But it's probable what you are talking about is probable but not precise?

CHENG: That's correct.

GERAGOS: And that there are large uncertainties; is that right?

CHENG: I did. I state it a relative matter. One, it's a large measure, again, what --

GERAGOS: You said specifically that it invokes large uncertainties; isn't that correct?

CHENG: I did say. Did say that.

GERAGOS: That wasn't my words.

CHENG: I did say -- you don't need to show it to me.

GERAGOS: You don't want to see where it invokes large uncertainty?

CHENG: Yes, I did.

GERAGOS: Okay. You wrote that, right?

CHENG: Let me remind you, Mr. Geragos, that, as you know, we are moving into the internet stage here, that when people write e-mails, typically you don't go through the peer review and editing your text, and all these things. You know that.

GERAGOS: That's why we have cross examination.

CHENG: That's why we have typos in the e-mail.

GERAGOS: Got our own peer review here. It's called cross examination.

CHENG: Getting efficiency of communication.

JUDGE: Both talking at the same time.

GERAGOS: Now, specifically, the other thing, I learned a couple of things when I was studying up for yesterday, bathymetric. I learned that term. That means the depth of the water, correct?

CHENG: Correct.

GERAGOS: Then the other one was, it starts with an "E". And it's estuarian?

CHENG: Estuarian.

GERAGOS: What's estuarian mean?

CHENG: That denotes the region where river meets the ocean.

GERAGOS: Estuarian is a region where the river meets the ocean?

CHENG: Again it's a loosely defined. You can say that, yes.

GERAGOS: Okay. And why is that?

CHENG: That's because there is a fresh water coming from the river, and meets the oceanic water coming from the ocean.

GERAGOS: Where does that come into play in this area here?

CHENG: In this area, depend on the month of the year, and --

GERAGOS: How about December?

CHENG: December, no.

GERAGOS: How about April?

CHENG: April, depend on how wet, how dry the previous year -- water year was.

GERAGOS: Okay. What if we had a very large storm in January, extremely large storm in January?

CHENG: Well, the -- as a matter of fact, it's -- I know these days we have developed so reservoirs and dams here, major runoff would not start until March, and is much regulated.

GERAGOS: Now, did you look, for this year, as to what the runoff was for that year, 2003?

JUDGE: 2003? You said this year.

GERAGOS: For 2003.

CHENG: 2003, I think in terms, even the effect from the fresh water runoff would not affect the currents.

GERAGOS: I'm not asking you about the currents. I'm asking you if fresh water runoff goes into this are

CHENG: In the year 2003?

GERAGOS: Yes.

CHENG: I did not look at that.

GERAGOS: You did not look at that. Is it a fair statement that it was your opinion that if the -- one of the factors or variables is that you assume that the body were in the shallow area -- and you call this the shallow area?

CHENG: Yes.

GERAGOS: That you assumed that the body were in the shallow area for months?

CHENG: I did not assume that. I just say I was given the mission to find where the bodies started traveling. Body could have been there for months.

GERAGOS: And just so that I'm clear, it's -- based on your formula and your trajectory, you could not do -- this did not work for Laci Peterson; isn't that correct?

CHENG: That is correct.

GERAGOS: Thank you. I have no further questions.

Redirect Examination

CHENG: Could I add something?

JUDGE: He's going to be asking some questions. That's why we redirect. Mr. Harris, I'm sure, will give you an opportunity to clear up what you wanted.

HARRIS: I'll start with that right away. What was it you wanted to add, doctor?

CHENG: Okay. I just want to clarify typical scientific investigation, even for that, that I -- that you typically would start a hypothesis. Otherwise you don't know where to start. But a

boat-laden hypothesis does not mean a jump-on-the boat conclusion. You start with the boat hypothesis here. You need to back it up with some scientific data, scientific theory, to get to the conclusion. And about two or three months ago, I was approached by the DA's office asking me to serve as an expert witness. I agreed to do that. At that time they gave me this piece of document that you also have in your hand here. So at that time, after we did this calculation, backtracking, and all that, I have been questioned by Mr. Geragos that -- about the uncertainty, and all these things here. Typically, in scientific investigation, it is important to have independent cross check -- cross checks. And in this police report -- actually I studied that over the weekend too. And everybody was working on the weekend. Let me flip to the page. I'd like to read to you too, Mr. Geragos.

GERAGOS: I don't believe it's responsive at this point. It's nonresponsive.

JUDGE: It's nonresponsive. It's narrative.

CHENG: Could do more specific things that --

HARRIS: Doctor, that means the Judge wants me to ask you another question. You are talking about peer review. That means that somebody else looks at the same data?

CHENG: Yes.

