>> MR. JONES (FAA): Thank you for the opportunity. First, a few disclaimers: I do work for the FAA, have done so for over 20 years now. I was a public school teacher before that.

I have no background whatsoever in geodesy. But at the same time, I really enjoy the subject and however, more disclaimers, I'm not here to make any policy for the FAA, and I'm not sure that I make policy in my own family. So with that, in my home library, I have a college physics book published in 1903, not my personal one when I was in college but it is there and as many science textbooks want to do, the opening chapter is a discussion on the scientific method. And in this discussion of scientific method, the author of the book points out that the earth is solid through and through, except for the oceans of course. And the scientific method that he applies to verify this is that there are more scientists that believe that it is solid than those that do not believe that it is solid. So therefore, it must be solid through and through. So, you know, even when I read that the first time, I thought, you know, that does not even account for volcanoes let along anything else that might be going on. So I had even doubt then. You have to realize this book was published before the special and general theories of relativity so it is over 100 years old.

Now, let's leap forward about 60 years. I was a geology student in high school. There was absolutely no mention in that text whatsoever of anything called plate tectonics. Everything was based upon (low audio) and Isostacy or whatever they call it, isostasies I think they call it, whereas mountains wear down, the junk flows downhill and it gets weightier and does this number, I'm thinking that can't be right. So a couple of 3 years later, a college geology class had a single paragraph, a single paragraph that suggested that the new theory of plate tectonics and now, the dynamics are well, use the term loosely are well understood.

So here we are, now, we believe in a continuously, shifting and colliding plate that is interacting with a dozen or so other shifting and colliding tectonic plates and we are in a dynamic situation. I mean, can't you feel the earth move?

But at the same time, historically as geodesists, map makers, cartographers, whatever our pasts may be, or a simple mathematician as myself, we tend to want to pin down our coordinate systems. But since the last revelation of NAD 83 or NAVD 88 or WGS 84, we have been on the move. And we will continue to be on the move.

Our coordinate system must move with the earth. If we are -- if I can read my own notes, if we nail down our coordinate system, then, in a short time, as we are doing now, we will have to pull up those nails and nail them down again someplace else. If we fix the coordinate system not by fixing the coordinate system but by incorporating not only they the XYZ and their associated velocities and even possible associated accelerations, then we will have a coordinate system that moves with us and remains precise over time. Now, even that in time will be off.

Now, as one mathematician I want to say, is Irving Box, but I don’t think his first name was Irving because Irving is a lawyer in Oklahoma City but a mathematician named Box said all math models are in error but some of them are good. Some of them are useful. And that's what we are trying to do. Whatever we come up with, we know is in error. But, is it useful? Now, technology being what it is, my first calculator to explain to the peers out here in the audience, my first calculator would gobble up four double AA batteries in about 4 minutes and nixi tubes. Go look that up. I mean, I started drawing

the sand before I got my first abacus so technology has changed some in these years. But, we need to move toward a dynamic in-motion coordinates system within the FAA, within hydrology, within the Weather Service, within Charting and Mapping. When we put a benchmark down, it's got to have date and what system was used to put it down so when someone else comes up and says, I'm going to start here, I will use this coordinate. Oh, it's five years later, let's apply the velocities and accelerations and see where we are, we're not here anymore. What was it in -- I wanted to say in 1997 when the FAA change from NAD 29 to NAD 83. I was thinking boy, that is the first time in history that I was in two places at once.

Well, we don't want to be in two places at once. We like everybody to have a good idea where they are and have that consistent with their neighbors who think they know where they are as well. So, I of course will be pushing for personally, a dynamic ITRF system that can be updated on a continuous basis based upon the velocity and acceleration from known geodetic points whether it's done with the GPS or old chain and theodolite or whatever method you're using. That's what we have to move toward.

And sure, our calculators at the current time do not necessarily have the capability to do that in a rapid motion. But how many years ago was it that it took ten minutes or so using Loran C citing different stations independently and using hyperbolic geometry to get a fix on where you were mid-ocean? It has not been that many years. And I don't believe it will be that many years before not only can I pull out my cell phone and get my GPS coordinates, but I will be able to push a couple of buttons and go either forward in time and find out where I was and where I will be if I stand on the same spot for a number of years.

So that is just food for thought. I hope that some of you digest it. The rest of you may spit it out wherever you choose. Thank you very much.

>> MR. DOYLE: Thank you Allen. I also reflected in high school, my geology text only made a very brief mention of the concept of play tectonics.