U.S. DEPARTMENT OF COMMERCE
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NATIONAL OCEANIC AND ATMOSPHERIC

ADMINISTRATION (NOAA)

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HYDROGRAPHIC SERVICES REVIEW PANEL (HSRP)

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MEETING
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THURSDAY
MAY 5, 2011
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The Hydrographic Services Review Panel met in the Kona Moku Ballroom at the Waikiki Beach Marriott Resort and Spa, 2552 Kalakaua Avenue, Honolulu, Hawaii, at 8:30

a.m., Edmund Welch, Chair, presiding.

HSRP MEMBERS PRESENT:

EDMUND B. WELCH, Chair
MATTHEW WELLSLAGER, Vice Chair
LAWSON W. BRIGHAM, Ph.D.

JEFFERY J. CAROTHERS
MICHELE DIONNE, Ph.D.
CAPT. SHERRI HICKMAN
CAPT. THOMAS A. JACOBSEN
DAVID A. JAY, Ph.D.
GARY JEFFRESS, Ph.D.
JOYCE E. MILLER

SCOTT R. PERKINS
SUSAN SHINGLEDECKER

VERTICAL AND HORIZONTAL DATUMS STAKEHOLDER PANEL:

STEPHEN S. ANTHONY, Director, USGS Pacific Island Water Science Center
CRAIG CLOUET, Solutions Engineer, ESRI
CHRIS GUERIN, Hawaii Department of Transportation, Highways Division, Design Branch, Cadastral Engineering Section
JOHN MARRA, Ph.D., NOAA National Climatic Data Center, Regional Climate Services Director, Pacific Region
BILL WARD, NOAA/NWS, Chief, Pacific Region Headquarters, Environmental Scientific Services Division

ALSO PRESENT:

MATTHEW BARBEE, UHSOEST
JULIANA BLACKWELL, NOAA/National Geodetic Survey Director
PAUL BRADLEY, NOAA/NOS
ARTHUR BUTO, DLNR
EDWARD CARLSON, NOAA/NGS
VIRGINIA DENTLER, NOAA/HSRP Staff
RICHARD EDWING, NOAA/CO-OPS Director

MARC ERICKSEN, Sea Engineering
CAPT. GERD GLANG, NOAA/NOS
LCDR MARCELLA GRANQUIST, Waterways Management Division, Sector Honolulu, U.S. Coast Guard
LAURA HAMILTON, NOAA
TIFFANY HOUSE, NOAA/HSRP Staff

DAVID M. KENNEDY, Asst. Administrator, NOS
JEFF LaDOUCE, NOAA/NWS, Director, Pacific Region
CAPT. JOHN E. LOWELL, JR., NOAA/OCS Director
RAY MORGAN, Critigen
DANIEL G. MORRIS, U.S. Navy COMPACFLT
KAREN MUNROE, Critigen

JESSICA PODOSKI, U.S. Army Corps of Engineers
DAN POLHEMUS, U.S. Fish and Wildlife Service
LT. KYLE RYAN, NOAA/OCS

ALSO PRESENT (Cont'd):

RONNIE TORRES, HI-ARNG

NANCY WALLACE, NOAA/NOS

KATHY WATSON, NOAA/HSRP Staff

HENRY WOLTER, USGS

C-O-N-T-E-N-T-S

P-R-O-C-E-E-D-I-N-G-S

1:04 p.m.

CHAIR WELCH: Good afternoon, let's resume our meeting on the second day of the Hydrographic Services Review Panel. I want to thank Matson Navigation and all the various folks that worked on our outing this morning over to the Matson container port and container vessel. I think we got an instructive several hours over there.

And so we will get back to our regular agenda. Captain Lowell, have you got anything you want to say as we begin our official day two?

Okay, we would encourage all of our guests who are here today for the first day to sign in on our sign-in sheet behind us on the table. If you signed in yesterday you don't need to sign in again, right?

No, if you signed in yesterday you have to sign in again today, according to Kathy. So if you would, if you'd be good

enough to take a moment or two at some point in the afternoon and sign in we would appreciate it.

We are going to start with our second stakeholder panel, talking about vertical and horizontal datums. Do you think John Grisham could work that into a novel?

And so we have got a good representation and what we will do gentlemen is we will recognize each of you in turn, have you make your presentations and the panel will hold any kind of comments or questions until you all finish, unless something is really a burning question in which case we might make an exception.

So I guess we'll just start, John Marra, with you, and have you talk about accurate elevations in the Pacific Islands. So welcome. Go ahead John.

DR. MARRA: Great, thank you. Aloha, and on behalf of the other islands in the Pacific, talofa and hafa adai. Thank you

very much for the invite. I really appreciate the opportunity to speak with you.

I am the regional climate services director for the Pacific region. I work under the National Climatic Data Center out of NESDIS, one of the other NOAA line offices.

If there are any problems at all with this panel, it's Ed Carlson's fault. So what I am going to talk a little bit about are climate services and then the hydrographic services' role in that context, and then I'll focus on one particular area within the -- sub-area within the climate services.

There is a definition, again, I won't read that for you, but really what we are talking about is in the end there ultimately is actionable information that can be used to support decision making.

I think the Weather Service provides a very good analogy in that folks, without really thinking about it, depend on

the information, the products and services they provide, on a day-to-day basis to make decisions, and I would like to think that maybe 10, 20 years down the line, that climate services will serve that same role in people's mind when they begin to make decisions, you know if they are planning things for the season or even longer-term projections for buildings and things like that, is they will begin to think of climate services in that way.

So that's really what we are talking about. In the Pacific, PaCIS, the Pacific Climate Information System, is really the umbrella under which climate services are being developed.

It's a program integration and planning framework if you like. It's focused on the U.S. flag and affiliated islands but not limited to them. It really includes the agencies, institution, organizations across the Pacific.

So we have participants like the Australian Bureau of Meteorology, the New Zealand Met Service, in addition to folks in Guam and Marianas Islands and Samoa, so it's really region-wide.

So PaCIS itself evolved from a lot of the work that folks like Eileen Shea and Jim Weyman and others did related to the Pacific ENSO applications climate which is known as the Pacific ENSO applications climate center where folks across the region began to coordinate around ENSO events, and that has actually developed this mechanism through which we have these partnerships towards kind of combined products and services today.

So I just want to emphasize this partnership, particularly in the context of climate services, is a real, very important part of the whole process.

So this is kind of the conceptual framework I guess is what you might call it

for how we are pulling together climate services.

Much like Rich's comment yesterday, we have identified several focus areas, but the idea is that the products and services are user demand-driven.

So these three priority areas were identified through a series of meetings and workshops: it's freshwater resources and drought; community resilience to sea level rise which is one I am going to focus on a little bit more in the next coming few slides; and then marine and terrestrial ecosystems.

And of course there's sub-sectoral applications like transportation and tourism, creation, that even -- that kind of cut across and through those.

The idea is then that in addition to the focus areas, there is a set of core capabilities that essentially any one of those focus areas that you draw upon to

deliver the products and services within each of those areas.

And among those are, and it's anywhere from education, outreach, observational products, research and development; together this kind of defines the end-to-end climate services system.

And I think there's a couple of pieces in here key that you guys can pick up on. One of those is the observing systems section, and that's clearly where a lot of the stuff we have talked about to date in the context of hydrologic services fall.

It's the framework data, it's the datums, it's also some of the sea level station information, that's a key piece of that, so it's a major part of the puzzle.

And then there's also some of the specific derived products, some of the things like the CO-OPS sea level trends that are also relevant in the context of the piece that's -- so there's climate variability and

change but kind of the full term for that is understanding and predicting climate variability and change.

So there are several pieces within the context of these core capabilities that this group supports.

So using that same -- the focus area is kind of the organizing framework, I have just highlighted a couple of different specific sorts of applications where the hydrographic services would be relevant.

I think there's a number of other speakers on the panel that are going to begin to address these specifically, so I am not going to touch too much on the individual areas other than like I said, the sea level rise piece.

But what we are talking about really are geodetic and tidal datums, topographic and bathymetric data that you have got to have to run models and things like that, the data itself, the data

services, which is very important, the actual provision and access to the information, and then again some of these derived products.

And so as I segue into the sea level stuff, the way we begin to do this is what we are calling focus area coordination teams.

So we have actually brought together -- in this instance it's around 20 or 30 people that are all doing work related to sea level rise, inundation, extreme weather, sort of the -- not necessarily the program manager, but really at project level, and begin to talk a little bit about who is doing what and begin to kind of align each other's interests and activities.

And that's -- again it's this idea of the partnerships is very important to how we are trying to kind of leverage resources and move, act a little a bit more efficiently and effectively.

So I am going to go ahead and move

into some of the sea level stuff, which I think is an area that we are actually probably pushing forward further than maybe the other two areas, or at least earlier and we will probably learn form some of that as we move into some of the other focus areas.

My main point here that I am really trying to emphasize is when we start talking about sea level, or I am going to call it coastal -- or sea level rise -- I am going to call it coastal inundation because it is really broader than simply sea level rise.

And so we are not just talking about tides, and we are not just talking about the sort of long-term, the steric if you like, the fact that it gets warm and expands and ice melts and there's more water.

We are not just talking about that when we are looking at these sea level station records.

There's really a range, a variance

and a range of different frequencies all being forced by different parameters that are all, each changing with the changing climate.

So this is kind of on the -- the pictures just represent some of the pieces of that puzzle that are within what is known as essentially the non-tidal residual component, if you like, of the sea level record.

The one on the -- oops sorry about that, I'm looking for the pointer. This is just a map of the waves indicating one component is storm surge. I think folks are very familiar with that.

In the Pacific there's the ENSO signal, which is very important. We are looking at variations on the order of a foot or two every six or seven years, so that places like -- Hawaii isn't necessarily so bad but the south -- excuse me, western Pacific experiences these sorts of sea level variations. When your tide range is only a foot or two those sorts of things can be a

big deal.

On the Oregon coast, where it is about 10 feet, it's not such a big deal. Oregon Coast gets that foot or you could even say they get 20 or 30 years of sea level rise every five or six years.

So there's some -- you know you have to kind of keep in mind these -- how these are expressed vary from location to location.

The bottom here, what I'm just showing with this blob of water is basically a sea surface height anomaly. They are known as mesoscale or anticyclonic eddies. These features that are about 300 kilometers wide and about 10 to 20 centimeters high and they basically move across the Pacific to the east about every one or two years.

So again, when you have got the tide ranges we have here, you combine that with a high tide, when one of these come in it can actually be pretty severe in terms of

elevated water levels.

And then finally, just the sea level piece itself. We often see the idea, oh it's three millimeters a year, on average, and it's important to point out that that really is a global average, and that you know, it actually varies considerably across the Pacific.

And this isn't just the ENSO signal where you know, the normal signal is everything is piled up against the west, and the ENSO signal, during La Ninas, that gets even worse, but there's actually even some suggestion of some longer-term increase in that. So the idea is again these different locations feel these differently.

So Mark Merrifield, I was going to mention, has done a lot of the work in this area and I am going to talk about some of his stuff in a minute or two.

So this is just another way of describing what I was just talking to you

about. The idea, then, is so each location has its own unique signature if you like, within which these different variance components are expressed.

So this is what it might look like, something might look like for over the South Shore here in front of us. Yes, they are pretty good-sized waves, but when it actually ended up as run-up, it's not -- the run-up component is pretty small.

There's the tidal component. For the most part storm surge is really not a big deal because the waves buffer most of it, it's a different bathymetric configuration, so it's actually a relatively small component. There's a little bit of a seasonal cycle.

These anticyclonic eddies that I mentioned, in a relative sense are actually a pretty large component of the signal, as is the ENSO piece.

And there may be some larger-scale

variations that even at further out time periods, and of course the sea level rise component itself.

And so we can begin to sort of combine those if you like, to look at what are the extremes, how do those all combine in any given situation to look at sort of the idea of return intervals.

I guess that was left over from before. There's this other thing called a tsunami that actually does affect water levels in Hawaii on occasion.

So that's kind of the complete, the signature if you like. And so what we are able to do, as we begin to pull that information together, this is an example of exceedance probabilities, generalized extreme value analysis, it's a return interval, that's another way to think about it, I guess.

So this is the water level above mean sea level and over time, and you are

seeing, in this instance what is kind of unique about this plot, is it's actually non-stationary, in other words we have actually got the sea level trend incorporated into the extreme value analysis, and then there's the five largest for any given year.

In the context of our conversation, notice that it's relative to mean sea level, so everything has to hang on something, on water level stuff.

If we didn't have datums, it's useless, it's just floating in space, so I'll just bring that up.

Here's another diagram that's -- that really isn't the -- so if those were the sort of longer-term trend that we would use for projections if you like to support things like, oh, Army Corps of Engineers, or DoD needs to build some facilities in Guam for example, they want to know what the water levels are going to be like 30 or 40 years from now.

This is another piece of it. There really isn't a trend, it's the patterns. And so instead of looking over the duration of the record, we are really looking at, how does the water behave on any -- over any given year how does it behave.

