DAVE DOYLE
O.K.! If we can get everybody back together and get started again.

We enjoyed a rather lively debate in the previous session, and I would like to think that that will only be enhanced – if you will – when we talked about the geopotential side of this – the vertical. It always does seem to us at NGS that the use or the need for higher accuracy vertical particularly is 2-to-1 in terms of the horizontal. So our next panel is going to be discussing exactly that, this transition from a monument-based vertical reference frame to one that's going to rely on geopotential as Dan Roman outlined earlier this morning.

So this afternoon's panel is Juliana Blackwell again – when you're the boss, you get to be in front of everything, that's right. Vicki Childers who runs our GRAV-D program. DRU Smith who is the NGS Chief Geodetic Advisor. Advisor! – Chief Geodesist. Hey, I'm old! I get to say that now – senior moment, senior moment. Dan Roman who leads the geoid team, Dan Martin who is our State Advisor to New Hampshire – isn't it? Oh, some place where they don't do maple – to Vermont, and Mark VÉRONNEAU, another colleague from Canada who is their gravity and geoid guy.

So with that, I will turn this over to Juliana for a few opening remarks and then please jump in again. Our colleagues online please engage us with any comments or questions that you have; and just one other comment before I turn it over to Juliana. I realize that quite a number of you representing your specific agencies may be a little reluctant to ask a question or oppose something because of some policy issues. We hope that you will just ask them in the spirit of the question and not with respect to any particular agency protocols or policies, but just give us a flavor of what you might personally be thinking with respect to what you do. We realize that many of you in terms of developing actual policies are going to have to go home and discuss this with the powers that be. But we would certainly encourage you to throw your two cents worth in – even if it is your personal opinion and you won't be held to a policy statement.

With that, I'll turn it over to Juliana.

JULIANA BLACKWELL
Thanks Dave. Just echoing really what Dave just said is that we want to hear, want to hear not only from the State and the private sector – we want to hear from some of our Federal partners. And I don't want to put anybody on the spot – that's not what we're here for. But the questions, the concerns, the ideas that you have or just to start the conversation about, you know, what does this really mean, or have you thought about the impact it's going to have on my organization? You may think that we know, we may think that we know, but we might have totally different perspectives on how easy or how difficult something will be in providing a new datum and that means to you. So again, it doesn't have to be Federal folks, but this is the opportunity to throw those things out there. We may not have answers today, but it certainly will give us some more things to think about and to broaden our discussions the next time we hold something like this and we certainly will have other discussions in different levels. And as we talked about in the last panel session, if there are opportunities for targeted seminars or talking more individually to groups about their individual needs, those are the kind of things that we want to plan out now. We can't do it all this year, we can't do it all next year, but we want to have an idea of the breadth and depth of the information that we need to look into, and developing this datum and doing the right type of outreach and education. So, please don't be afraid to speak up and tell us what you think. Thanks.

Anybody want to start?

PANEL
Somebody from the floor! How about our friend from the Corps of Engineers? Heights must be important to the Corp of Engineers. Where's Jim Garster, do you know, did he run away?

AUDIENCE
Is this on? I'm Jim Slater from the National Geospatial Intelligence Agency. I had a couple of questions that overlap, I think, between these two sessions. One is what I guess is a nomenclature thing. We're calling this a new North American Datum, and I guess I want to address this to either the Canadian representatives that are here – Mike included from the last session – or Mark from this one.

If Canada is still using an old NAD and you know, and I don't know about Mexico, but are we looking at is this really a redefinition of U.S. national datum rather than a North American datum? I mean how much is Canada going to be involved, how much is Mexico going to be involved – either in the inputs to this thing or the output products – whatever that might be – or the reference frame? That's my first question. I'll stop it, you know for that.

DRU SMITH
Jim, I'm going to start with what I know about this, which is first of all, there's no name for what we're proposing. It's not a new North America datum. It is a replacement for NAD 83 that we're talking about, and it's used in the United States. So, well, no he said it had to do with both sessions – what you're talking about NAD 88 or NAD 83 in both cases. We're talking about the official datum that NGS produces based on our mandate for use in the United States. What that's named is still an open question.

Mexico, as far as both the horizontal and the geometric side, is on ITRF; and on the geopotential side they are happy right now with a benchmark based vertical datum. Canada has – and also you've heard from Mike, and I'll certainly turn this over to Mark in a second – different views on the geometric versus the geopotential side. So I would actually turn it over to Mark to give the actual full Canadian answer.

MARC VÉRONNEAU (PANEL)
Well first of all I will say that Canada and USA has been working closely over many, many years on the organization of reference frames – whether it will be geometric or vertical. 1983 was a true North American corporation between Canada, USA, and Mexico. Basically, we have the same reference frame across Canada and USA, and even we talk about '93 original, or we talk about '93 CSRS in Canada or NSRS in the USA. It is defined by the same concept and definition.

And the same thing with the vertical – we worked together to produce NAVD 88. It was adopted in the USA in '95, I believe? I never worked up there in CANADA, because we are somewhat worried about the systematic error that we see from coast-to-coast. It was indicated that Pacific Ocean next to Vancouver was about a meter and a half higher than the water level next to Halifax on the East Coast - Atlantic Ocean. So we were kind of worried about this systematic error while in a relative sense, CGB 28 the occurrence established was most locally used, so we didn't see the point to move to a new system in Canada at that point.

But today we realize that for the cost of maintaining such a network, which in a certain country overall like most of Canada, have no benchmark, no access to this datum at all. So we realize by the late 80's with the advance of GPS that we have today, we could move to our new system and it will be a joint based system. So there again about the 90's roughly, to move on to a joint based system. Now it is just a question can we write the datum that will be consistent over the years because many users were worried because we published a model in '91, '95, 2000 and each one was quite different from the next one to the next one. But now with the advance with gravity for satellite like Grace Mission and the upcoming Ghost Mission will bring the first result, we can convert to a consistent solution that will please most users across Canada – especially be able to provide an access to a accurate datum in Northern Canada like in the territories of Northern Quebec, Northern Manitoba for example.

So I see a lot of people being willing to move this new datum use for the north. Naturally like Mike mentioned there is a lot of people still considered when they see that the local system worked well for them and it will resume and stay there in Canada as long as there are markers on the ground. We don't intend to do more leveling, so markers will disappear with time. So it could be another 50 years with markers, but people can resume a system, but will also offer the new technology of using GPS or new NGS system to convert an ortho height into ultimate height in a precise way so their height will be compatible with topo maps and to make sure to know where water will flow.