HARRIS: And from --

CHENG: Did similar analysis.

HARRIS: From your review of this, just going back to what I was looking at up here earlier. Looking at 284, this particular chart, from your information, was this also reviewed by the Coast Guard?

CHENG: I don't know of the fact. But, however, from the police report --

GERAGOS: There is an objection.

CHENG: I had no --

GERAGOS: There is -- he doesn't know about facts, that he can't rely on.

JUDGE: If he relied on it in forming his opinion, he can testify to --

GERAGOS: Right.

JUDGE: You can say -- you have to lay a foundation.

HARRIS: Since you were going through this, you are looking at the police report, does it have an indication in there of whether the Modesto Police Department provided your data or independent data to the Coast Guard for them to conduct the same type of research?

CHENG: By reading from the report --

GERAGOS: There is an objection if he didn't.

JUDGE: I think that's what we are here leading up to.

GERAGOS: Okay.

JUDGE: He is -- I think that's what we are leading up to.

HARRIS: From reading the report, does it appear that the Modesto Police Department provided your information to the Coast Guard as well?

CHENG: Yes, you did.

HARRIS: And does it appear that the Coast Guard came up with results too?

CHENG: That was paragraph --

JUDGE: Okay?

CHENG: I wanted to read --

JUDGE: Doctor Cheng, in forming your opinion that there is the probability, if I can use that word, that's where the body -- the body was located, did you consider the Coast Guard report also in forming that opinion?

CHENG: No. That's not the point. I did not.

GERAGOS: Right. That's why --

JUDGE: Objection is sustained.

HARRIS: Now, to go back through some of these things, counsel was saying that you haven't conducted any tests where you have thrown bodies in the water to see how they drift. And you were talking about how you take scientific principles and you apply them to other tests. I want to go back through though something that you were saying when you first came in here, we were asking about your degrees. What is your degree in?

CHENG: Aeronautical engineering.

HARRIS: Aeronautical engineering has an application to hydrology?

CHENG: They are studying basically the knowledge of fluid mechanics, the basic knowledge shared with hydraulics and aerodynamics. I think the basic understanding of fluid mechanics.

HARRIS: Fluid mechanics are how objects move. That's the same, whether it's an aeronautical engineer, or if it's in -- where things move in The Bay?

CHENG: That is very similar. There is called a law of similitudes.

HARRIS: So in terms of you being asked if you have ever put bodies in The Bay, I think you had said something, you put -- you have put buoys in The Bay?

CHENG: We have put drifters in the oceanographic study. We wanted to track the movement of currents. You put drifters in. That's not a body, but device that follows the movement of the currents.

HARRIS: So this is some type of floating device that would be on the water and you can observe?

CHENG: It can be adjusted to certain weight that could be representing the water movement at certain depths, or near the surface, or at depth.

HARRIS: Is this something that's done on a regular basis in the field of endeavor that you work in?

CHENG: I wouldn't say regular basis. It's commonly used.

HARRIS: So, again, the scientific knowledge of how things move through the water, that is done in your regular scope of employment?

CHENG: That has been used, but not on a regular basis, yes.

HARRIS: You were asked about -- counsel mentioned something about chicken wire. And you said that was not emphasized. I want to go back to that. You were saying that there were different phases -- I think counsel came up with the term of May. If we refer to when the police came to you prior to the bodies, that being phase one, and after the bodies were found being phase two, or the May phase as Mr. Geragos used. So having that reference in mind just to go back through that briefly. When you were doing this track that we is see up there for phase two, or the May phase, you weren't taking this into account, this chicken wire. That was not a factor for study or review at that time, was it?

CHENG: No.

HARRIS: In fact, you were advised by the Police Department that the bodies the body of Laci Peterson had come up and it was not intact at that time.

CHENG: That is correct.

HARRIS: So they were asking you to help find where the missing limbs might have been.

CHENG: Correct.

HARRIS: And what the most probable location was where those limbs and possible weights might be?

CHENG: Correct.

HARRIS: So where you were looking at this particular phase two, or the May phase to try and try to track that, we weren't even dealing with the complete body at that point in time, were we?

CHENG: No.

HARRIS: And counsel also asked you if you had -- you put a box up there where it was in the first phase. We see your box with the "X" up there. Is that by Buoy Number 4?

CHENG: I don't recall. I can't look at the start possibly. I think the location is correct.

HARRIS: If you can, I don't know if you can find it. If you look up there, see if you see Buoy Number 4.

JUDGE: Can you see Buoy Number 4? If it's there, would you point out with a pencil, or pen, or something where the jury can see it?

CHENG: I can use any finger. I don't see Buoy Number 4 and 6. Actually I did not -- I should -- box should switch over slightly. That doesn't make any difference in conclusion between Buoy 4 and Buoy 6, correct.