And so we are looking at three different locations here: the Guam; Pago Pago and American Samoa; and Honolulu. And again you have got kind of a height here, it's above -- it's relative to me, high high water, and you are looking at -- so for any given day over that record it's basically what has the water level been on average.

And so at the bottom is the mean water level. The short-term is essentially the storm surge, the short-term component. The blue is the tide. And then that black is the total water level.

And what you are seeing here is very weak tidal signal in Guam. There's nothing strong. All these events, in other

words everything that generates high water levels, those are all typhoons, hurricanes, cyclones, whatever you want to call them.

So that signal is dominated by -- they are dominated by the storm signal. So typhoon season, if I am an emergency manager in Guam, that is when I want to be worried.

Pago Pago, on the other hand, is almost completely dominated by tides. It's the solstitial and the winter/summer solstice essentially, that is controlling when those high water levels are.

And you can see that reflected in the total water level and that is when the bulk of the top events are. So again, if I -- I want to be keeping an eye out -- this time of year, if I am somebody like an emergency manager or even FEMA for example, thinking about when I might need to worry about flooding events.

Hawaii is kind of interesting in that it has clearly a strong seasonal signal,

but there is this one outlier here. Does anybody in the audience know what that one is? September. If I look at it, it was right around 1992.

It was the Iniki. And so what you are seeing here is the fact that in Hawaii you have actually got a mixed signal. So you get these extreme events or a combination of you know, everybody knows that it floods on the North Shore during the winter, during those high tides, just around, what, December, January?

But you can also get similar sorts of high water level events if you get a hurricane going through. And again, this is all, you know, you really have to have these datums to be able to hang this information on or it's irrelevant.

Okay. So this is just another example of some of the sorts of products we can develop through the analysis of these sea level station records.

This one is going to look familiar to Rich because that is the -- that's right off-of the CO-OPS website. This is actually an experimental product. I don't know if they have got it out, but the service did, it's real nice from a user standpoint, you know it lists return intervals and then it plots them relative to tidal datums and the geodetic datum, so it's kind a useful kind of a stick.

I am not going to dwell on any of the others right now. It's just kind of summarize some of the key points then.

So clearly we need to do -- we need these geodetic and tidal datums. Right now the -- this is -- Ed is helping me out on some of this, so if I don't get it quite right, Ed, feel free to jump in.

You know, the Federated States of Micronesia and the Republic of the Marshall Islands, these are U.S. affiliates and so we do have obligations to support their needs as well.

And so Ed has started to do some of this work and he has done a lot in Guam and Samoa and I guess the idea is that we need to really repeat that process through Pohnpei Chuuk, Kosrae, Yap and Majuro.

And then within the northwestern Hawaiian islands, I think Joyce had pointed out that there aren't a lot of tide stations out there and that also means there aren't a lot of local tidal datums.

So we need to begin to tackle that problem. And then within the, I guess I think I have merged this one here that was actually supposed to be the bottom one, excuse me, this is within the main aid itself and the idea is here we do need to reference our local. We have local tidal datums for each of the Hawaiian islands if we need to reference that to a common datum, and just the idea of -- in an ideal world we would have these all tied to the, you know, the CORS and tide stations are seamless.

The sea level stations themselves, yes we need more stations. But probably even more important than that, we need to make absolutely sure we maintain the existing stations and that we also maintain these records, the data stewardship component.

In some instances that may involve data recovery, so those are critical considerations. It's not very sexy stuff, but it's very important. I'll come back to one last example as I close.

And then finally, the same thing with respect to data services. We need to ensure that we are providing this information to all the users.

And the interoperability piece is very relevant here. There's a lot of challenges here in the Pacific between -- in some of these places where you get information from Australia or us and we use different datums and let alone the challenges between University of Hawaii sea level center

and the GLOSS, which are the Global Sea Level Observing stations and the NOAA stations. So this interoperability issue is key.

I'll just -- I think a real good sum-up is I was in the Solomon Islands a couple of weeks ago and they spent about a week brainstorming climate -- needs related to climate change and variability, and sea level rise came up.

And after a couple of days, their conclusion was, well, we need LIDAR, we need all this really good LIDAR data and we need all these detailed hydrodynamic models.

And so I said -- I raised a question and said, how is your geodetic control? And they said what do you mean? I said well do you have benchmarks, do you have vertical and horizontal datums?

And they said oh, no we don't. I said well, then maybe that isn't what you need to be doing. Maybe you would be better

off, you know, going out and measuring it by hand or something, but it just shows that this stuff is not -- maybe it's not publicized, but it's absolutely critical to the generation of all these products that folks need. And that's it. Thank you.

CHAIR WELCH: Okay. Thanks John. Next, representing the Hawaii Department of Transportation, Chris Guerin, and his topic is Hawaii Leveling and RTN, which is Real Time Network, if you don't know, which I didn't know until Juliana told me.

Chris, welcome.

MR. GUERIN: Thank you. This picture is actually taken from Diamond Head so most of you guys who have never been up there, at least you get to see it now instead of having to walk up there with all this equipment.

The purpose of the height modernization that we started here in Hawaii is a lot of that was due to a lot of our

control network or benchmarks have been damaged, destroyed, due to highway widening, subdivisions coming in, just about anything, even vandalism, we have noticed in Hawaii that people are stealing the benchmarks just for their brass or copper.

So when we looked at this height modernization, we looked at when was the last time any leveling has been done and with the help of DBEDT we actually had to go back looking through all the records and it has been since the 1970s since either the DOT or any state agency or even NGS has done any type of leveling through any of the islands.

After looking at that component, we decided to look at it horizontally also. We are still back on NED 29 so we are really behind the U.S.

After looking at the horizontal component, and we decided to take things one step further in Hawaii. We actually looked at creating a new GOI model for Hawaii. We are,

I guess, we don't have enough data for NGS to make a really good GOI model.

So we were looking at what else steps that we can do to help out NGS in the long run.

The plans for the DOT height modernization, we actually broke it up into six phases. The first phase that we are going to do is actually the digital leveling for each of the islands.

We are looking to do on a first order, class 2, following all NGS guidelines, so the data that will be given to the DOT will be actually seamlessly going to NGS's database.

Everything will be tied to all the NOAA tide gauges so we will be starting at the benchmarks at the tide gauge and then running outwards and doing loops as we can.

Everything will be done by digital leveling with invar rods, thermisters and all the specifications will be followed through

the NGS guidelines

The DOT actually took a step and actually went out and actually looked for the benchmarks in -- on Oahu only.

We also had the military surveyors help us out on the military bases where there may be some issues with taking photos, so they went out and actually had photos taken of certain benchmarks and had it submitted to I guess clean up a little bit.

Of the benchmarks we searched for, we only found 197, so when we talk about how much things have been damaged or destroyed, now you -- at least this is only for Oahu. I cannot speak for the outer islands yet. We are still you know, in the process of doing those.

Currently the DOT does not have the time or the money to go to the outer islands to actually look for the benchmarks. So we are actually relying actually on the community to go through the NGS, their data

recovery program.

So we rely on the other engineering, surveying, and also the GIS community to help NGS fill out the sheets when they find a benchmark.

So it will save time when we put out contracts to the consultants to do work, they will you know, they are not spending time searching for benchmarks that no longer exist.

This picture is of all the benchmarks that were existing on Oahu. Most of it has gone through most of the populated areas, so --

This is what we are actually proposing so we are actually looking to run through a lot of the existing, but also increasing the amount of data points that's going to be out there.

The area that is in blue, the Kahe site, we are currently not going to be doing because the road hasn't -- I guess they

collapsed the road so they don't want people really out there, so we are going to leave it at that for now. Maybe in the future, we may run it.

This is on Maui so you can see there's not you know, there's only a few areas that they ran it and then going to -- this is what we are proposing. So you can see we are really going to be adding a lot more data to the benchmarks this year.

On Kauai you can see a very little bit. And then the proposed -- Big Island, what it is is actually just going up to the observatory, that's just about only ones that you have.

This one is the one that is going to be the most time-consuming, but the most beneficial to the people on the Big Island.

As you know, on Lanai and Molokai, there is actually no leveling that we could find, so we will be adding some data for them also, and Molokai was pretty much the whole

island.

On Oahu, we are estimating about 211 miles, Maui 251 miles, 120 on Kauai and 410 miles. All these are just estimated, that we just took off our state plans and did the best estimation that we could.

A lot of the actual numbers will be adjusted once the consultants have run through all the actual miles.

All this data will be given to the DOT and then submitted to NGS to include into their spatial reference system.

The second part that DOT is planning to do is the CORS and VRS system. As you can see we are looking to cover the whole state of Hawaii.

The one red one in Molokai is actually one that we are trying to see if we can do because there is not much Internet connectivity out there.

We are looking to use the current GPS systems, GNSS and the equipment all will

have server backup, batteries and everything else.

The construction, mainly we want to stay in any state, federal or county property just so that there's no issues about access. If we have property owners then we sometimes might not be able to get access to the stations for a couple of days to maintain or repair if it goes down.

The other thing we are looking at is having a server on each county, so that would be one in Kauai county, one in Maui, one on Oahu, and one on the Big Island, plus a central server on Oahu.

So if one goes down there's additional server backups all located throughout the state.

So this is just a review of where they are located so you can get a better idea of where they are going to be at. We are actually going to be -- I didn't plot the existing CORS stations on here but most of

you guys will know where they are at.

So this is the Maui county ones. We are not going to put anything on Kaho'olawe at the moment. That's the bottom picture, the bottom item.

And this is Kauai and Maui -- Big Island. So on Oahu we are proposing seven stations, Maui eight, with a possible ninth and then Kauai six and the Big Island, nine.

We will level, digitally level to each of the CORS sites, so they will be tied from the tide gauges to the CORS sites.

I guess we are asking NOAA, and not only that, NGS, we would like 20 percent of our stations to go into the national area.

The main reason we looked at this VRS system is a money saver. Some of you look at it now, when you see people doing GPS on the side of the road, you will se a babysitter with some of the equipment, and that's just time and money wasted for somebody to sit there and watch it.

This VRS system will allow any user to complete projects in a big area in a shorter time.

The DOT has done a couple of hiring HARN projects. First project that we did was back in 2004. That covered all the way from Kahe power station all the way out to Kaimuki, and it was an interesting project because the DOT has never done anything like that. With the help of Ed, we actually got it done and the data looked very good and it was published into the NGS database.

In 2006, we actually went back out and actually started identifying the two main areas -- Ewa Beach and Waipahu -- with a lot of stations.

And then 2008, we actually added a lot more stations going from downtown to Diamond Head. So that picture of Diamond Head actually came from -- the first slide came from a 2008 picture.

So this is the area that we

covered with the HARN projects. A lot of this is through the DOT corridor that, you know, a lot of it, the rail has gone through.

So the rapid transit can use a lot of the NGS controls that the DOT used and helped put into the database.

In the future, what we are looking to do in phase 3, 4 and 5 is actually doing LIDAR with airborne gravity, and then research and development you know, for new GOI model for the state of Hawaii, and then also the reference center where all this data will be residing at.

The other thing -- well, we looked at also who is going to benefit the most: the private sector, and then you have your engineers, the surveyors, the planners, contractors, construction contractors; the government, well, federal, state, county, the military, even the GIS community; but the big important guys who benefit is the actual taxpayers at the end, with a reduced cost in

their, you know, for projects.

This is just my contact information. Thank you very much.

CHAIR WELCH: Okay. Thank you Chris. We will come back to that at question time. So next Bill Ward will be making a presentation on Pacific GPS Met Program. Bill?

MR. WARD: Okay. Hi, I'm Bill Ward. I work for the Pacific Region Headquarters for the National Weather Service and I am going to be discussing a lot of kind of first of all, what we do and what we are up here and then get into the GPS units themselves and how much it's really helping us and what we have to look forward to as we move forward with the things.

I'll start out with our area of responsibility in this kind of work through what we do up here and then as I mentioned, get into our GPS systems.

Our area of responsibility and

what we do out here is we have two WFOs, several WSOs, our Hurricane Center, we got a tsunami center, an International Tsunami Information Center and then we do aviation stuff throughout the whole Pacific, as we do climate and marine, and then we even have our own ITs, well mainly ETs, that take care of a lot of stuff that is way out in the distance and I will get into that a little bit more as we move through.

This is our area of responsibility. It's roughly four times the size of the CONUS so we have a lot to take care of out here.

Our PR observing program, we have a lot of things that we try to do with very little land and very little resources, but we certainly do surface network errors, observation satellite, we have our own ground satellite stations, just recently GPS sensors have really started getting a foot in throughout the Pacific.

We are trying to get more in the way of buoys. We use what we can with what ships are out here and planes that fly through the area.

And all of this data is very invaluable support for our Watch, Warning and Advisory Programs. It's providing forensic verification for what we do out here and even if something big happens, to where we can do -- use it for assessments and every bit of this of course is used in all of our forecasts, watch, warnings and advisories as I mentioned.

The challenges? Boy, do we have a lot of them. Comms throughout Micronesia and all that can be very troublesome, I mean there's times where some of the folks out in Micronesia is only running at maybe 4,000 bytes per second and it's really hard to get systems operating out there when you have data breaks that horribly low.