But still in the new system, we want to make sure to users that the new fundamental height in the hydro side is not the determined height, but surely the height is the one you observe in the field and you have to safeguard in your system. While the geoid model may change with time, so it is a new model you have to be able to switch the old one out and bring back a new model to obtain more accurate information about the height above the geoid. And basically, that's what I perceive.

AUDIENCE
I have one more question that kind of overlap again both panels and this has to be with the kind of satellite paradigm for defining the reference frame, either the horizontal or let's call it the model, the GPS leveling model. Are we looking now in the future of defining these things with respect to GNSS as opposed to GPS? I mean Richard was talking about now your CORS stations are going to be combined GLONASS GPS. IGS has been producing GLONASS orbits for a long time now and have gotten very good.

So I guess the question is whether when you develop these new datums – or whatever you want to call them – are we looking at doing that in the context of GNSS as opposed to just GPS which we have done in the past?

DRU
The answer is yes. This is going to incorporate all of the data from the satellite navigation systems. But not blindly, not without consideration of the weights of the various impacts that each of the systems can bring to this.

Quite frankly, as a scientist, I would say that if there were a system that beat GPS hands down, I'm going to be more interested in that. On the other hand, there is the United States desire that GPS be the gold standard for satellite navigation. It is. But there are not many other

competitors. So, how that gold standard holds up ten years or twenty years from now remains to be seen. But I think the best thing you can do scientifically is take all the information and put it in its proper place with the various weights attributed to it.

PANEL
Jim!

AUDIENCE
Jim Garster, Corps of Engineers, and I guess I'm speaking for one of thirty-eight different entities. I guess within the Corps we have different districts and everyone has their own little thing going on. But what we are trying to do at the overall level is you know, a couple of comments I want to make and I have a couple of concerns that are very valid.

We're in an effort right now to try to relate al of our projects to – and we're very careful to say – NSRS control because of the issue we see kind of coming down the road of NAVD 88 kind of going away or being changed, at which we try to make that not very known within the COR because people are going to go to 88 because we know is going to be coming along in ten years. In ten years we're going to something else. But we are very careful to do that. In fact we put a policy in place to have things go NAVD 88/ NSRS. That's something we are sort of moving to, and since we are relying more and more on GPS to establish these connections to the NSRS, that really the geoid based systems are very important to us. Geoid models are very important and the need for very accurate geoid models are very important.

But, there was a comment I guess or one of the presentations talked about passive monuments not being that important and they were kind of going away. Those are extremely important on Corps of Engineer projects. That monument in the ground and how that has relationship to not just the NSRS – and that's what providing that tool using GPS and geoid model to establish that – but the historical aspects of in the past and how it relates to water levels surface. Because we are not only looking at just geodetic datum, but we're really concerned with the water level – which way is the water going to flow? That is our main concern.

And so we're hoping that eventually this aspect of going to a geoid based will allow us to go to a total hydrologic type models that are based on whatever new NSRS. But would those have to be documented and allow for transformations because a lot of our projects we are looking at from starting and planning and engineering design all the way through to O&M, and we are looking at anywhere from 10 to 15 to 20 years in some cases. And we know when people start looking at, "Oh, we can change the geoid another couple of centimeters here," it's going to be done. And that's a very big concern of these changes through time. So, being able to document that and being able to know when these changes are so we can transform between those and be able to accurately account for that, that's extremely important for us.

JULIANA
I'll just say a few words and you can chime in also. We may see different things, but I'll talk first.

Jim, I know that internally and probably not so internally, the discussion about the passive monumentation, and whether or not it's going away, or what NGS is doing with it. I think it's important to think about what we talk about how we got to where we are today. We needed those marks in the ground to help define what the datums were – are, okay. And the fact that

you don't have to go through that process of setting the benchmarks and creating those loops in that entire network again at the cost of 200 million dollars and up.

We're in a different place. The fact of the matter is that there are plenty – there are many marks in the ground. In some places too many, and some places not enough, for people to do the work that they need to do. But in order for most of our stakeholders, I would say they need a reference point and if what they said is a concrete monument or if they use a PK nail or whatever it is that they use, they need to mark the spot so they can go back to those areas and take new measurements or validate the measurements that they have.

So I don't see how there is any way that things are going away. Now NGS is not going out there and setting many monuments unless it is for a special need for a project to do research, things along those lines and that's always quite possible. I would like to think that we can retain those capabilities of doing things like that for the near term. But people have different needs and so for the Corps of Engineers being able to go out there on the levies and be able to survey those points again you absolutely need something that's going to be stable enough for you to be able to re-measure and there are certainly other -- that is just one component of why people need marks in the ground, otherwise, how do you know you're back to the same place? Who knows, you know, 20, 30 years, what that's going to mean. But for now, we're not talking about ignoring the fact that people are using and need to use marks in the ground and so, maybe we need to say those things in different ways where people don't interpret the fact that we are saying passive monuments don't count, ok. That's not the case. And hearing your stories and why you need those and internally having those discussions at NGS, people are on a similar page of how we are going to move ahead with future datums and supporting our customers is why we're here.

So, I'll stop there and let anybody else disagree with me if they want to, but go ahead.

DRU
I dare not disagree with my boss!

JULIANA
He's learning!

DRU
Slowly!

Passive marks will have a critical role in the future that is different than the role they have played for centuries. Passive marks cannot be replaced for their critical role in monitoring change at a location. I would hope beyond hope that Corps of Engineers puts passive marks on every levy and GPSs them regularly – and then you can repeat where you were and see the change in time on that levy and know what the actual velocity, vertical velocity of those points are. Passive marks will have a role in high precision geodetic control. If I'm going to put in a foundation CORS, you bet I'm going to put passive control around it so that if I have to swap out that antenna for a receiver to recreate the actual site.

Passive marks have a role in the future. However, a role I don't want them to play and I really think that they should not play is when a mark has been surveyed and it has not been resurveyed for a very long time and somebody goes out to that mark, starts on it and says, "Uh

huh, all I need is the data sheet, the coordinate that NGS says is on this mark, and I'm going to go from there forward." Because we found that there are plenty of reasons that should not happen.

If you allow me to two little war stories, one of them happened about in the last 18 months, where a gentleman in Texas – his house flooded – and he went through the entire legal process of figuring out why, who is to blame. Turns out that there was an NAVD 88 benchmark involved that had not been visited in over 50 years and it subsided 3 feet in that time. You cannot do a 2005 flood plain map based on geodetic control in a subsiding region that is 50 years old. That is the wrong use of a passive mark.