HARRIS: And so they were asking you, based on whatever information that they had, or for whatever assumptions for you to consider being in that first phase, in that area by Buoy Number 4?

CHENG: Would you do that again, please?

HARRIS: Okay. When the Modesto Police Department in the first phase were asking you to look in that area that you have drawn up there with the X in the box, that's in the area about Buoy Number 4?

CHENG: Yeah.

HARRIS: When you were asked about these things that you had said in the e-mail, when you are talking about -- I think you said it was a definition of the degree of preciseness. In the scientific field, is preciseness something you really strive for?

CHENG: Trying to anyway. But sometimes, because of other limitations, you may not accomplish what the degree accuracy that you would like to accomplish.

HARRIS: And as you conduct scientific experiments in your chosen field all the time, do you try to strive for preciseness?

CHENG: Yes, I do.

HARRIS: Is it always easy to achieve?

CHENG: It's hard work.

HARRIS: When you apply that over into this application of what the Modesto Police Department asked you to do, to try and find the probable location of where Laci and Conner were at, is this what you were talking about precision is not necessarily achievable, but the science doesn't

change?

CHENG: I'm trying to, based on my experience, based on the science.

GERAGOS: Objection.

JUDGE: Overruled.

CHENG: I'm trying my best based on my knowledge and experience to achieve the answers that we were looking for.

HARRIS: Now, counsel asked you last whether you were able to reproduce the results for Conner and Laci. So the track that we see up there, your computer -- your simulation, your analysis of this, this particular track is for Conner Peterson?

CHENG: Correct.

HARRIS: Who was the smallest of the two bodies; is that your understanding as well?

CHENG: That is correct.

HARRIS: And then we also have Laci who was in this disarticulated state, that's what were you advised by the Modesto Police Department?

CHENG: Yes.

HARRIS: Again, part of what they had originally told you that she was anchored or weighted down in some fashion when you were doing your initial analysis?

CHENG: Yes.

HARRIS: If she were weighted down, weighted down, or had anchors attached to her, would that make her properties in water behave differently than that of Conner?

CHENG: It would.

HARRIS: People have no other questions.

Recross Examination

GERAGOS: And specifically you were told in your February exercise to assume a number of things, correct?

CHENG: In February, the previous event, right, yes.

GERAGOS: Yes. In February you were specifically told to assume that Laci was 153 pounds, correct?

CHENG: Correct.

GERAGOS: And you were told to assume possibly four anchors at eight pounds apiece, correct?

CHENG: Yes.

GERAGOS: And also the third thing you were told is possibly wrapped in chicken wire and some form of plastic wrap?

CHENG: That is correct.

GERAGOS: And, specifically, you were not able to -- as Mr. Harris just asked you, you were not able to reproduce the trajectory of Laci's body, correct?

CHENG: I did not need that information at the time when we were doing the trajectory, those information.

GERAGOS: I understand that. I'm asking you a separate question.

CHENG: Okay.

GERAGOS: Separately, what Mr. Harris just asked you is, following your same -- the same exercise that you did up here, you were not able to produce the traveling trajectory of Laci's body?

CHENG: Not without further assumptions.

GERAGOS: Okay. And you had already, I believe, specifically said that the two bodies turn up in two different spots, and that you could give some explanations for that. One of the explanations for that is that they were placed in the water separately; isn't that correct? Isn't that a possible explanation?

CHENG: That is a possibility. But even, I think also stated in e-mail, for the two different objects placed in the water at the same location could possibly wind up in the different locations.

GERAGOS: Correct. And you also stated in the e-mail that you couldn't, based on the assumptions that you made and the information you were given, you could not reproduce the trajectory, correct?

CHENG: For Laci, right.

GERAGOS: Right. And you also specifically cannot say, unless you make assumptions when the bodies were placed in the water, correct?

CHENG: That is correct.

GERAGOS: Okay. And, specifically, you can't say -- I guess you did these tests, or you have done tests with things called drifters; is that correct?

CHENG: Uh-huh.

GERAGOS: How much does a drifter weigh?

CHENG: As I mentioned, that a drifter can be adjusted to a neutral density to water. So it weighs in the area -- it's irrelevant how much it weighs in water.

GERAGOS: Right. How much does one of the drifters weigh?

CHENG: Zero.

GERAGOS: Zero.

CHENG: Neutral buoyant.

GERAGOS: So that's what some of these assumptions are based on is your drifter studies, correct?

CHENG: Correct.

GERAGOS: Which has a weight of zero, because you have reduced that, or offset that in the water, correct?

CHENG: Yes.

GERAGOS: Thank you. I have no further questions.