Trying to get airlines out to some

of our far, remote islands outside of the main ones such as Majuro right there at the main site, you know, we have got stuff that's in like Ailinglaplap and other places, and things like that, and even as we go across to FSM there's still locations out there that we have tried to do our best in getting automated sites out there but just trying to get ships and airlines just to get us out there is really hard.

And then resources for operations and maintenance for each of these programs can be kind of costly and rough for us to operate.

And then of course since a lot of these islands, especially out in Micronesia, are no more than eight feet above sea level, you get an awful lot of corrosive salt invasion into the equipment and stuff, so if it's not visited quite often, it falls apart quite quickly.

I mean I used to live out in the

Marshall Islands at the DoD missile range out there. A bike would just about fall apart on you in less than a year if you didn't take care of it.

So, and then in addition to that it's high cost for equipment, contracts and travel and shipping for everything that we do out here in the Pacific region, for the National Weather Service.

Now getting into the GPS itself, I found out about a lot of this oh, I'm going to say roughly about three years ago with a trip up to Boulder talking to Sandy McDonald, and then eventually Marty Ralph, Allen White and Seth Gutman and Kirk Holub.

I don't know if any of you folks realize or know who all of these folks are but when I found out what we could do with these and what value they added to our upper air program, our satellite that we are already using up here, I was just like wow, sign me up, how do I get this moving and what

can I do to get these things out in here.

And luckily through the coastal storms program, I managed to get some monies and we started moving forward on that.

But I probably don't need to go into a whole lot of what all this does, other than mentioning that you know, we have certainly used a lot of satellite stuff through CIRA and through calibrations and validations we have been able to show that these things are very accurate with the total integrated precipitable water that we can get because that is the one thing that is kind of bad with a GPS, it's one signal that hurts it is moisture, and for us that's a huge benefit, so I was really happy to see that and to be able to use that and then to find that the systems -- I think when I first started looking into that, these systems were running roughly around $11,000 each. We now found a couple of companies out there that are doing this for around $4,900 each so I

couldn't be happier that the price has come down, it's just I wish the airlines and other ways of getting out to some of these islands would come down too.

Right now, these are the ones on the left-hand side that I certainly have already worked with our ET folks and everybody else and the folks up in Boulder and Giovanni and the CORS sites in Boulder as well to ensure that we get these all in place and online.

And right now everything on the left-hand side is taken care of. On the right-hand side, Kwajalein, that one should be hopefully done by the end of the summer.

We have got a data collection office in Lihue, I hope to get that one completed this summer. There are some in some of these locations on the right-hand side, but we are having a little bit of trouble with getting continuous data or they are not into the CORS site itself, so I want to make

sure that we do what we can to get those in there.

I believe Ed Carlson is working with one to get into Midway. I would like to see what we can do about getting one into Rose Atoll and even Wake Island down the road.

Right now, again, this kind of goes back to the big overall picture I showed earlier of our area of responsibility, but yet, you look at what is in the CONUS versus what we have out here in the Pacific, and it's pretty data-sparse.

So if you guys could do me one real big favor, if you could help me find some land, it would be really helpful to get some more sites out here.

But we are going to do everything we can with what available land we have and some of the monuments, and like I mentioned, Wake Island, Johnston Island and some of these other locations, if we can find ways to

get them into there, that would be valuable.

I show one of the things that we did out here, as I mentioned earlier, talking through Ed Carlson, Giovanni, the CORS sites and even the folks up in Boulder, I show this antenna that we mounted here because I want to make sure that people realize that we are doing absolutely everything we can to make sure that these are, even in the most remote locations, we are doing everything we can to fasten them so that everything is great in the x, y and z, so that they don't move whatsoever.

What's going to happen in a typhoon or something, I don't know, we will see. But I think the way they are mounted right now, it should be pretty good.

The programmatic areas that we kind of take care of, and how these even help us in them, for local forecast and warnings, this does indeed support model validation for the moisture in the column.

Tropical cyclone forecasting or tropical forecasting in general, I think these systems itself, with time, with being able to see the changes in moisture increasing, decreasing, may actually be able to help us understand that sudden increase or decrease in a tropical cyclone or what have you.

The atmospheric rivers, I can pretty much say that we know these are coming out of the Pacific but it's kind of the chicken or the egg, you know exactly what starts these and how do they get moving, because it may even be something that is triggered from the mid latitude, but the moisture has to be coming from the deep tropics.

Tsunami information, I just recently discovered you know, because of the fact that we are doing these things roughly, I believe it's every five seconds they are transmitting, ground displacement is

something that can be greatly valuable for the seismic folks in being able to tell how strong an earthquake was and the possibility of a tsunami.

So there is some possible tsunami warning center support for both the Pacific Tsunami Warning Center and the Alaskan Tsunami Warning Center in Anchorage.

Elevation datum, that's critical to a lot of the things that we do out here with our data and observing systems, and the climate information.

The thing that we have got to make sure is that if we don't have tide stations in some locations, we have got to see what we can do about getting them in some areas so that we can get a little bit of ground proof and understand exactly how the ocean is rising or lowering or whether it's actually the items themselves that are decreasing in height.

This is a little bit of some of

the things that I have already mentioned, the cal-val, radiosonde and aviation, and one of the things I guess I should mention here too, since I was mentioning how this can help with intensity on tropical cyclones or deintensifying, our radiosondes are launched twice a day every 12 hours, but these systems, these GPS-Met systems gives us data on a continuous basis.

So using the radiosonde data that we have every 12 hours, we can certainly see where the moisture levels are, and if this is something that is very relative to some type of system that is out here in our forecasting responsibility, we can get a -- we should be able to get a clue as to what is happening in that column as to -- when we see decreasing -- or decreasing moisture or increasing moisture.

Numerical weather prediction. This is probably going to be one of the first times we are going to be able to see this

getting assimilated into our atmospheric models, and I am hoping to certainly see some value in that.

Climate reference. We are -- Geographical Reference Upper-Air Network, I apologize for a lot of the acronyms. If you have questions on any of that, please speak up, but I think we are going to be able to see a lot more time, or a lot more information with that.

Let's see. I think that I pretty much mentioned all of the other ones here and then the other areas. Oh yes, the laboratories and universities are also very jumping into this and wanting to help out with some research and be able to get things back into our operations with all of these systems that we are getting out here.

Oh, yes. I mentioned earlier the new sites that we have just now gotten into, the deep tropics largely across Micronesia, and so I am really pleased about that so I am

hoping that maybe in another year or so, as we have gotten a lot more data and can start compiling things over the full spectrum of our -- what we like to call our two seasons, our dry season and our wet season out there.

I have listed a couple of sites that we use. Folks up in Boulder have created a GPS-Met site so that you can actually see what is being done with these systems.

And then I also work a lot with the satellite folks and that's the total precipitable water that we get out of some of the polar orbiting systems and I want to mention too, this also helps with that too, even though we are getting total precipitable water out of the satellites, we don't see those but maybe every four hours they will pass over a site, so this helps in between all of that information too.

So we are getting -- these systems are really helping us build more of a blended product so that we get continuous data all

across the board.

Here's a depiction of the integrated water vapor that is just done by the polar orbiting satellites and this is kind of a case where moisture coming out of the deep tropics ended up causing a lot of problems all the way up into Colorado and Tucson, Arizona, where there was a great deal of problems with rain and even blizzard conditions up in those areas.

Here's another depiction of some ways that you can actually see it in water vapor imagery that we get off of our geostationary satellites, where there's a very, very strong and vigorous upper level low over the Hawaiian Islands, kind of similar to the thunderstorms that we got here just a few nights back.

And then you can see up to the higher right, where you are going up above Baja going into CONUS, where the moisture gets bumped all the way up in there from the

deep tropics.

And then, as can be understood and has been publicized many times, all of the landslides and things that you see in California and all that.

So I can see where having these systems out here in the deep tropics is going to not only help us, but it is going to help folks far beyond that with modeling and understanding how the moisture is pumped up and moved across the globe.

Here's another example where we had a Typhoon Rex many years ago but the more important thing I want to point out here is you see the cloud trail that's coming all the way back there, and if you could see that in motion, you would see that there's a great deal of moisture and cloudiness in thunderstorms, something else, that goes right up into the tropical cyclone, and as this was happening, it was wholly evident that this tropical cyclone was intensifying

and it would be great if we could have had signal systems back then that would have given us more information as to how much moisture was coming up, where it was coming from, and the time interval in which this was running in.

Then, my data quandaries, you know, where can we better put additional sensors, I like to -- and listening to Chris's discussion here, cause they're looking to put more sensors in, but we have got to make sure that they are also co-located with Met sensors and that would -- so I plan to talk to some of you guys probably flying afterwards to get more information on how we can all work together and build a system that works well for the entire communities.

Automated data sites, if I can get those in some of these, way out there in the middle of nowhere locations, GPS sensors could be located with them.

I would like to see about getting wind profilers out here but one of the problems there is that is a very costly system.

And then I am hoping that maybe as we move down the road here too, with the satellite integrated precipitable water, we can build additional algorithms and things that may help us understand a little bit more and even build additional satellite products that will help us with our forecasts.

And last thing is this is, again, you know, I think it will help us with our vertical transport of moisture, the meridional transport and then whether it really is the tropics that is running the program, or I mean running the moisture, or maybe it's mid latitude systems that are running across that helps pull it out.

But I am hoping that we can really move forward with helping the entire globe with moisture with these systems and what we

are doing out here with satellites.

So just kind of a summary, as I noted and showed, we do indeed cover a very vast area of responsibility. We have a huge problem with comms and then diversity in our offices and services that we need to make sure that we provide the people, and then resources. I guess that's always kind of a thing that's needed to make sure that you can always move one step forward.

And that's all I've got. I will pass it on to my next individual here.

CHAIR WELCH: Okay. Thanks very much Bill. Our next speaker is Steve Anthony and he is going to be speaking about using these datums for groundwater resource assessments, so Steve, welcome.

MR. ANTHONY: Thank you very much, and again I appreciate the opportunity to be here with you and share what we see are some of the needs with respect to accurate horizontal and vertical datums to support our

groundwater resource assessments.

For those of you that are not familiar with the USGS water mission, our goals are to provide information to help manage, protect and enhance water resources in Hawaii and the western Pacific.

We do not -- we address water-related hazards, flooding is one of the main areas of concentration for our work, and we are a bit unique among the federal agencies in that we have no regulatory role. We are strictly a scientific group to provide information that is reliable, impartial and timely.

Although we don't have a regulatory role, a lot of our information gets caught up in rather contentious water disputes here in Hawaii, and those are handled by our state water commission. But we find our information often is in the middle of that.

We have many partnerships,

cooperators that we work with. We primarily work on a reimbursable basis. Our office has about one and a half million dollars of matching funds we make available to other state and county agencies.

We also do work with other federal agencies, such as the National Park Service, the Army and the Navy and the Marine Corps, for state agencies, the state water commission, state civil defense, very interested in the flooding reporting that we do for them, the Department of Health, DoT, Department of Hawaiian Homelands, Office of Hawaiian Affairs and at the county level with the various water departments and public works departments and then some work with the University of Hawaii as well as the University of Guam.

Groundwater in Hawaii and much of the western Pacific is critical and it's one of the most valued natural resources. In Hawaii in particular and in Guam, more than

90 percent of the public drinking water supply comes from groundwater.

And one of the challenges we face and why these datums are so important is that the water table is extremely flat and when trying to get an understanding of what those water levels are, there's a potential for large error in some of the coastal areas.

And we use these need for accurate water level measurements that are referenced to a common datum, we use these for determining groundwater flow directions and change in the freshwater storage in the aquifers. These also help for understanding how contaminants in the aquifers move.

And then we also use these water level measurements that we make to calibrate our numerical groundwater flow models used to assess water availability.

This is a cartoon of the freshwater lens for the Pearl Harbor aquifer here on the island of Oahu. This is the most

productive aquifer on the island, and most of the water is coming out of this basal freshwater lens area here.

And as you can see, the surface of the water table here is very flat. It has a gradient of about one foot per mile as you move inland.

And this is a map showing water levels that we measured in 2003 in a series of wells in the aquifer, and as you can see in plan view here, the differences in water level are not great spatially and so it is very critical that we understand these elevations very accurately.

Let me go back. We have been working very closely with Ed Carlson at NGS to help us update and create new benchmarks in some of these areas so that we can update the measuring point elevations on these wells.

And a number of years ago, we were working in Maui, and Maui, for those of you

that aren't familiar, development there is constrained by the availability of water.

And what we found when we were working with Ed here is we went out and we resurveyed established benchmarks for common datum and then resurveyed all the wells.

And we found that for several of the wells, the measuring point elevation had changed up to a foot and in some cases a foot and a half.

And this is really significant in that that changed the perception of the availability of water on the island, in that for every foot of freshwater you have above sea level, that represents approximately about 40 feet of freshwater below sea level.

So it's very important that we have accurate datums to work with and that these are updated periodically as these resources are extremely important to our communities.