When we say passive marks should go away, that's what I mean, the issue should go away as the primary starting point if you haven't checked the coordinate. If you have your primary, if you love your passive control, God bless you – I'm a surveyor, I'm right there with you.

Start by checking the coordinate. Don't assume that it's right. Take a GPS receiver – check the coordinate – and when you get that coordinate, share it with the world. I am a devout of OPUS DB. That is still a struggle for us is to know how much you want to share your solutions on passive control with the world.

I personally think if you put passive control on levees and you GPS them, that every solution you have ought to be turned into mark on an OPUS DB sheet. There ought to be a front page that shows a little graph and how this point has changed over time. And I thank my friends at FEMA might be able to grab all those solutions and be able to see that area is subsiding and better take that into account when they are doing flood plain control.

So this is why I think the passive control has an important place, but different place than it ever has in the past.

>>Dave Doyle? >>Do you have something?

AUDIENCE
Okay, this is a set of 3 questions here.

The first one is - is there going to be any discussion on deflection of the vertical in relationship to the panel today?

The second question is – the Ohio Transportation has had numerous discussions with NGS about the vertical component of our CORS. We have performed an in-depth study on Orthometric heights over the last five years and we have seen some disturbing results. I would like to know how NGS plans to address the current issues with antenna calibration issues and what appear to be errors in the Orthometric heights in the CORS data?

And the last question is – will the vertical component of the CORS still be computed and managed by the same people and will some someone actually looks at our concerns? Our concerns with the vertical component of the CORS system has so far fallen upon deaf ears and has been attributed to everything from post glacial rebounding, to having had someone use an inappropriate allen wrench when we installed the antenna. A new vertical datum does us no good if the information in the database is incorrect.

DRU
Wow, a lot of questions!

PANEL
For the question of the vertical – part of our process is to try to develop a model of the gravity field. To get vertical models after we get our geoid models. I do*** Some of our test data sets are geodetic. So yes, factor in strongly and continue to use those models. Right now we have two flavors up, one tied into the reference frame and as it is, and the other tie into the reference frame and we have had a lot more requests for that and offshore environments.

DRU
We have got the ortho heights on CORS.

Ortho heights on the CORS is – what a wonderful subject! We have multiple interesting discussions about this at NGS and I'm not sure who they have been speaking to because this is the first I have heard of it. So it is no longer on deaf ears and I hate to make it sound that way but if you ever feel something is falling on deaf ears, send me an e-mail I'll take care of it, which is to say I'll find the person who is being deaf. Send me an e-mail, I'll take care of it.

JULIANNA
What did you say?

PANEL IN UNISON
Dru.Smith@noaa.gov

DRU
But I suppose the question of Orthometric heights on CORS to me I'll give you my personal take on it. What is Orthometric height? It is a GPS receiver; it does latitude, longitude and ellipsoid heights; or it does xyz. Orthometric heights require either – well at this point I would say NAVD ellipsoid height require leveling to your CORS antenna – an Orthometric height requires to knowledge of the gravimetric geoid.

So I'm not quite sure of the issue. But in the future it will be – get your solution out of GPS in a geometric frame, ellipsoid based height; get your gravimetric geoid from the NGS latest model or the official model, which represents the vertical data and it could convert to Orthometric height.

So the need for an Orthometric height added to the COR station – the application I'm not sure what we are trying to get at there. You can certainly compute in the future an Orthometric height at a COR station by removing the gravimetric geoid model.

But as far as today's application, I don't know if I fully understood the question. So I would be glad if you have the time if it comes in with clarification.

DAVE
Person over here!

AUDIENCE

NGS has done a fantastic job as far as the OPUS DB is going. Is there any plan do the same thing for the LOCUST – your leveling application?

JULIANA
Anybody else want to talk about that?

PANEL
Is there a plan? Locust is being worked on. So from that perspective it is a viable project. It's something that energies are going into. I don't know if it's been fully decided whether or not it's going to go the full route of OPUS as in being able to publish, although that is being discussed right now. Having two options – would you publish or not publish? I think there are some decisions that we are looking at.

Unlike OPUS or unlike GPS from the OPUS perceptive, leveling as most folks know is quite a different animal. It's pretty easy to go out – collect some GPS data; submit it on line; say here's my antenna; here's my height; here's my name; and boom! You get an answer back. It is pretty straightforward.

From a leveling perspective, it is a lot different. There are a lot of user choices that have to be made; there is a lot of analysis of the data itself; a lot of analysis of the existing control that you are tied to. So from that perspective, the Locust is a little bit more problematic because the user has to truly, truly understand what they are doing with that data. And so can you publish it? – Sure. Do we want to publish it and have it be an NAVD height? – I don't know.

So, I hope that answers the question. I mean I know we are moving in that direction. It's still in – is it alpha beta? – It's in the early stages right now but moving forward.

DRU
It is that but LOCUS exists and the beta. It exist now as a tool where people are able to take their digital leveling data and submit and process it, but

Dan is absolutely right that right now we are in NAVD 88 is the official vertical datum and people are perpetuating that by submitting to us both height modernization GPS surveys – as well as leveling surveys. In the leveling, processing is ordinarily, manually intensive. If you hit ten existing benchmarks, you put fifteen new benchmarks in and that's your whole survey and something does not fit quite right. There is a lot of, well – does his existing benchmark have a bad height; does it need to be superseded? These are things that are performed in-house by people with decades of experience and processing leveling data can't be easily automated into GPS processing. So while we are interested in having some form of automated online leveling processing tool turned into a data sheet, we just don't see with clarity the right way forward to make that happen automatically because there are such decisions to be made on analyzing the quality of the benchmarks hit while analyzing the quality of the data itself is taking.

JULIANA
Just a last comment on that!

What they said is true. It's impossible to compare the two systems, the OPUS and the Locust. And I think Locust has come a long way in being able to integrate the other software for the vertical for the leveling data and being able to have individuals use improved software so that they can get clean data into the process so that it can be looked at without submitting it to NGS and having it set and waiting for somebody to pick it up and look for errors and do the in-house checking that we used to do before. Locust in the software that come as part of that package enables individuals to get through those hurdles themselves and be able to clean up the data so that they can actually run it through and get some results.