Some of the areas that we have

worked with NGS recently, as I mentioned, central Maui in 2003, an effort in Lahaina in 2007, west Hawaii, the Kona area, on eastern Molokai and also out in northern Guam.

Current needs, looking this summer, we are looking to do an update of the benchmark elevations in the Pearl Harbor aquifer area.

And again, in closing, I just want to thank Ed and the efforts of NGS because without them, we really wouldn't be able to9 accomplish our mission, because these datums are sort of the foundation for which all of our work hangs, and without it, we don't know where we are in space and we just really could not accomplish our mission, so we really thank all that NGS provides to us. With that I will pass it over to our next speaker.

CHAIR WELCH: Okay. Thank you. Thank you Steve. And finishing the panel will be Craig Clouet, is that pronounced

correctly?

MR. CLOUET: Yes.

CHAIR WELCH: All right. And we are talking about GIS Needs Accurate Datums and Transformation in the Pacific.

MR. CLOUET: Thank you all for having me. So we have a small office and I'm not sure, but most of you have probably heard of ESRI, the company.

I am not going to actually talk sales pitch today or anything to you guys. In fact today what I am going to do is talk about all the GIS people of the -- in Hawaii and the Pacific.

And part of my job is to take calls from people so every day people call up, anything they want to ask, they ask. And funny, you would think that it's all about software, but in fact one of the most common calls I get is about vertical datums or horizontal datums and like how it relates to their everyday needs.

So I will just go through what some of those needs are that people keep calling me about, since you guys are the ones who hopefully will know what to do to help us out.

So, the GIS community out here in Hawaii and the Pacific is very broad. It's from all the governments basically are using GIS, military of course, private companies, utilities, very important use of GIS, and then of course the natural resources, coral reefs and wildlife protection, all using GIS very heavily in Hawaii and the Pacific.

So for example, let's start here at the Federated States of Micronesia. So the Federated States of Micronesia telecom came up, took some classes in GPS and went back and they were mapping out new locations for cell phone towers.

So they would map out where they were using GPS and USGS maps. They would map out using, do some analysis using USGS 10-

meter DEM, which is the best available. They would map out where the coverage would be with these new cell phone towers. So here is an actual use in the remote islands.

But again, they do need some upgraded modern data and datums. So here's another one of the islands. So they did for all of the islands and they went around, it was sort of a big project and it was really good that they could do it themselves too, that's also very nice.

So here again, the remoteness of some of these islands that we are talking about, very small, tropical islands far, far away, hard to get to and expensive.

So now we can move over to Guam for example. So Guam is right now, if I get a call, about a third of the calls are going to be about people who are working in Guam.

Guam is undergoing the most massive military buildup with base relocations from Japan and Korea.

Every architecture, engineering and construction firm in Hawaii and a few from California is working jobs in Guam right now.

So they are calling up all the time. They want data, modern, up-to-date data, and also they are GPS-ing or they are surveying and they need to get good information about the datums, especially datum transformations between the historical, like Guam 63 or something with the modern, WGS 84s and the data 83s.

Another thing about Guam, I put this up here, PALP, Association of Land Professionals, they had a conference in 2008, 2006, the professional land surveyors of the Pacific, Ed Carlson does a lot of work for these people.

This is a great organization in Guam APS is very good as kind of a central location for the Pacific so it is great to have the conference out there with a lot of

the local surveyors and I hope that there's one coming up soon.

Some of the other data products that people love and want more of, the SHOALS LIDAR, I don't know if you realize there's the terrestrial LIDAR where you take the land, then there's a special, they generally call it SHOALS LIDAR, that penetrates through seawater.

So this actually is Kaneohe Bay so you can see Chinaman's Reef is that pimple, but everything else you are looking at is actually coral underneath the water. It's very accurate, it's very much needed for things like tsunami modeling, coral reef preservation, regulations of who's doing what on the reef, navigation of course.

You can see what looks like a river there is actually a submerged river from the time when the glaciers sucked up a lot of seawater and that was actually a dry reef and actually land at one point. Right

now it's about 50 to 100 feet under water. But the SHOALS LIDAR can pick it up that well.

So people want this, all the islands want it, Guam did a little bit, plus the Hawaiian Islands have done it although it needs to be done in certain areas and updated at times.

Other things we can do with the LIDAR and our coastal resource, again you can use a lot of visualization. Everybody nowadays wants their 3D visualization, the Google effect, right?

So here is Honolulu Harbor with some LIDAR, Army Corps of Engineers and DOT harbor division have been working on projects using GIS, and again, very critical to have accuracy when you are talking about giant ships in a very small harbor like Honolulu Harbor is.

And again the 3D, any time you can get us more LIDAR and good imagery, 3D is

always something people are asking for.

Of course, you can't not talk about disasters out here recently. So not only is there disaster response, which is obviously critical -- preparedness is of course more important.

And we in the Hawaiian Islands and all throughout the Pacific with our cyclones and tsunamis, are always concerned about this.

And of course vertical datums are very critical, not only again does it include how much and what effects the damage of the tsunami and all that, but again, the property, later when we go back and rebuild, you have got to know exactly where your lot is after a tsunami or something like that. There might not be anything left over except for bare earth.

So to have accuracy all across the islands is very important to be able to rebuild and private property issues and

things like that.

So here's the two, unfortunately the 2009 Samoan one was much more devastating than the one we had recently in Hawaii.

Dr. Chip Fletcher, just a couple of slides here from our University of Hawaii, we have a great team in coastal geology, they do a lot of work with coastal resources and erosion and things like that.

Climate change of course is very much a slow problem here, we are just using slowly, imperceptibly beaches in areas, but it adds up over the years, the damage.

And also property damage, you are talking about beach erosion on very expensive beaches in the small islands.

And also again, the storm surges and inundation isn't just a huge or quick thing or always just a tsunami, this could just be large surf generated by a storm. This is on the east shore in fact. It's property damage, protecting private property it is

very important to have these datums, both horizontal and vertical.

Transportation, this is a list of all the groundings, actually as you know, GIS is generally not used for ship navigation, but we use it more for cleanup and remediation when things like this happen.

So this was when the United States Port Royal grounded itself off Pearl Harbor a little while ago. Unfortunately it damaged a lot of reef and that reef is being rebuilt and it was measured heavily with GIS and GPS.

Here's another grounding recently, Cape Flattery, a cement ship carrying raw cement, it started on fire, they had to unload a lot of cement while it was grounded on the reef off-of Oahu so they could float it.

So as they were offloading all the cement of course it made a mess everywhere in the environment, and then of course it did destroy a lot of the coral and it had to be

rebuilt and NOAA did a lot of work on rebuilding the coral and stuff like that.

And then there are of course fines and things like that that are incurred in events like this. GIS and GPS are important for the legal aspects of ship groundings.

Undersea, this is a new one for us all here, a brave new world. So undersea cables. We do have tons of undersea cables for communication here in the Hawaiian Islands and we definitely need them, and we always are trying to make sure they are not being dug up or -- luckily we don't do a lot of fishing that is dredging off the bottom.

But occasionally anchors do dig up our communication links and drop out some of our fiber optics or telephones.

But now we are going to add something to that. A private company, Hawaiian Electric, is thinking about putting wind power onto the smaller islands, Lanai and Molokai, and putting underwater cables to

Oahu. They are figuring it's going to cost at least a billion dollars.

And basically those are telecommunication cables you are looking at there, but it would be the same sort of route from those two small islands on the, your left to the right to Oahu.

It hasn't been figured out 100 percent yet. There's still talk from the other islands who are putting up the windmills but it looks like it might go forward so again, you can imagine how accurate this is going to have to be to lay a huge cable for underwater electricity and so it's definitely going to need some very high degree of accuracy.

Of course NOAA does a lot of work and so do a lot of the state and the other federal agencies in protecting our environment, especially our unique and rare wildlife. We have some of the rarest wildlife here in Hawaii in the whole of the United

States.

Something like the monk seal, there's only about a thousand left. So obviously it's great work that NOAA does, and also things like the marine boundaries like whale boundaries for navigation and stuff like that, again GPS and all that is used by the navigators is very critical. There are restricted areas where you cannot fish. There are restricted areas where certain boating activities are prohibited due to the whales or monk seals or whatever, and again that needs to be mapped out and it also needs the ability to have people who are using boats and things like that to know where they are allowed and where they are not, especially going to be a huge issue with the northwest island monument, because again there are certain areas where they do not want people at all, period, and so you need very good charts and you need very good GPS communication devices to get -- to make sure

that the navigators know where they are going and where they are at all times.

This is one of my funniest ones. GPS, yes GPS nowadays is everywhere and everybody has got one, right? Who does not have a GPS?

And unfortunately the GPSs -- fortunately and unfortunately -- have gotten so good even though they are still five to $10,000 but they are so good and so accurate, everybody has got one, and so everybody is out there thinking they are mapping everything down to submeter nowadays although most people are saying that because they are reading the box and they are not necessarily testing their equipment or they don't really know anything about datums.

I know when they call me up and say they heard about this datum thing, what is it, I know we are in trouble. When they have their one foot GPS that they just bought for $10,000, but it happens all the time.

And I know we are running into it more and more, and keeping it smaller and smaller and so everybody is going to have this GPS. So we really have to put a lot of effort, all of us, both on the commercial and private side but as well as the government, of getting this GPS mess sort of cleaned up, as I call it.

The other thing that we like is, and we think would be really good for Hawaii and the Pacific in particular, is the USNG, United States National Grid, it's a grid mapping system for defense, I mean not for defense, for -- basically for public safety needs and also for government measurement of assets.

Especially on these small islands it works very well. It's also particularly suited for our island style because we do crazy things with our names, street names, we -- everybody has like five different street names and everybody locally knows them and we

do a lot of landmark references, even still to this day, we'll say oh go Diamond Head, turn -- stuff like that.

So it would be really nice to have a mapping system that was much more accurate for public safety, especially after a storm or something like that.

And it would work really well on the small islands, again, it's very simple and on a small island, you only need a couple, to know a couple of digits basically.

Data. Data is the other thing that people call me up about all the time, oh, where is data, how do I get it, even though I sell them the software they want me to provide them the data.

So I am always trying to show them your guys's website and tell them to keep up the good work.

But the other thing is of course, once they get the data, then they always call back and say how do I use it, right?

So I do have to know something about it. So one of the things I noticed about the data and you can see here, this is bathymetric service from Hawaii, for the last basically 20 years or so.

But you can see it's a patch of different data in different years, and there's tons of data and you can probably see at the bottom there, but it says one of the data sources for example is from 1930 to the year 2008.

So if you can imagine how many datums could possibly be in those date ranges, it's incredible. So you can imagine the amount of work when you get the data of trying to get it all to match up.

Because although it looks really nice and thick, you might have a survey from 1950 next to a survey of 2009 and issues like that, so there's a lot of work and NOAA has put a lot of time and effort into making reports, and also going through and scrubbing

the data as much as possible, but it definitely, it's a great effort, and more of it is good.

All right, so on the vertical datum issue again, this sums it all up, for most users, and again I deal with the, kind of the technicians, the guys in the field, so when you start talking about the -- they always think that sea level is just zero and everything is above it. Most people -- or zero and everything below it, but of course there's always different tidal datums and Hawaii, unfortunately, just a lot of confusion about the datums. Some people say there is and other people say there's not, or it's local, and it's not.

So there's still a lot of confusion and I could use some help with trying to educate the local community of what exactly there is and what it means. That would be great, from you guys.

I know you do a lot of training,

in general NOAA has done a lot of great training in the Hawaiian Islands for different things and this is definitely one, because nowadays what people want is this seamless, from top of the mountain to the bottom of the sea kind of approach, which is really good for studies for example for like tsunamis, you can't have two different data sets of the coral reef and then the land above. You need one, seamless data set, beach erosion, sea level change, all the volcanic activity.

So here's an example. So here's the Hawaiian Islands. This is where I -- in the lower one, Kaneohe Bay area, Mokapu Peninsula. You can see it goes down 6,000 feet and so you can actually see these great subterranean canyons and things like that, and LIDAR in the middle and then USGS.

So that's what people are starting to want, and the GIS software is starting to allow that to happen.

And then also you can see the Hawaiian Islands in the upper image and you can see it goes all the way back to actually Midway, but you can see we are definitely an island chain, just built off the deep, deep ocean out here.

And then we -- cell phone companies also have issues, I mean, transformations is one of the biggest ones we got calls for because it is confusing, and even we don't help it out by doing these crazy -- trying to make it sound easier but it looks pretty confusing.

So what we did locally for our users is to put up a map that shows all the different possibilities of the common uses, so even I could see, if you work for the county or get county data you would be in state plane zone three, although there is strangely not any uniformity for the counties as far as the state planes -- some use state planes, some use state plane feeder meters,

Kauai County uses UTM, so it's a bit difficult.

That's another reason that the United States National Grid would be well suited for the Hawaiian Islands because the counties all use different coordinate systems and then the state uses UTM zone four while federal users generally use zone four or five, so it gets rather confusing for the user.

And again, you can imagine, in the case of a natural disaster it's really difficult because you have to know all that stuff in advance to get anything to work together.

All right, so then, when we get to the final nitty-gritty here we are going to talk -- we are going to go deep. So Richard Snay is one of your great guys. He is the father of the PACP00.

So I am going to go a little deep in the datums, so you know, there's the North

American Datum of 1983 but then because Hawaii is on the -- and Guam are basically Northern Mariana Islands are on different plates, geologically we are a moving different than the mainland.

So they decided to create a special realization of the North American Datum called the Pacific Plate 2000, or 00. But then of course there's the too, and they say that they are the same or different, but there's a lot of confusion, and the only real information is it's really difficult to read articles for geodesists.

So I get calls all the time on this, so when to use what, and what does it mean, so if you guys can ever work it out, some information for simpletons that would be great, and also or even translations between them because again, as a commercial software company, we will put it in the official translation. That is what we always prefer to do because they are not always -- there isn't

always one available.

And so on top of that one, that's just one, but the other one is of course the WGS 84, World Geodetic Survey of 1983 and North American Datum of 1983.

Of course they were at one time the same and now of course they have parted ways years ago, but this is a very difficult situation here because of course GPS is in WGS 84 which is aligned to the ITRF, international reference framework, and then NAD 83 has been fixed.

And so again most of these people are going out and buying high accuracy GPS and then they want to always map it down to the land in general, which is generally North American Datum 83.

And so it's problematic because of course WGS 84 is actually changing over time whereas North American Datum is fixed. And so what happens is a lot, nobody, including us software companies or you in the government,

are actually publishing like Epochs on the 1984.

So 10 years from now, there will actually be quite a big difference between your measurements and positioning and it's going to be again a big mess.

And so we all have to work together to put Epoch tags on our WGS 84 which no one is doing yet. And also, we really need to use the NAD 83 Epoch tags as well because again, computers are very nitpicky and it's not exact, they do whatever they want, basically.

So this is why I think we get a call all the time is really again with this high accuracy GPS, people are using all the time but they keep calling up and saying it's not super accurate, and this is most of the reason why.

And here's an easy explanation of what is going on there in the Forest Service. In case you didn't understand what I tried to

describe, this is what -- so yes, simpler documentation and more training on the subject matter from NOAA would be great out here in the Pacific.

And so again, it really does matter, even on the simple cases between state and things -- the 1983 original, we call it, or 1986 here in Hawaii, has its older brother now, the HARN, which is the newer, nicer, more modern, and the difference is 1.57 meters.

So again, it's quite a big -- if you have a submeter accuracy GPS, it's 1.5 meters, so it's a phone call to Craig. How come my equipment is not working so well? And also it's important again for -- no one is going to do too but engineering but they do do some, like wells and especially some commercial people, environmental firms and stuff like that, will go out and do some work and get data from state, the state GIS for example is still using the NAD 83 original

for their data, and so again, they are -- there just needs to be some awareness of it and maybe some direction from NOAA and USGS as to what we should be using and what is the best for the state and governments to be using.

And the other part on this one is NOAA itself is publishing a lot of data now in WGS 84 for the Pacific islands and even for land-based things, like you are going to get your imagery and everything like that.

So again, at one time I believed there was a standard that they were supposed to be using for land-based North American Datum and for surveys of the geodetic model, but NOAA itself seems to be publishing a lot of data WGS 84 which is fine, but it matters greatly again for surveyors, because they can't just, especially over time, it's going to matter a lot, because in five years, if they just have something called WGS 84 and they don't know where it came from, if you

are doing super high-order surveys, that will make a difference.

So it would be nice to get some clarification from NOAA and the government as to what is the official datum that government agencies are typically using, just so we know and we can adjust to that.

Yes, and the use of Epoch tags.

And I think just lastly, of course, the silent giant we call it, the metadata, thank you so much NOAA, you always are definitely one of the best organizations to publish not just data about data, so if I give you data, it will tell you when it was made, who made it, how it was made, all this information that really is critical for anybody using GIS for analysis for example, they can't just do analysis without knowing information about the data.

And so with metadata, while it's the most boring part of the hi-tech industry, it's one of the most critical because you

really can't do valid analysis without it, and NOAA is great, they are actually going to provide training out here in a couple of weeks for the Hawaiian community and the Pacific as well, so thank you NOAA for that.

There's some great stuff from the UH, the bathymetric and sonar, so thank you very much. That's it.

CHAIR WELCH: Okay. Well thanks to all the panelists. I'm sitting here you know, reflecting that from what I hear from this panel and some similar panels that we heard in other locations on this subject, convinced me that if there had been a hydrographic services review panel in the 1960s, and if Bob Dylan had been a member of the panel, he would have written: You don't need to be a weatherman to know which way the wind is blowing but it would sure help to know vertical and horizontal datums.

So, what kind of, so what kind of questions do folks have or comments to this

panel?

Okay, Matt.

VICE CHAIR WELLSLAGER: Excuse me, Matt Wellslager, South Carolina Geodetic Survey. John, I got a question for you. It sounded, if I can get things straight, you were using a lot of sea level stations for trying to determine what the sea level was in this very, very wide region, is that correct?

DR. MARRA: That's some of the work that is being done, correct.

VICE CHAIR WELLSLAGER: Some of the work, right, okay. And the tide gauges that are being used are all installed by, say, the National Geodetic Survey or are they going to be Australian or is it a mix of a lot of different moves that you are using together?

DR. MARRA: It's a mix of multiple groups actually, yes.

VICE CHAIR WELLSLAGER: Is it?

DR. MARRA: Yes, and a lot of it is coordinated through GLOSS, the Global Sea

Level Observing System, so there is an official GLOSS network. But the in LAN, so the CO-OPS stations constitute a portion of that, but then the international component is managed by the Hawaii Sea Level Center, but then you get crazy when you start going, well, the Australians actually have a set as do individual countries, and some of those are within GLOSS and some of those are in different levels of precision and accuracy.

The idea is that GLOSS basically has at least some sort of climate quality standards within which you are supposed to use for sea level analysis.

VICE CHAIR WELLSLAGER: Right. So, let me get this straight. With all these different groups doing it, is there a, for a lack of a better term, an ASCII format that the data can be submitted to a centralized location, so the Australian tide gauges could be used with the United States, with whomever else, but they are all on a unique type of

format so that the data could be combined in a uniform way and you can all analyze it?

DR. MARRA: Again, the primary mechanism through which that occurs is like, is the GLOSS sort of stuff. There's the Global Seal Level Observing System.

So that Mark Merrifield, who is the director of the Hawaii Sea Level Center, they have several different sets of data that are sort of the official sets, like the, what is it, the JASL, Joint Archive for Sea Level.

So there is -- via that site you can at least get maybe 300 to -- I think it's about 350 sea level stations are at least in a consistent QA/QC in addition to the, just, you know, the U.S. stuff.

But there is, you hit a good point that there is no single place where you can get every single tide station on the planet accessed, and in fact one of the challenges right now for example if you went to go look at -- you can go pull up a site much like the

CO-OPS site, where you can look at the tide information that you saw, and I think the CO-OPS at least allows you to reference to a couple of different datums.

If you went and did that same thing to the Australian sites, they would reference you to a totally different datum. So not only is it not interoperable in the sense of there's not a common data format, but even the way that we display it, you know, a user could be looking at two different charts and that are totally referenced once -- I think they reference to like low, low water or even something different than that.

CAPT. LOWELL: I think it's -

DR. MARRA: So -- what's that?

CAPT. LOWELL: I think it's lower astronomic tides.

DR. MARRA: Yes, so it's -- so you are aware of these sorts of considerations, but so there really isn't, at least in my

knowledge, sort of the ultimate interoperability in the sea level station datum data. It's one of the challenges that they have had to do in analyzing some of the global sea level stuff, is dealing with the whole variations in not only you know, which stations you use and the quality of those stations, and so there's been actually a lot of debate in the sea level community about sea level estimates as a result of those kinds of considerations.

VICE CHAIR WELLSLAGER: Rich, is there any thought or consideration about trying to create something like a RINEX format for all these different types of datums and issues? One thing that CO-OPS could do by themselves but maybe spearhead the idea of trying to get a unified format?

MR. EDWING: Well, that is one of the missions of the IOOS program, is to achieve interoperability between some of these platforms, not just work level --

VICE CHAIR WELLSLAGER: Right.

MR. EDWING: It's not for the purposes of sea level per se, in GLOSS, but they are trying just to allow a little datum to be integrated with other kinds of data for whatever application folks are trying to use.

GLOSS is the umbrella organization for those countries and networks that are following those standards, and they have an archive in England that pulls together all those stations at the GLOSS station data.

Actually they take some of that data and send them to us in the right format that we display along with our data to sea levels on the website.

So there are things moving in that direction but of course it's a long process.

VICE CHAIR WELLSLAGER: Oh, I'm sure it is. It's a lot of data there. It would be good if we could all use it at the same time.

DR. MARRA: I agree. That's why I

mentioned that I think the interoperability is really important. And it's not even the sea level stuff. It's the shorter-term stuff that is actually very important, you know, the storm stuff.

VICE CHAIR WELLSLAGER: Right.

CHAIR WELCH: Scott Perkins.

MEMBER PERKINS: Thank you. Chris, I have a question for you and maybe it's a follow-up question for Craig. You had mentioned wanting to get a server on several of the different, you know, geographic locations.

Looking at your project and the concern with costs and limited funding, I guess the question is, have you looked at going cloud-based with that, and have you looked at what ESRI is putting out there now in the way of geospatial communities, so rather than the expense and the infrastructure and maintenance of putting that stuff server-side and maintaining it,

maybe you can go elastic with it, put it in the cloud and use the free thing that the guy at the end of the table is providing with the geospatial communities.

MR. GUERIN: Actually, we did not look at the cloud any time yet, because at the time we were doing this project, cloud was not available.

So that may be a possibility but we would have to look at if the real time network can handle through the cloud, or will there be enough -- will there be delays in the transmitting of the data. But that, possibly we could look at that.

MEMBER PERKINS: Yes. I compliment you on the presentation and on the program you have undertaken.

MR. GUERIN: Thank you.

CHAIR WELCH: Yes. Please come up to a mic.

MR. LADOUCE: I'm Jeff LaDouce. I'm the regional director for the National

Weather Service out here in the Pacific. Mine's a comment more or less.

I'd like to thank NGS and through the efforts of Ed Carlson, who have contributed to our efforts out here. I'd like to tie a couple of things together that Bill Ward and John Marra brought up, and that's the importance of the geodetic data that we have for the instrumentation, for the climate.

And one of the areas that has not been mentioned very much is the tsunami inundation maps that we are responsible for. We are producing them -- a number of different organizations are producing them for the U.S. flagged areas, but NOAA basically is producing them for American Samoa, Commonwealth of the Northern Marianas, Guam.

They are instrumental in collecting the data, both the hydrographic and bathymetric data, and then developing the

charts or funding the development of the charts at PMEL, or Pacific Marine Environmental Laboratory.

Ed's work is particularly important in being able to get the right leveling information for those charts.

But I have -- we have one other responsibility in NOAA and that is brought to us by the Compact of Free Association. I don't know how many people here are familiar with the Compact, but there's two of them.

They are treaties with -- one treaty with the Marshall Islands and the Federated States of Micronesia, and another one that is in the Congressional approval process right now for Palau.

That makes those countries look a lot like they looked when they were the trust territories of the Pacific and we owned them, basically.

So NOAA has the responsibility to provide all the weather support, the climate

support and everything that's interrelated. I would like to -- and it gets complex and complicated and nobody appears to have a real clear picture of what that Compact means.

I will give you -- try to make it a quick example. About three years ago, FEMA said we don't do foreign, and so we are getting out of the Compact countries and we are going to turn that over to USAID.

So we had a tabletop exercise here with the Ambassadors from Marshall Islands and Federated States of Micronesia and FEMA Region 9 and USAID.

FEMA got up and kicked off the conference and said we don't do foreign, this is very unique and we have been doing this for the last 20 years, we are now turning it over to USAID who does foreign, and they know what to do.

And USAID got up and said yes, we do foreign, but we don't understand this thing. These islands have a unique

relationship with the United States that we don't deal with.

So there is -- there are some uniquenesses and there are some things that we -- me as the guy that's responsible for providing about 99 percent of the NOAA support to the islands, I am interested in protection of life and property, and so we deal with it.

I was interested in the water because we have worked together in some of the water issues out there. It's the number one issue in the islands and some of these islands are no more than five feet high. We don't know whether they are rising or whether they are sinking. We don't -- and so there is a number of things that the NGS provides for us to help us do that support.

I would like to thank you for that and hope that you continue to support our efforts out here. They are important. We are saving lives. We have people who are losing

their farms, they are losing their fresh water, and in many cases the Marshall Islands are probably losing their islands.

So thank you very much.

CHAIR WELCH: Thank you. Let's see if other panel members and then we will turn to our guests. Any other questions or comments?

MS. BLACKWELL: Juliana Blackwell, Director of the National Geodetic Survey. I want to thank you all for your wonderful presentations, and I know the datums are complicated for those who don't work with them on a daily basis, and even if you do, it still is mind-boggling when you start to think about all the different relationships, horizontally, vertically, that we have to deal with.