Now being able to take that and either submit it for adjustment and loading into the NGS IDB is the next step and that's where we need to have people within NGS looking at how that's going to be done and how that's going to work.

In some areas – and maybe it is beneficial in some areas of the country if there is no data there. But to add additional data into areas where there is currently a plethora of information that has not changed, then it's not really advantageous to the datum or the user. But if the user wants to run it through the proper process so they can see how things fit with their own level information, it is a great tool for them to be able the use it.

We don't just necessarily need to have that information submitted like we needed to in the past in order to expand the vertical network.

And that's my two cents on it.

PANEL
If I could just add one more thing just to follow up on what Juliana said though. I think that one function that Locust certainly could provide would be – if you're going to be submitting a project into the database, many of the tools and the software programs that we have available today are far superior to what we had just five years ago. I see Locust as the next step of that. So you have got your new descriptive software, you’ve got your level processing software that you can run yourself. The next logical step is to create the properly formatted files–the blue book format file for verticals–run those through Locust and that should almost get you to point where we are with blue booking today with horizontal – where if you do this, you do this, you run our adjustment software it's pretty simple. You send in the prospect with the data and project report and they publish as is because it's gone through all the checks and balances. So I see Locust as being able to be if we're going down the road of continuing to publish vertical data, I think that's one thing that Locust could provide.

PANEL
To the back!

AUDIENCE
I'm Kevin <last name> with the Corps of Engineers in Sacramento. I'm chief engineer out there. Our region is pretty big. It covers an eight-state region throughout the entire southwestern United States. And I want to agree with Jim on one thing but just to emphasize it, and I have a comment and a question as well.

Having the static points is pretty critical to a lot of what we do and my concern is based on what Dru had said was that if we don't have National Geodetic Survey maintaining some type of a

network for static points, then we will have communities developing local vertical datum, and local vertical datum will be something that we won't be able to relate to the modern system–to the National Spatial Reference System–when we try to tie in historic information that they surveyed to their local vertical datum to our project on the Federal side.

So what the Corps' doing is we work with the local communities, the State, and we try to make sure everything we do ties into NGS standards in our areas. So we're trying to bridge that gap. But local communities will do their own thing out there if there isn't something in place in their local area.

The conversions in the earlier session this morning – and I waited until the vertical session to mention this – there was some talk about just going back with original observations and re-computing solutions. Going back with original observations is going to be difficult in a lot of instances. And it's going to be expensive.

So what we would like for a conversion tool is a tool that allows us to say, here is what the value was of the three-dimensional coordinate on this date and time with whatever the spatial reference system was, and get an answer that says here is what it is today with an error associated with that answer. And the error associated with the answer from the vertical perspective and the geoid is pretty important to us. So when we go out to an area and we are occupying a location and submitting something into OPUS, and we're seeing what our answer is, or solution, and then we're seeing what someone else had, and they're significantly different from what our needs are from the surveying perspective.

Understanding what the error and the model is – is pretty important to us. Steve Gill left, he's not here this morning but the same thing applies to the CO-OP side of things on title datum, and we have talked to them about that.

The question I had is – how will a GRAV-D system affect what we're doing with dynamic heights and calculations on that? I know it's an issue with IGLD and it's also an issue with us as we're designing and constructing dams and doing analysis on those from the hydraulic perspective.

DRU
I'll begin by addressing a little bit on the transformation and the error mapping and let Dan talk a little bit about the new paradigm for computing dynamic heights out of the system.

One thing that I would like to know first of all – OPUS DB, I forgot who said it earlier – if you don't tell us what tools you need, we'll just build tools that we think you want. So if OPUS DB is not doing what you want it to do then let us know and we will put the right widgets in there.

One of the things I envision of doing in the future as we build it up is the following. I think ultimately if we're going to run a passive mark database–survey database–for the nation as we are doing now–OPUS DB style–each point ought to have at a minimum, not just the coordinate, but the coordinate; its error bars; and a velocity; and its error bars. Now just with those four things, the error bars and the velocity, let's just take the height to begin with. The error bars on the height change are not zero. There is in fact some lack of knowledge about the actual velocity itself. I might begin with a height that's good to two centimeters. But OPUS DB ought to build time growing error bars because the velocity is not known terribly well. And if somebody goes and says, "Alright, here it is." Ten years after that point was put into OPUS DB and I

pulled up the dynamically created data sheet for that point, my error bars which ten years ago was 2cm darn well better be 10cm because I don't know the subsidence of that region until somebody has checked it, at which point, the velocity will shrink again.

So that's one way that we can instill sort of the habit of saying, “Oh geez, this point has terrible errors bars” – not because somebody surveyed it poorly, but because it has been so long since somebody surveyed it and there just wasn’t enough checks.

So that's one way I hope we can get that information back to you to make sure that that model of not just velocity but lack of knowledge of the velocity is built into something so that uncertainty is built into models and tools on your end as well.

PANEL
I'll try to pick up some of the other things you were talking about.

For starters, currently the way we produce a model – the Geoid09 models; the hybrid models as we term them; basically, we're not interested in where the errors come from – we’re just basically interested in replicating the datum errors or the systematic components that are present. So any errors that might occur through subsidence or ongoing types of changes are incorporated into that model.

Now, the idea that we're looking at this with basically with GRAV-D, is basically implementing a geoid model that also have some time varying aspects. This gets kind of what you were talking about in terms of these local communities. If you describe at least not only where the datum is but how it is changing vertically, you get them to occupy it with GPS and they should something that’s more contemporaneous as far as the heights with the metrics heights that are derived at that location.

In that manner, they can stay more consistent, and still go out to that same mark if they want to. They’re bounded and determined to setup that mark in the ground – they can do so. That gives us some kind of tie back, and this gets back what Dru was saying, as long as they feed it back to us, then we have some information coming back in to us to help us try and validate that point. Nothing will take the place of going out and leveling between those points and trying to glean how much there has been of a height change. But the idea is that that gravimetric geoid is supposed to be accounting for some variation. But that accounts for the change in the datum. That does not account necessarily for the change in the surface – the height.

So you do need some other mechanism and that's where the ellip occupying it with GPS and observations determine how the surface is changing as well as the datum itself is changing commensurably. Now as to how you might relate that to dynamic heights, that’s one of the things we are looking at in terms of basically trying to understand the gravity field as accurately as possible. We’re looking at digital decency models, train models for trying to build up a model for the gravity field so we can use to describe not just the geoid height model then, but also the gravity along the plume line, if you will, so we can express the geopotential number – and then with the geopotential number, you can gain dynamic heights.