Just a few general comments about -- NGS understands and appreciates a lot of the issues that you have brought up today. We are working on datums for the future which

will help with a lot of the issues that you have brought up, the fact that the conterminous United States has a different vertical datum and all the different islands have their own sort of starting points for measuring elevations.

The National Geodetic Survey has begun work on two new datums, one that will be a geometric-based, one that will be geopotential-based for elevation information that you will be getting for datums.

What the new datums will provide is it will get rid of this fraction between the islands and the territories and the mainland and so we are looking this holistically, we are doing this with a GRAV-D based geoid model that will then develop into a new vertical reference system.

So I know, again, this is very complicated, but we have started this as our GRAV-D project, we are now in our third year of GRAV-D collection. We are doing a lot of

work in Alaska right now, Hawaii and the areas around Hawaii are part of that plan.

I believe that right now the time frame is four to six years from now before we would actually plot that airborne gravity.

But we are always looking for partnerships and/or from federal and state entities to make this work happen faster because obviously it's all tied into budget, and budget constraints.

And if there are ways that we can work together to make this airborne gravity and new vertical system work faster, because we can all pitch in and do this together, we would be glad to talk to those entities who can try to make things work as well as and as quickly as it can in the Pacific area.

So one specific question I guess I would have for you Chris, is do you have a time frame for the leveling work that you proposed?

MR. GUERIN: Currently, right now,

we have the data in our contracts office. They are six plus months behind due to furloughs and reduction in force and other issues.

So they have six months of work to get out first before they even get to ours. Once the RP goes out, we are looking at another eight months before actual contracts are inked and approved and everything else and then they can get started.

And then I think when we estimated the project to complete start to end is two plus years of field work and then office time. So you are still looking at several years down the line to get the leveling out the door.

In the meantime we are also going to be starting the VRS data paperwork on our side too, start getting it out. We don't want to, you know, finish one project and then wait for the next one. We want to rush them all together.

MS. BLACKWELL: I think it would be helpful if we talked off line about ways to look at that and look at our GRAV-D initiative and see if there is some way that we can work together.

MR. GUERIN: Yes, initial -- when we did the initial estimate of the LIDAR, we did ask Ed about your GRAV-D and we took the figure out of your guys' book for what it would cost and we actually put that into ours just in case one type falls behind the other and hopefully we can get it all done at the same time.

CHAIR WELCH: Other panel members?

I have a question. One of the challenges of the geodetic survey and the profession, those of us that are interested in trying to translate all these strange terms and this esoteric process and the things that people can relate to, the tsunami, people can relate to it, at least people on the coast can relate to it.

But even people inland, you know, tsunamis are something they see on TV. People understand cell phone towers. People gripe about their lack of cell phone reception. Craig, can you talk a little bit about how the use of this data, these datums for locating best cell phone tower locations on the island, does it seem like you could do that, that would be useful anywhere?

MR. CLOUET: . Yes actually they are doing --

CHAIR WELCH: And people would understand that and say hey, this kind of stuff relates to what your cell phone reception is, average person.

MR. CLOUET: . Yes, both American Samoa and the FSM have been doing this project, I guess it was ARRA money. But, and they actually hooked up their GPS. Again, it really does make a difference by foot, even, where those towers are, so like, if you put it on the wrong spot, all of a sudden you get

these black areas.

CHAIR WELCH: People understand this, they intuitively know that if you locate the tower in the wrong spot or the wrong elevation, it makes things better or worse.

MR. CLOUET: . Especially with the ridges, and these islands all have very deep ridges, so again, if you are like one foot off to the side of the ridge, the whole other valley is just not going to get anywhere.

So, yes, the ridges are always very difficult here in the Pacific, different in low-lying islands.

CHAIR WELCH: Yes, I think I am saying the geodetic service ought to come out with a one-pager about how what we do improves people's cell phone reception.

(Laughter)

Seriously.

Secondly, though, Steve, on the groundwater, do you have situations that you

could point to where the use of this data showed that there actually was more groundwater or less groundwater and therefore people made different policy decisions as a result of that?

MR. ANTHONY: Yes, the example we have for Maui illustrates that quite well.

CHAIR WELCH: And but, what I couldn't understand from your presentation was did that lead to more restrictions or did that free up things for more development?

MR. ANTHONY: Created confusion. Yes, it created confusion and the end result was actually it was less water available.

CHAIR WELCH: Okay. Again, people can understand that too, you know.

MR. ANTHONY: Right.

CHAIR WELCH: Okay, thanks. Gary Jeffress.

MEMBER JEFFRESS: Ed, what you're talking about is knowing good elevations everywhere, like the cell phone tower thing

is like, you need, pretty much need line of sight from your cell phone to a tower to get good reception.

But then you have got to know where the topography is, because if there is a mountain it is probably going to block it, or -- and so their idea of good elevations is that the topography and the hydrography, the mapping of the sea floor, is on the same elevation datum.

But traditionally they are not because topography, you want to know from like mean sea level or mean highwater, and the bathymetry you want to know it relative to the mean low water because you don't want to go running either things in a boat.

And so that's where the difficult comes in, modeling in a maritime area along the coast, matching that so you can do models for tsunami inundation and storm surge inundation, that's where the problem comes in.

But with the cell phone, this is just by the way, with the cell phone problem, the Air Force has actually a solution for that.

They now have air ships that stay on station at 60,000 feet. That's above the weather, it's above the jetstream. They are solar-powered so there's plenty of sunshine up there and because they are not using any of that energy to stay aloft, because they are helium-filled, it's an ideal location for cell communications and it covers an enormous area on the ground.

They cost about 10 percent of the value of a satellite. They already have the solution to that little cell phone problem.

CHAIR WELCH: I wonder if that will result in a decrease in cell phones.

(Laughter)

Other panel members? Okay, we had some guests that had a couple of comments.

MR. POLHEMUS: I'm Dan Polhemus

with the U.S. Fish and Wildlife Service and I am also the Chairman of the Monument Management Board for Papahanaumokuakea Marine National Monument, and I believe yesterday after I departed, David Swatland from the monument made a few comments in regard to some of our issues up there.

I think that your panel member Jeffress just brought up a very salient point in regard to the monument, in that we have got 10 islands up there. Three of them are high and seven others are essentially low. And just like the situation alluded to with the Marshall Islands, those islands are isostatically sinking and at the same time the perception of the sea level around them is rising.

Mark Merrifield from UH has indicated that at least at Midway, there's some tide gauge data that that level rises about five millimeters per year.

So that's an inch every five

years, and that's not trivial when you are dealing with a low-lying monument.

We also have a climate change working group within the monument management board that I currently chair, and one of the things that we are doing is having a look at a vulnerability assessment, coastal vulnerability assessment, looking at both inundation and potentially, erosion issues.

And we are trying to acquire data in terms of LIDAR, talking with John Brockett, USGS Reston, and they have a MOA with NOAA to fly the ERL system that is emerging off-of NOAA's King Air fixed-wing platform. They would like to bring that out to the Pacific I believe within the next couple of years. I think they are going to proof of concept in the Virgin Islands.

We are looking at acquiring satellite data from via of all things USDA NRCS.

But in all those cases, no matter

how good the data we get and no matter how nice the toys we have are, in order to do accurate scenario planning and actions, take actions related to that, we really need to know where zero is, you know, what is sea level, what are we going to agree that we are going to use for sea level, and how are we going to measure what's going on from sea level down versus what's happening from sea level up in terms of tsunami impacts, which were non-trivial in the northwesterns, I mean the largest island at Pearl/Hermes was sliced completely in half by the tsunami.

It washed over 70 percent of one of the islands at Midway. Modeling those potential -- a potential recurrence of those impacts in the future is very important, but we need to know where zero is.

So this is where the geodetic survey can really help. We need to constrain that. We need to have a reference point so that we can analyze status of trends going

forward, see whether our projected scenarios are playing out, for better or for worse.

And our panel member from National Weather Service had pointed out the major problem is there's not enough land in the Pacific.

But we have 1,200 miles with 10 islands and we would be very happy to cooperate with National Weather Service in the location of instrumentation out there.

We are undertaking a strategic instrumentation plan. That said, none of us are geodetic experts. None of us are meteorological experts. So we could use all the very good advice we can get.

At the same time we are very happy to help co-locate instruments that would give us information and that would fill in holes in broader, regional networks.

And so I would say that we would be very interested in having dialogues with anybody who is either on this review panel,

or on the expert panel, or if there are people you might know who might talk to me about any of these issues. Thank you.

CHAIR WELCH: Thank you. Other comments or observations from anybody?

Yes.

MR. ERICKSEN: I'm Marc Ericksen with Sea Engineering. We are a local ocean engineering survey company that was founded in the islands in the '80s.

We have been doing hydrographic survey work in Hawaii and the Pacific for 30 years now, and I want to kind of reiterate some of the comments that were brought up here, because we have kind of been on the front lines of dealing with these issues as they have developed and progressed.

We are kind of, I guess, lucky or not lucky to be in the position where we were interfacing with marine hydrographic, oceanographic type data sets with local land-based surveying.

And so we have encountered the problems of using GPS-based data and trying to integrate that with local land survey systems.

So, all of the datum problems, horizontal control problems we have encountered from the very beginning, and Ed was a very important resource for us when he did come to the islands in terms of starting to clarify those things.

And there's been great improvement over the years but we still encounter horizontal control difficulties using differential GPS around the island now.

For example for a lot of the marine survey work, the coastguard differential beacon is available. And then there's also systems that use local, HARN-based ITRF reference system.

For example, a SEANAV, C&C Technologies, SEANAV system, versus a U.S. Coast Guard beacon. Right off the bat you do

see that 1.5 meter difference.

So these are issues that really you need to pay attention to, in particular when you are trying to interface with coastal engineering projects.

Same thing with vertical controls. We constantly encounter differences between local -- the most recent NOAA tidal epoch sea level datums, and those that are used by local land surveyors.

And again, these are key differences when you are looking at engineering projects in ports and harbors, dredging projects for example.

We did a series of survey work in Guam for the commercial port of Guam, just as an example, a couple of months ago, and the Port of Guam controls that we were provided to do those surveys show an offset of about half a foot with respect to the most recent NOAA tidal epoch, at a NOAA tidal station in Apra harbor less than a mile away.

So, you know, I think it's -- those problems still do exist. I think it's really key the communication and the dissemination of that type of information to the local survey communities, and also to the local agencies responsible for upgrading a lot of the land-based controls. Thank you.

CHAIR WELCH: Thanks. Other comments or questions for the panel?

If not, I want to thank all of our panelists for participating with us and your contributions to us today and we will continue to stay in touch with you and invite you to stay as long for the afternoon as you can. So thanks again.

(Applause)

CHAIR WELCH: Let's -- we're scheduled for a short break. Let's come back at 3:10. We are scheduled to come back at 3:15 but let's come back at 3:10. We might be able to finish a few minutes early if we can do that. (Whereupon, the above-

entitled matter went off the record at 2:53 p.m. and resumed at 3:17 p.m.)

CHAIR WELCH: Okay, let's reconvene and just let me remind our visitors that a few of you have not yet signed into our guest sheet over here at the table and we hope that you will.

And before we go to our members making their presentations, I had meant to, before everybody got started, beginning to give the floor to Ed Carlson for a little context-setting and I am bound to do so, so please come right on up and set the context for us after the fact.

MR. CARLSON: Well, I wanted to give you some history of the Pacific region, NOAA's Pacific region, so I happened to have these two handouts out.

One is what our mission is and what we are supposed to take area of our responsibility. But I think from the last presentation, you heard a lot about it from

Bill and John, about how big our area is.

And the second one was just the graphical view of how big our area is, like we say it's almost two times the size of the United States, and I say in here that -- but the land there is only about the size of New Jersey.

It's a big area but very small. And the other issue is that we have the issue of going across seven time zones, so we work, today, right now, it is -- today is Thursday. It's Friday, one o'clock in the afternoon in Guam. So these are the issues that we have to work with, to deal with.

And I just wanted you to have an idea of how big the area is that is out here, I mean a lot of people don't understand it and realize it.

When I talk to people that come from the mainland they say oh, you're just off the coast of California. Well, we are way off the coast of California.

CHAIR WELCH: How long does it take you to fly to Guam from here?

MR. CARLSON: Eight and a half hours.

CHAIR WELCH: And how long does it take to get to American Samoa?

MR. CARLSON: Five and a half hours.

CHAIR WELCH: Okay.

MR. CARLSON: And we are in the -- that's right, we go to the southern hemisphere, we have northern and southern hemisphere, too. So we have different seasons. When it's winter here, it's summer down there. When it's winter down there, it's summer up here.

That's all.

CHAIR WELCH: Okay.

CAPT. LOWELL: Before you go Ed, let me just ask you a quick, I guess, clarification for me, but this graphic that you provided here, it looks -- I only took a

quick glance, it's the one that Bill put up on the screen -- but it looks a different shape.

So can you give me a little clarification?