So it is to be able to describe the gravity field and the masses that are contributing to it in such a manner we can describe deflection of vertical, geopotential numbers, Orthometric heights, dynamic heights, whatever types of height systems that are going to be necessary. And then try

to validate them against various sources of data as well as doing comparisons with other regions, if you will, such as South America where they are many a similar system. So, the idea is to have some fairly comprehensive system in place but still to allow for some aspect of it so you can try and monitor what is going on locally.

PANEL
If I could add one thing on the idea of communities sort of creating their own local datums.

I agree that that very well is a possibility and very likely. But I think that Dan had a nice cartoon up there earlier today that says, ten years. That's all you got to do. Just go out, plunk down a GPS receiver and you're there. Well that's true. But when we are talking about replacing a datum, or replacing a tie to a datum, what we're talking about is also the incorporation of new procedures.

Along with this new paradigm of how we're going to do it, we also have to think about what type of procedures do we have to mandate in order to want to make sure that my datum is the same as your datum.

When I create mine and you create yours next door that we're really, truly in the same system. So in theory it's as simple as putting a GPS receiver out there and getting ellipsoid heights, track the geoid height and we're there. But I think it's from a procedural standpoint, it's something that we as users of this system - as it starts to come out - need to start to think about sooner rather than later.

When you think about the procedures, what do we have to do as users to utilize this system? What do we want to make sure – how are we going to maintain the integrity of it as we go forward? So as a State Advisor, those are some of the concerns that I have, is I need to make sure that the people who are using that system in my state have something in place well before we throw the switch to make sure that they are educated about the right way to do it; how to do it consistently; and how to do it so we don't end up with island datums.

So, that's something I'd like everybody to think about because every one of you has an agency that practices some kind of geodetic surveying is going to have to think about that in your own field procedures or contractors' procedures.

DAVE DOYLE
Dave, you had a comment?

DAVE ZILKOWSKI
I have a couple issues.

One that you mentioned – IGLD dynamic heights – it's more than just computing dynamic heights. So about what the CORPS is talking about when they talk about dynamic heights, they're talking about IGLD and there are correctors that go through. So practice has to be a part of that process. And I just want everybody to understand NGS realizes that, and that will be part of it. You have to have good dynamics heights to start with or it does not make any difference.

The issue about NAVD 88 in the long wavelength, I got real excited when I saw Dan's view graph up there. Actually I saw it earlier because it was sent to me about the long wavelength –

the difference used in Grace. And to me – and I think Dave Doyle, who just left, mentioned that the change won't be much with the vertical datum. I'm thinking that the vertical datum will have large changes also. Your relative differences will be small, but there could be large changes in the absolute height, which once again, are the tools as you saw from the diagram that we had can be made well in advance of some of these differences. So you can start looking at what will the real impact be.

When we did the 88 – unlike Canada – we had a lot more data in our database; and we had a lot of the State information; the Coast and Geodetic Survey did a lot of the leveling; so we were less dependent upon all of the States to do the local work, but we had a lot of data in our database. But there are a lot of inconsistencies in the 29, so the 88 wasn't really from a national standpoint worried about coast-to-coast.
We were worried about fixing regional differences because they were large errors between things that are 30, 40 kilometers apart. We always realized we might have some kind of systematic affect in there that we could not find. So Dan's independent look at it is something that I think is really one of the main reasons that redoing the NAVD 88 is a good idea. I can say that because I was the Project Manager. So if you're going to redo it, there's a good reason for doing that.

The last issue is Locust. The important part about Locust is if you're doing an NAVD 88 height, if you go out there and just do classical leveling and don't apply the corrections and don't use the NAVD 88 gravity value that was used in NAVD 88, you can change that but you got to do it all at once – you can't do it piece by piece. Then you're not really getting NAVD 88 height. The importance of Locus is it applies to corrections, a refraction model, the using the geopotential numbers, geopotential differences, and then computes the Orthometric height – all based in the same system. I believe that Locust will be important. Like Dan said at the end, he is trying to say consistency in being able to add to the network, and Kevin said it also. Locust will allow you to accurately add to the network.

You do have that problem that Dru mentioned. But how do you know you're starting coordinates are good? I would say if you are going to use Locust with OPUS to be able to check all these points and then you're going to know your starting stations you have – or at a certain level are going to be accurate, or you're going to use your local state system to be able to validate them very quickly and say, "yeah, these stations either moved or they didn't." Now I got new starting coordinates to a certain accuracy level but my height differences are good and that's really what most people want – is those height differences. So I think Locust is something that should be to be continually pursued, but also think about it in the new 2018 system as a tool that's critical.

AUDIENCE
Hi, I'm Paul Rooney from FEMA. Some thoughts on the vertical from that perspective:

The accuracy or inaccuracy of the flood maps – not withstanding – the real challenge from our part is measuring the elevation of other stuff. So there is hundreds of thousands of building permits, tens of thousands of applications to be exempted from flood insurance, purchase requirements, and millions of flood insurance policies all of which need a local point survey to determine the adjudication of that particular request. The buildings have to be built at a specific elevation. If people can demonstrate that their surrounding yard is higher than the flood elevations, they can be exempted from certain requirements. And all that work is done by

professional land surveyors under the licensing of their state and the national guidance provided by National Geodetic Survey.

It's one of the biggest challenges from both a quality control perspective on the program. There are hundreds of war stories – like Dru's – of completely erroneous results that we can't really police and we don't really have a good solution for improving on necessarily. But then there is also the cost issue. One of the biggest impediments of people getting any flood insurance is they have to pay $1,500 or a $1,000 to a surveyor to get that building elevation before they could even buy the insurance. For the privilege of paying $1,500 a year to the government, you can first pay the thousand dollars to get it surveyed. It does not really make people excited in our product.

So the idea that this new vertical datum can really solve those problems in a substantial way, I think is really exciting, and the technology of GPS and be able to go directly from the GPS to an Orthometric height without the connection to the local network. Such as it is, is an advance that could really make a huge difference in terms of how that stuff works.

In terms of the challenges, so there have been various references to the Province of Canada that need to adopt new laws or the fifty states. Well, there are probably at least 10,000 – potentially as many as 20,000 – communities that have written in to their local ordinances are FEMA-based flood elevations referenced either to NAVD 88 or perhaps NGVD 29 – all of which need to be updated at some point, should this change. Now first we have to update those potentially millions of published baseline elevations. And each one of those individual governments has to take a – I don't know if it is legislative, but at the local level they have to readopt that ordinance in reference to new heights.

So there is a massive management people challenge in accomplishing that. And then there is the kind of understanding challenge. One of the things we've always had with this ongoing transition from 29 to 88 is people get it wrong all the time. As much guidance as you give them, they get mixed up; they do it backwards; they forget to convert; – Whatever! And the idea that we might have two vertical datums on the same map has always been taboo because administratively it makes sense. We're only updating a small portion of this community; we'd love to put that on 88. But to then have a set of maps that a local official has to understand that in this area, it is one vertical datum and in that area, it's a different vertical datum and get it right all the time. We feel like we would be asking too much of them to administer that successfully.

But that's the same challenge that's going to come up, probably even more so when this transition. I don't have a good solution, but I think those are the kinds of things that will make this difficult to work through over the next ten years as we get ready for it.

DOYLE
We have our work cut out for us.

AUDIENCE
I'm *** I work for NGA

My question is how accurate is the new geoid going to be and how are you going to verify that accuracy?

PANEL
The aim is to have centimeter wide accuracy – at least in the coastal regions – hopefully, more in that range in the more mountainous regions. As far as validation, we are looking at a number of external data sets. Title benchmarks should be one of the things we'll be looking against in conjunction with ocean topography models. We also have offshore LIDAR profiles where we're trying to get it more the instantaneous ocean surface. We're also looking at astro-geodetic – the relative geoid heights if you will, difference between GPS surveys and leveling surveys that where obtained at the same time to avoid any problems of subsidence. But the idea is to keep them minimally constrained so as not to fit them to any NAD 83 or any NAVD88 trying to get at the ellipsoid and potential/geopotential differences series of points that are all interconnected for us to get at that relative geoid.

So we are trying to look at a number of different data sets to try to pull together in part just as a matter of validation; but too, to see if there is any potential for trying to incorporate that information in further refinement.

AUDIENCE
How can you validate the geoid to a centimeter when you cannot get the GPS vertical component to centimeter?

PANEL
We will look at your potential sources and doing the comparisons between the different potential sources at any given location using leveling and other information. Yes, what you are talking about now is separately on-the-fly taking this model and then trying to interpolate at any given location. If you have some higher degree of confidence at the center or to the centimeter level with that geoid. This is one of the questions that have been raised with regard to the GPS – are there procedures, maybe with L5, or any techniques that can be employed in the future to try and reduce the uncertainty in the GPS observation? I'm fully an advocate of that because at this point, I still have my work cut out for me to even get to the centimeter level on the geoid side. But certainly with one of the concerns that people have expressed here is, if you have uncertainty in the GPS, that's going to propagate through and it's going to create the same level or higher of uncertainty in the Orthometric height.

Still you have got to keep in mind you have consistency then from one end of the country to another when you're looking at those type of heights. We want to at least establish that as a starting point and from that local survey. This is one of the things brought up earlier. This will not take away from the benefit of a local survey. If you have a starting point and from that you propagate a survey, that local survey it is going to be consistent at whatever few centimeters level of absolute accuracy – to one say California to one conducted in Florida. And that's the intent behind this – to get consistency on the national scale.

AUDIENCE
The local survey does not really care about your geoid because the local survey you can do the leveling and enclose it and find out how to could have closed the loop. What I'm talking about is if you go at the point in Colorado, how are you going to know that your geoid is good below a centimeter in that location or in any location in the U.S.?

PANEL

I understood. Now I'll answer the first part actually because I disagree with you about the leveling surveys because they do actually extend these for several hundred kilometers at times, and that's where my concerns comes in.

You've heard it expressed here – people are more concerned on the local level, but the problem is when those local levels start to merge. We've seen this in Texas where each of the jurisdictions has its own city-wide datum. The problems start to crop up at the boundaries between those datums or they start to have flooding issues because they have not addressed the actual tie between those datums between the two different cities.

In terms of an absolute sense, it gets back to some of the data sets that we were just talking about.
The Rockies in particular in Colorado remain a problem. Some of the GPS leveling I had up there is actually some of the worst I have in the country – unfortunately for Pam, wherever she is.

We do have issues particularly with coming right out of the mountains into the plain states, and that is exactly my concern. It's the quality and gravimetric information that we have there and that's one of the reasons why we are going to be running a calibration line. We're going to be collecting astro-geodetic, GPS leveling – as I talked about for the relative geoid – as well as absolute gravity measurements along a couple of calibration lines in an attempt try to define how consistent we are with regard to the gravimetric geoid – we do to define that.

Keep in mind the idea with the airborne surveys is to try to get consistency. Internally, between the surveys, and then once we have that, to tie it in with the Grace and GOCE data. With that, then we hope to basically use then these external data sets – the surface data sets – to try to look at the quality that the models we are producing from that, and see if we can gain some sort of absolute sense of accuracy – in terms of the quality of the models. We do want to of course incorporate information of shorter wavelength and that's going to the train models, and that's going to be a lot trickier. Train in density – not to account for density variations in the column, and it's of course more problematic in the mountains and that's as you understand. So those are the parts that we are trying to fold in and as they say, we will have all these external data sets to start to calibrate it to see if we're hitting it or not. And I'm sure this is going be a process that will be refined as we go on, we may find we have need more information or we may find that we have sufficient at the level that we try to collect it at right now.

>> Question from the phone please.
CALL-IN
Yes, this is Mike Londe with the BLM (Bureau of Land Management). I have a couple of concerns.

Maybe I have misunderstood, but it sounds like you're with the shift to new datum proposal that we will be essentially abandoning the passive marks system. The issues that I would have is that we do have a large number of say boundaries that do reference elevations – wilderness areas; - I know of multiple withdrawals based on like elevations around reservoirs, dams and such. We will need – I see it as a critical need to gain some tools that we – a tool that will exist that will help us be able to move and reclaim these both legislative, your defined boundaries based on elevations. That's going to be a practical survey.

The issue of localized datums, I see as much bigger than really I think the panel can appreciate. Every surveyor wants its spike in the tree at one-hundred foot elevation. I've seen the same thing happen like in doing pollution studies – trying to put monitoring reservoir elevations on especially with things like petroleum, gas fields that might extend for tens of miles.

So it's going to be critical that as part of this process and tool development that we also begin to have the procedures in place to decide how are we going to do these types of surveys? Are we just going back to a 1-point survey and radio out? How do we combine multiple .50 aerial aspect of a future understudy that's big enough?