MR. CARLSON: He just made it rectangular. I just made it more trapezoidal.

CAPT. LOWELL: Okay.

MR. CARLSON: So they are different shapes, but it goes to the same area. This one goes all the way over to Guam. They have responsibility, more responsibility in the weather service than what's on this. They have to do predictions for aeronautic flights all the way to the Philippines, where we don't.

CAPT. LOWELL: Okay, and those areas, I guess I'll verify with Bill, is that agreed on via the international convention that the U.S. will take weather authorities for areas?

MR. WARD: Well, because of the

cluster towards the Compacts even as Jeff mentioned, they still fall under us. We have money that is delegated directly to the Compacts such that we take care of them in both coastal and weather services, and until such time that they can come up and take care of their own services, we are on the hook and we will continue to do weather and build up the entities out there to help them move along.

CAPT. LOWELL: Okay.

MR. WARD: Now, I want to mention on the map that you mentioned, that is a Mercator projection, and it is indeed four times the size of the CONUS. CAPT. LOWELL: I guess I just want to make sure that it wasn't multiple Pacific regions that we were talking about.

MR. CARLSON: No, it's the same area.

CHAIR WELCH: Okay. Thank you Ed. All right. Let's move from the south Pacific

to the north, and recognize our own fellow panel member, Lawson Brigham, for a presentation about the Arctic issues. So the floor is yours.

MEMBER BRIGHAM: Quite, quite amazing to be here in Hawaii. When I talked to Roger about this, we joked -- we knew each other from headquarters when he was working in Washington and we both had a good laugh about briefing on Arctic here in Hawaii.

I'm not sure I can answer the questions today of how NOAA should respond to the Arctic, but I thought maybe it's useful to give, not necessarily a 101, but what's going on in the Arctic and try to dispel some notions of what you might read in the paper and how things are interpreted by the world and how we interpret them in the Arctic Council.

Of course NOAA image here, a passive microwave of the least extent of sea ice in 2007 and in this slide we used for the

diplomats a number of times in the Arctic Council to remind everyone there are lots of ships in the Arctic Ocean today. There are 6,000 voyages -- 6,000 ships and 12-13,000 voyages. That was in 2004.

Lots of different types of ships, the only one that is the outlier is in the lower right. It's a cruise ship, not ice-strengthened, the flag is the Bahamas and the question is what is it doing there, and Ed knows what it's doing there, it's making money.

Does it fulfil all the safety rules and regulations for a polar-clad ship in the high latitudes and, of course, the answer is no.

John and I have been meeting -- John, part of the U.S. delegation, myself as a briefer, the Arctic Ocean Hydrographic Commission, which is a new group under IHO, and part of their work is this bathymetric chart just to remind you all of the huge

continental shelves in the Arctic Ocean.

At the North Pole, it's 4,000 meters deep. The red dot -- blue dots and red dots about 2,200 nautical miles across the top of the world so if you are thinking about crossing the ice more than 2,000 miles, it's kind of a controller of speed, et cetera.

CHAIR WELCH: Lawson, can I ask a question and I'm sorry if I am interrupting, but if we look at that, that's the Arctic Ocean more or less.

MEMBER BRIGHAM: It's the Arctic marine environment.

CHAIR WELCH: But when you -- a lot of people talk about the Arctic policy, and there you don't see anything see south of the Bering Strait but a lot of the people are talking about Arctic policy and they are talking about things considerably south of the Bering Strait, so what are we talking about?

MEMBER BRIGHAM: Yes, in the

United States, in legislation of which you are aware, it's one of the U.S. Army Research Commission, there was a definition for the United States of the U.S. Arctic -- of how the United States defines its own Arctic area and it's from the Aleutian chain north, and that's to include the seasonally ice-covered sea, so it's not irrational, that we see ice in the Bering Sea for more than half a year, so it is a polar sea, it just happens to be sub-Arctic, below the Arctic Circle.

So defining the Arctic mean environment is the way we deal with it in the Arctic Council, because you know that for the Arctic Ocean and the UNCLOS activities, it's only five states.

But when we talk about the Arctic marine environment, the whole of the Arctic, it's actually eight Arctic states. I'll -- maybe I can clear that up, but U.S. Arctic policy is Aleutian chain north and includes beyond our EEZ out the extended continental

shelf and around the whole of the basin for marine issues.

CHAIR WELCH: How is it then just sometimes we have using the same term and envision larger or smaller geographic areas?

MEMBER BRIGHAM: I think we are the -- only Canada and ourselves have in legislation a definition of Arctic, but the other countries, with which we dealt in the Arctic Council and we asked for data from your, that had a fluid and a dynamic definition, like our Russian friends, of what the Arctic might be and that causes some friction.

You have all heard about and saw or maybe read about Dr. Chilingarov taking the flag down to the bottom of the North Pole with Australian dollars, in an expedition -- private expedition -- but CAS has a governmental expedition and of course it's 4,000 meters deep, and the question is, at that depth, whether anybody has an extended

continental shelf.

Well, all of that activity has no bearing, no basis of international law, but a great adventure and it gave tremendous tension to this issue of who owns the sea bed in the Arctic Ocean.

Of course the framework of the floor of the Arctic Ocean, this is UNCLOS, and as we go from left to right, from the 200 mile EEZ to something different, an extended continental shelf, and that's -- the Healy is out there, and folks in New Hampshire exploring with the Louis S. St-Laurent from Canada the sea bed and trying to define what our extended continental shelf will be beyond 200 nautical miles, even though we haven't ratified UNCLOS.

So the framework for all activity, it's another ocean planet and that needs to be explained not only to the diplomats, but the whole of the Arctic Council in this work, is that it's a little different ocean because

it has an ice cover but it is a marine area, no new Antarctic treaties, no new Arctic treaty, the treaty and the framework in fact is UNCLOS.

I'll talk a little bit about --

CHAIR WELCH: UNCLOS being the UN Convention --

MEMBER BRIGHAM: Convention of the Law of the Sea.

CHAIR WELCH: which the U.S. has not ratified.

MEMBER BRIGHAM: But we may be close to at least getting it up for a vote.

CHAIR WELCH: Yes, that's what people have been saying for 25 years.

(Laughter)

MEMBER BRIGHAM: Yes -- but Senator Kerry is going to offer it up there pretty soon, I think. Here are some topics, I'm just going to run through them real quick -- marine access, use of this report, and then how does this relate, and I suspect I

might brief again or work with the staff and we can come up with some words together down the road.

If you just look at the passive microwave images, you can see, in our lifetime, an extraordinary change in openness. On the left you can see wide areas are open. This is at the minimum extent of course.

And I put the red lines on this one across the Northwest Passage, open for about 14 days in 2007, and across the Russian Arctic, there's ice interacting with the coast so at the minimum extent in this particular -- this is the minimum extent on record, satellite record -- but even at this one there's ice interacting with the coast, which means you need a polar-clad ship to operate.

But we remind the diplomats, I remind you here, the Arctic Ocean is ice-covered most of the year through the century,

and beyond.

So as a mariner and as a regulator of this, I take the reverse for my daily work as sea ice oceanographer and looking at the trends and stuff, I have to think about how much is open, how much is it changing.

But actually it's not changing a lot from a maritime perspective. The place is ice-covered. It's thinner. There's less extent. But there's a heck of a lot of ice in the Arctic Ocean forever.

The amount of heat to -- as a climate scientist looking at it -- to melt the top of the world, the ice cover, there would be astronomical temperatures in the rest of the planet, and I don't think we'd be worried about marine navigation or anything, we'd be worried about frying the rest of the planet.

So the place is ice-covered, so that has regulatory implementations throughout whatever we want to do there.

This big assessment was the Arctic Council, led by the United States, Finland and Canada. It had lots of workshops. But the key challenge for the Arctic states is that the rest of the world is coming -- shipbuilders, investors, Chinese ships, Japanese ships, a lot of people who really don't have much understanding of the Arctic, and that's the challenge for the Arctic states including our own.

There was Mercator projections mentioned a minute ago. Throw those away please when we are looking at this part of the world.

Don't look at them ever again. With the distortions of Greenland and the whole of the Arctic basin, you don't want to use Mercator.

I've covered the report, I've passed it to the panel members, maybe many of you have seen it, you can download it. Here are the chapters of this.

We covered a range of topics, of course indigenous use in the Arctic is hugely important. The ship is the Russian flag icebreaking tanker built in Korea with Finnish technology. It's operating by Sovcomflot, a Russian -- largest Russian shipping company, so you see the globalization of the Arctic.

We'll run through a couple of slides of use today in the Arctic Ocean, just to give you a sense. World's largest zinc mine of course is in my state, and it's the Red Dog Mine and some of the largest bulk carriers on the planet come and anchor off Kivalina in Alaska.

But those ships are all non-ice-going ships and free water ships so they don't operate in the wintertime.

On the other side of the Arctic we have the largest nickel mine in the world, fourth largest copper mine, largest palladium mine, large taxpayer of the Russian

Federation at Norilsk and since 1979, there's been year-round transport between the port of Dudinka and Murmansk.

The largest high-grade ore potential mine is here on Baffin Island and there is a big plan to ship that ore to European steel mills, and I think that will begin in the next decade. So the place is tied to a wealth of natural resources, particularly mineral resources.

These are the kind of ships that are operating in the Russian Arctic, Finnish technology, independently-operated ships. They don't need icebreaker support. These are the very small, 660 TEU container ships.

When we talked about pods on cruise shops and other ships, here's a pod on this ship and I wonder if some of you might guess what might be something -- a problem with this picture.

There's no redundancy. We talked about three radars maybe on the Madison ship.

There's only one pod here, so the future regulatory push is for redundancy of equipment in the Arctic because the ice of course can do some interesting work on your machinery.

Marine tourism at the North Pole, of course, the Russian nuclear icebreakers but the primary marine tourism, other than the coast of Norway and Svalbad is this area of the world, western Greenland, and a couple of pictures of -- excuse me -- a couple of pictures of that.

All of these ships in Greenlandic waters. This is a picture taken standing on Nuuk looking out from a ship with 4,000 passengers and oh, 1,300 in the crew, a small city almost larger than all the towns and communities in Greenland itself.

And those ships are operating with minimal charts. Great safety systems on the ships but you don't want to have a fire in remote regions because there's not much

infrastructure.

But the challenge to the Arctic states -- and this is the largest challenge, the biggest challenge right at the moment, is how do the Arctic states respond to something like this if there is a crisis or a problem with one of these ships.

Key fisheries of course, we know, two of the largest fisheries on the planet are in the Arctic, or sub-Arctic, Bering Sea, of course the Barents Sea, modest fisheries, and these places bringing fishing vessels from around the world.

Oil and gas is one of the bigger drivers of marine transport. We have leases of course and happily, Shell has not been able to drill yet out in the Chukchi. Of course they're on the beach here and BP has NorthStar, so some activity, not requiring marine operations, very much marine operations.

But most of the activity today is

in northwest Europe. LNG has carried from Hammerfest, Norway to Chesapeake Bay and Spain and around the world, as the Norwegians move from the North Sea up into the Arctic when this is ice-free.

And the Russians are moving oil and some gas, but oil, both westbound and eastbound in the summer, and the new adventure of course is drilling for oil, exploring in the Greenland coast just last summer and more to come this year.

I joke, a little cynically, but every Greenlander, all 56,000, pray that they find oil because Greenland could become an independent state after 300 years of Danish rule, and would be analogous to a Kuwait of the North.

Who would buy that oil? Maybe China, maybe we would, who knows what country? So it would be an interesting dynamic as Greenland would replace Denmark as the Arctic state. Highly plausible.

Off the coast of Russia, the Varandei terminal, this is an investment of Conoco-Phillips, the United States company of course, and Lukoil, the Russian company.

Again, the ship is built in Korea with Finnish technology, operated by a Russian flag and so it's a mix of investments today in the Arctic.

Summer sea lift in both Russia and about 100 vessels sailing in the Canadian Arctic in summer bringing ships to the Arctic Ocean.

And then finally, it's the exploration of the sea bed by highly capable icebreaking ships in all of these areas.

So we show this map essentially for the summertime to the diplomats to say all of the Arctic Ocean is being utilized today in the summer. Almost every square kilometer has been traversed by surface ships and of course by submarines also, in various times and places, continuing today.

But in the Arctic Council we focus on marine safety and environmental protection, and issues related -- and the non-security related issues.

We don't focus on fisheries either. But all of the vessels, the 6,000 vessels are all involved in these activities throughout the basin.

Of course we can't dismiss this activity, this particular Greenlandic hunter, and in the Arctic Council we deal with that activity too, because we have the indigenous people sitting at the Arctic Council.

In this transport study, we looked at using scenarios, future of the Arctic, what impacts might affect marine transport. And of course there's a whole host, like anything you pick: climate change, economics.

During the course of the study we -- the price -- the fluctuation of oil was $55 to a hundred and something, so that itself will change the dynamic of Arctic

shipping.

We pointed out it could be a major shipping disaster in the Arctic, but it actually happened in the Antarctic. You can see the happy customers, the tourists in the lifeboats, I say cynically, of course.