So these are all things that I think we need to really pay attention over the next decade and have in place when we start to move.

Thank you.

PANEL
All right, we'll try and address that to Stan Roman again.

While I may have implied that surface, rather than passive marks are going to be replaced – indeed they will be. I don't expect that will happen before I retire or probably even our new hires have retired. Quite honestly those marks are going to be there, and the EID is to continue to produce something – as I showed up there – that converts the surface to continue to provide some backward compatibility to this point.

That said – keep in mind where that particularly as you pointed out in some of these areas you experience subsidence and as such – you have to account for that. Now, what we're going to do is try to incorporate this into the model. When I talk about the time varying aspects of the geoid – that also implies there is some type of modeling going on. If you have an area where you have got groundwater, or oil, or gas for extraction out of the ground, and you're removing mass and you're changing the geoid, I need a model of that; but you are also–therefore–going to be needing to run some type of survey to try and quantify that surface change – as well as the mass change that's occurring. So that's probably going to imply that for the local modeler, whoever is going to be handling that – and it is not necessarily going to reside at the national level. This could be a local problem that will be fed up to us and incorporated into the national model – they are probably going to be running local surveys and they're going to try to repeat and detect the actual surface change say for a subsidence model; but also to help us describe the actual mass removal on the effects on the geoid. So I'll incorporate those aspects on the geoid, but you are also talking about surface height changes that also have to be incorporated in any type of elevation models.

So all tolled though, if you do have the models of those actual changes that are occurring in these systems, then that's built into the models that are going back around to the users; but that does imply that there are going to be local groups that will take an interest in trying to do this. The subsidence in southern Louisiana – we have already got a number of people that are interested in trying to model that and take care of those aspects. I will gladly incorporate those in the national model. So the idea is to try and take some of these broader range ones that we can try to monitor – coastline status adjustment either in Canada, or in southern Alaska, or southeastern Alaska. There are some smaller scale ones that we do not have the necessary resources to go out and model it, and we certainly will take input from people that can monitor

these and use those to try and tweak the national models to make sure that they reflect the local improvements.

This is akin to what we have a lot of the GPS in the Carolinas and other places where people go out and give me extra GPS and benchmarks – the hybrid model necessarily is better because I have more information. The more information that's fed to me at the national level and fed back into the national model is going to therefore benefit locally. Same thing is going to apply here with these geoid models.

The gravimetric geoid model will – in a broad sense, we're going to try to standardize it with the airborne surveys and try to clean up any of the two million surface data points that we have to make sure we have consistency; but in the end, there are going to be time varying aspects of it that are going to need to be taken care of and those are what we are looking for input from others.

If you look at the GRAV-D program as it was laid out, there is the snapshot that the airborne survey collects; there's the long term monitoring–which is essentially what we're setting up to look at some of the national scales and continental scales; there's the part that's really the unfunded mandated, if you will. Those are the local problems where people see it. They have universities that have taken an interest in it, and they are going to that feed back to us. Then maybe it's going to b a consortium of industrial groups. They are concerned about this particular oil field and monitoring of it – and I know for a fact they do that – I know almost all the oil companies monitor the ground oil extraction in that manner through gravity measurements and through actual observations of the surface changes.

So that kind of information fed back to us – maybe in a proprietary sense, or not, depending on the nature of the data – could certainly help us improve this national models that we are then producing. So I see this as a lot of information here that's going to be fed into this ultimate model we are trying to produce. And again, this gets back to kind of what Mike was asking, "How do you know you're going to have the centimeter level?" It's going to be because you are going to be taking observation levels and a lot of different scales and do comparisons to see how well the models that we produce actually fit the observations on the ground. And that will be a very complicated process, but we will be looking for input from a lot of different sources to try to help validate that.

DRU
Just in general on the opening comment Mike made on the passive mark.

We have every intention of providing transformation, but if you want an orthometric height in a new datum on a passive mark of interest to you, do not go to our database and get the 88 height – take the GPS receiver out to that point; get the ellipsoid height; get the geoid model from us. You'll have your Orthometric height done.

But don't trust it forever!

CALL-IN (Mike Londe)
At the survey level, we do have, like I said, some of these federal boundary surveys, local boundary surveys that do rely on elevations, and even without factoring substance, and we will have to look at the tools that are needed. Again, just like with horizontal be able to move – go

back and forth – because if we're taking a meter, that can make a big difference over the land that is transferred or under somebody else's jurisdiction. So these are just other practical considerations we need to keep in mind.

DOYLE
Thank you Mike! I want to get this gentleman over here first.

AUDIENCE
I'm Tim Black from Dewberry.

One of my issues is that I can't wait eight more years to get a better geoid. I'm working in Puerto Rico, which I'm gone from 2.5 meters down to about 30, 40 centimeters and I'm working in Alaska. So how is the GRAV-D going to be implemented on a program level so that it can start benefiting me now as opposed to ten years from now?

PANEL
I'll start and let these guys take it.

It is being implemented now and you probably don't know this because it crept silently in. But if you are using OPUS today, recently added to OPUS is a prototype Orthometric height – as if the new vertical datum was implemented, and it is deep in the extended output. What it takes is the existing gravimetric geoid–such as we have it, and takes an ITRF 2000 based GRS 80 ellipsoid height, takes away the best gravimetric geoid we have and gives you an orthometric height to the extended output.

You can start using that if you like. The problem is if you are working somewhere where gravimetric geoid is not terribly good, you get what you get. And so the intention is as gravity gets operational, the data will be flown; the data will come; be processed; be turned into effectively an annually updated gravimetric geoid – which is not the vertical datum yet. But every year you'll see the gravimetric geoid kicked out with the improvements where we have flown, and that will continue to be plugged into this prototype in the extended output of OPUS, and you'll start to see what the heights **STOP** out the look like when well finally flip the swatch it lets everybody here skilled screamed for it it, idea of rolling out the vertical datum piecemeal, let's do it next year, south Carolina the year after, because as soon as lie, give plea the data. No other way is that going to happen because of in CONSISTENCIES the idea is no trip the switch one. But provided to you immediately in prototype
fashion and extended output.

>> Win thing that should help you out continuing hopefully quite soon, we're waiting on release of Geoid09 waiting on the loading of the Virgin Islands leveling data that's should be soon. Once that is done, then, geoid 09 will be promulgated over to Puerto Rico.

I just finished an article that hopefully will go through peer review looking at the Puerto Rico studies just may throng the north show but gust 809 stream to PATCH Moses points. So we are very happy with those results there is and still under contract tube finish the but making significant improvements in that hear.

The virgin Highland should be pretty well taken care of. And I hope that will be within the next month or so.

>> Vicki.

>> Let three step in just a second.

Just so you know, last year one flow the airborne survey over Puerto Rico and Virgin Islands Larry and there was quite Ma lovely data set. That has been collected and we have done a fair amount of work in Alaska and probable row survey between a third of the statement, this yeah, hope the find initial it next year. So your two priorities happen to be high on the list. So I would say there is a high likelihood, you can't get some of those products in the in name future that just is that we den some of that work.

>> The OPUS is talking about right now, what you will see is 23009 which does not incorporate any of this.

Now Puerto Rico, Virgin Islands, is all by itself so that one will happen fairly easy and less painful, asal Alaska comes in place, where these surveys stop, more of that will have some controversy but at the end of that survey I will see some clear artifacts unbelievable. So that's why we are not going to go down that road yet. And in addition, we would like to do a lot of testing validation before we come to the point that says here, go ahead and use this.

Again, for you the things that benefit Puerto Rica and Alaska were the first two areas we are flying the but knowledge so kind of fight floor you but for the the rest. And the con necessary reach GNSS as we going to go through and question will have these up on the GRAV-D web page, these models that we are talking about. These as these start becoming available, we starve to help them, point more to three any irmodels. But, as this information is made available and incorporated, we will display at that point. Let me give you the downside of this. At the current funding level, 2018 is not doing to happen, the current funding levels completing the collection and the compilation of this in 2022 I believe.

So, a lot can happen but just to fully disclose where we are at right now and the plan originally statement and currently funded at to complete this project. So, sorry!

>> Lou, Juliana, you just took the thunder out of my question here. If you want better geoid, better gravity sooner, make sure the NGS budget is supported and the more resources they have, the sooner this project can be completed.

A lot of data collection, a lot of air time. It's not just people in NGS but contracting out a lot of survey work. So I hope I can do my part to help you sometime in the future but Dru, you hit the mark dead on the head. A responsible surveyor would never go to one mark, base a survey on one mark. By protection we are not allowed to do that. There is to be some sort of redundancy. So that thing in Texas never should have happened?

>> Nevertheless, if you've gone to five, ten, or other marks in that same subsiding region, I have a feeling the entire region would have gone down.

>> No, this guy is in trouble. And so, that -- I do have a favor I have to ask of NGS, if you look at all the CORS data and is long term ten, you can get right off the same web site as the CORS page, you will see that many of the CORS stations have long term 3, 5, centimeter differences.

Why can't he look at that database, take the long term, trend out at least now, the near future so that again, the surveyor there starts getting a better feel for what this new data has to offer.

I'm very concerned that surveyors using OPUS get a very good solution based on coordinates long term trend and accuracy.

>> I'm tempted to point over your head and agree with von tee and say why don't he answer this question.

I will begin White apply Crockett weapon phone gets to them by mentioning that we begin the process and nearly completing a multi-year course reprocessing and in which coordinates and velocity will be improved. I would ask were to.

>> We have been working for the last-- I'm used to having it too close because I already speak loudly. We've working for the last four years in overhauling the whole mechanism we use to compute CORS coordinates. The reprocessing is part of this GIS that was alluded to earlier as well as all the reference and there is a whole series of changes have gone into this. We have completed all the processing part band now, we're getting into this nitty-gritty of how we are going to define the next version of our frame which we anticipate to come out in the fall, so the frame tag is what will change.

So we will be switching to no longer ITRF 200 but 2008 and NAD 88, probably, a tag there by COLS 08, I don't know what the CORS will be, we've not decided that, although there is still ample discussion and o open meetings on this topic which a number of people here have already participated on, is to move away from this link of 983 CORS and so go through full transformations to get to the current ordinance. And so the issues that you are concerned with Lou, we are well aware of and hope by September to hear from the new version that comes out.

One of the problems that we have with CORS, whenever we talk about transformation is that a number of CORS do not behave in a linear fashion. They behave nonlinear. So transformations actually trick you into thinking that you have charged everything to a new datum but it may be hopefully. And that is a big struggle we have within the CORS group. Do we just pick a sub-site of and say these are really robust which is what the ITRF says with no offsets. These are challenging issues. People don't want accordance to change, but they want all the data points to be in the same frame. It is hard to do particularly with new COR stations that we don't know how they behave, make you go invest your $30,000 but you got to realize your location is soaking through the ground rapidly so we are very close.

In terms of the geometric datum that's going to replace 83. Whatever the tag might be, we can use that very quickly if the new 93 will be a geometric one. As soon as we come out with our version in September, we can simultaneously come out with a version that is different and don't face the same issues that the group was having to conflict data. We all right put in all that invest. And we can make that available to everybody to start using on a trial basis.

So that's ready well before 8 years from now when one chooses to implement that is an agency decision to be made.

Thank you.

DAVE DOYLE
Any closing remarks from the panel before we close this out?

DRU
I want to mention one thing.

To expound on what Dan said and that is on valuation, one of the things that I hope we can accomplish is not just accuracy of the geoid height but certainly on the slope which is I think is an easier problem to solve. There is a variety of ways to do it; but co-locating mentally constrained GPS with the best deletion of vertical that you can get, in those ways we can check if we take a significantly long line and see something long enough, that we are beyond the frequency, 2000 kilometer line, something significant of that level, call that a will geoid slope elevation line, hoping we can put together something like that as a study beginning in a coastal region and moving to progressively more difficult parts to test the actual veracity of the guide model.

That probably will begin sometime next year if we can make that happen, continue on through the next couple of years the data was made available so other geoid models and other groups studying gravity could use all that data.

DAVE DOYLE
Thank you Dru!

That concludes our session for today. I would like to take this opportunity to thank everyone for attending, spending some time with us, going over some of these difficult issues that we have to address. Your input has been terrific. I certainly hope that everybody is going to join us again tomorrow morning to start with the minute session so we get some real feedback now that you have had time to consume this information and give it some thought tonight. Come talk and give us your impressions together so we can move this to a slightly higher level of discussion, if you will.

So with that, I will close the session for this afternoon and we will see you in the morning. Thank you very much!

(Whereupon the Summit was adjourned for the day)