Everyone was picked up, which is quite remarkable partly because of the relationship of all the cruise ship operators -- this is a Norwegian cruise shop operator.

But the explorers at the bottom of the ocean, down in the southern ocean but had been in the Arctic only six months previous.

And last summer we had Clipper Adventurer aground in the Canadian Arctic. We talked about a notice to mariners sent out by the coastguard and sent out by the Canadians to shippers.

And the mariners on the ship didn't have on the chart the new notice to mariners that had this reef -- charted reef, minimally charted but on the chart, well,

should have been on the chart but the mariners hadn't placed it on the chart so aground they were, shifting sands and other parts of the Northwest Passage. So the Canadians are beginning to have a challenge of operating in the Northwest Passage.

We put all these dynamics, these drivers and uncertainties together, and we found that -- and I say we, about 60 people over a year, meetings in Finland and San Francisco, we had some contractor help us -- but governance and the lack of rules or stable rules base situation, vice resource and trade, essentially natural resource development, a connection of the Arctic to the globe through natural resources, are the drivers of marine use and transportation, not necessarily the tourism, but everything else, not sea ice, not sea ice retreat, it's dollars and economics and global connections of the Arctic to the planet.

Unusual complexity here in our

part of the world which requires a lot of what NOAA information has to be provided, and maybe new information particularly oceanographic observations and datum for shorelines, for coastal erosion and all of that.

But for marine transportation, routing and then this is what I would consider the classic case of marine spatial planning to come, is how do you mesh the indigenous uses and the whale migrations with all the other activities that could happen not only in free water but of course in the wintertime.

This is right out of the -- this is AIS data, the marine exchange, a period of tracking ships in the period of May to September through the Bering Strait.

You can see Red Dog Mine and Kivalina. You can see some traffic on the Russian side, lots of traffic east of Little Diomede Island, along the coast, and this is

what I guess John you would use to see where the important places are for new charting.

Of course, Nome is down here. So we have some very interesting data, very useful for not only the charting business and hydrography, but of course, for the marine spatial planning work to come.

USGS, important report, said that about -- there's not a lot of oil in the Arctic but a lot of gas, 30 percent of the undiscovered gas probably on the planet is located in the Arctic.

I put the red dots on one of their chartlets, all indicate they are all coastal, within the coastal, the EEZ of the coastal states, so under the regulatory control of the coastal state, which is very meaningful.

But a lot of the future finds are all coastal, like off Greenland, off the Russian Arctic and off Norway, it's all coastal so it requires a response capability, et cetera.

In the end of this study, of course it had a number of recommendations and we had to package it and market it, and we did it with these three themes: enhancing marine safety is essentially working at IMO; developing a uniformity of governance and particularly for marine shipping; special rules for cruise ships and a SAR agreement.

And this week, maybe today, the Arctic Council is meeting in Nuuk, Greenland. The Secretary of State is supposed to be signing for us a new Arctic SAR agreement among the Arctic states, and that has some implications for the coastguard, but for all of you in NOAA also.

The other --

CHAIR WELCH: Search and rescue for somebody's --

MEMBER BRIGHAM: Oh, sorry search and rescue for the SAR, and having an Arctic SAR agreement, that means some good relationship among the eight Arctic states, a

movement towards a pretty secure and peaceful place hopefully.

And protecting people and the environment, lots of issues, invasive species, many of which are in special marine areas, delineating safe areas and oil spill intervention, a whole host of issues.

And then finally we have a special category for marine infrastructure which includes everything, charts, everything that NOAA is mostly responsible for, and the coastguard, response capability, hydrographic map and ocean data.

I show you this because the United States and the Arctic states negotiated this. So if you talk to the State Department they will say use the AMSA as the guide because we in fact signed up for all this whether you knew it or not.

But you did know it, because in the negotiation phase, the federal agencies that were involved in this, all got a chance

to have a cut on the dynamic of what would be approved by the United States.

Now these are very general and not specific, but they actually are negotiated and approved and so this is a marine policy document of the Arctic Council.

It's a guide for a whole host of players and actors. It's a baseline assessment and but really it's a negotiated text, so it is a very document of the Arctic Council, first one that really is negotiated and approved by the Arctic states.

You can look at marine transport like this or like the media does. You can look at it like this, from continental connections between Churchill and Murmansk.

But for the next 30, 40 years or forever, it's in and out of the Arctic Ocean on a seasonal basis essentially. Some crossings of the Arctic Ocean, we saw some in the last year or two across the top of Russia.

But most of this is not trans-Arctic navigation. It's going up into the Arctic, performing some activity, whatever it is, picked up a -- it might be year-round from Baffin Bay to Europe.

It is year-round already in the Russian Arctic. Summer operations maybe across, but most of it is destinational as we called it in this study, which has implications to the U.S.

We ran a workshop at UAF with the Arctic Council's support, and the highest priority issues in the Arctic are a mandatory polar code at IMO, a polar code that gives us standards of ship construction, and most important, standards for the pilot house and the mariners. That's probably the most important factor.

You can see tracking, monitoring of ships using AIS, search and rescue agreement, indigenous surveys.

If we have -- this one doesn't get

a lot of play, but very important, if you are going to use multiple use management, or marine spatial planning, we really need to know where the indigenous use is, to apply them into this mix of uses and that's tricky.

The next large task force and project in the Arctic Council, supposedly in the next couple of days we will hear about it, is the Circumpolar Response Capacity Agreement, in the next couple of years harnessing the capacity of the Arctic states.

Observing network you have heard about, of which NOAA will be part of it, AOOS is the U.S.-Alaska part.

And I would say, as you go down the road, we need -- if we are going to look at what should NOAA do and what should NOS do in this area, we really need to follow it closely, as you are -- staff are doing, this first one.

How is number eight being addressed, one of the objectives of the

Arctic Ocean policy is, addressing these changing conditions.

The changing conditions are described as, and related to sea ice retreat, when in fact there are no words of economic relationship which is really driving the train for marine traffic.

But that's okay, I mean we can ride under the guise of climate change and sea ice, but it really is natural resource development economics driving the need for marine traffic, most of the marine traffic.

This assessment, again, is a guide for U.S. policy and then of course, NOAA itself, and you passed this out to us, has its own vision and strategy, new, well one of the issues is forecasting of sea ice.

I would say that one missing element in the United States Arctic, we are the only country that doesn't have a sea ice atlas and have put our information together, maybe an interactive atlas would be of the

past, today and the future using IPCC models.

So that's one thing that is missing in it, and an atlas is useful for strategic planning. It's highly valuable for this marine spatial planning. If you don't know where the sea ice is, how are you going to plan out all these activities for safety and marine environmental protection?

Last slide I think, and we will have the discussion I guess after the next two.

CHAIR WELCH: Well, I think --

MEMBER BRIGHAM: What do you want?

CHAIR WELCH: I think probably what we ought to do is, if our other two panelists don't mind, we ought to take a few minutes on this and then each on -- so let me just ask a couple of questions to start off with.

Am I correct that in terms -- let's say that when we say the Arctic, the U.S. Arctic, we are talking about the Arctic

Ocean, in other words north of the Bering Sea. That's what I'm using right now when I ask these questions.

Okay, north of the Bering Sea in the U.S. territory, there are no commercial port facilities.

MEMBER BRIGHAM: True.

CHAIR WELCH: Okay.

MEMBER BRIGHAM: Well, there are coastal facilities along the north slope, but they are minor. There's no real port north of Nome.

CHAIR WELCH: Right, basically when they supply the north slope up there with the barge lift, they kind of beach the barges.

MEMBER BRIGHAM: Come from Seattle, come from wherever, no uptick.

CHAIR WELCH: Yes, they just sort of run --

MEMBER BRIGHAM: Beach -- yes, yes, there are a couple of piers up in the

north slope on the --

CHAIR WELCH: But nothing that you would -- most people would consider to be a commercial port facility, nor are there any coastguard bases up there.

MEMBER BRIGHAM: None. No, Kodiak is the closest air base.

CHAIR WELCH: Right. And the coastguard's icebreaker fleet is what?

MEMBER BRIGHAM: Well, it's really just the Healy, the two Polar classer. The Polar Sea is going to be retired this year.

CHAIR WELCH: So we have one working icebreaker under the U.S. flag that can get up into the Arctic Ocean?

MEMBER BRIGHAM: True.

CHAIR WELCH: And the NOAA vessels can't or don't go north of the Bering Sea?

MEMBER BRIGHAM: They do if it's free water, right John?

CHAIR WELCH: Do they?

CAPT. LOWELL: They have in the

past. They have been up in the Chukchi. They've been quite a bit. Most of the older ships are ice-strengthened. They are certainly not icebreakers. Do not confuse the two.

And both the Rainier and the Fairweather are ice-strengthened A1, E class vessels, I don't know exactly how they match to the polar code --

MEMBER BRIGHAM: What will bring traffic of course to the United States Arctic is not really this idea that there's traffic from Russia or through the Northwest Passage. I mean, there is going to be some, a few cruise ships, some on the Russian side.

It's offshore development brings an armada of ships. For each of the production rigs, after exploration, and that armada of ships could be huge, because each rig, if they are working in the ice to keep the ice away from the rig or reduce its --

CHAIR WELCH: The point I'm

getting at --

MEMBER BRIGHAM: Yes, I know.

CHAIR WELCH: The point I'm getting at is --

MEMBER BRIGHAM: No capability.

CHAIR WELCH: The U.S. government's physical maritime infrastructure --

MEMBER BRIGHAM: Is zero.

CHAIR WELCH: in the Arctic Ocean is pretty minimal.

MEMBER BRIGHAM: I mean, you know, NOAA provides some charts, we have some heard data, data shoreline work and important stuff being done, which is very important.

But for real physical infrastructure, other than providing satellites and getting information, which we have plenty of, about sea ice or whatever, no, there's no real maritime infrastructure.

CHAIR WELCH: It just strikes me as --

MEMBER BRIGHAM: None.

CHAIR WELCH: It just strikes me as exceedingly strange that we have all these people and all these governmental agencies in Washington, they are all excited about the Arctic, and they are not talking about, to any significant extent, where we are going to get the investments to put in government maritime assets.

MEMBER BRIGHAM: Well, the question is, what are those assets required for, why would we need a port? We wouldn't build a port like this here, because who is coming there?

But we need maybe a base for response. If you are going to have offshore development, the response base can't be in Kodiak or down in Dutch Harbor. It's got to be near the activity.

There are no ports except for Nome. Could be dredged. Could have handled offshore supply boats. There's a meeting here

in the next two weeks up in Anchorage, the beginning of the process the Army Corps is hosting with the state on where should the port be.

I am going to -- I think their vision of a port is a grand container port and all of that, and I am going to tell them that it's a response port with a couple of Coast Guard cutters and maybe commercial response, with oil spill equipment.

I mean that's the port of the future for the Alaska Arctic, because all of the ships, wherever they come from, are not stopping in Alaska, they are going to East Asia or somewhere else, and it's a response activity.

So it's not probably an economic generator that people are envisioning, some big meg-transshipment port. I mean, maybe it could be plausible in the future.

But it's more of how do we protect the place and the people and respond to

something that could happen, I mean, but there isn't any true infrastructure today, even communications is shaky. I don't know if you have sailed up there, John, but it's minimal.

CHAIR WELCH: Other comments or questions? No? Michele?

MEMBER DIONNE: So what are the next steps on this vision for the Arctic?

MEMBER BRIGHAM: Well, it's a little tricky. CMTS is -- I don't even know what the acronym stands for, CMTS? Is that --

CHAIR WELCH: Committee on the Marine Transportation System.

MEMBER BRIGHAM: Yes, they deal with it and I talked to the staff and some of those folks in D.C. are envisioning some big port that links somehow Alaska to the world, and I unfortunately tell them, I mean, our vision in the Arctic Council and the work that we did for the State Department is, it's not that kind of vision, although it could

happen I guess.

I think we are working on the wrong stuff, but --

MEMBER DIONNE: So, for the moments things are just sort of working out okay?

MEMBER BRIGHAM: No, the Arctic Council got a new SAR agreement, the Arctic Council is going to have an environmental response agreement of which the United States will be a part.

Stuff is happening in Washington. Gerd probably knows more about it than I do. Not any money, I don't think they have asked, NOAA or anyone, particularly not the Coast Guard, from what I know --

MEMBER DIONNE: For supporting this increase in shipping, it's not -- not adequate supports?

MEMBER BRIGHAM: Well, there is -- well, from the work we did in the Arctic Council, we would say it's not global shipping trade routes, it's more shipping.

Most of it's actually happening in the Russian Arctic and in northwest Europe. There will be some in the Canadian Arctic. And the shipping will be related to offshore development in the United States if we actually drill and do it, which --

CHAIR WELCH: There are people in Washington that think that container ships like what we saw today except bigger, are going to start going through the Northwest Passage, from Europe to Japan and China --

MEMBER BRIGHAM: Tomorrow.

CHAIR WELCH: Which is baloney.

MEMBER DIONNE: For 14 days of ice -- you said 14 days it was open?

MEMBER BRIGHAM: Yes, I mean, it's plausible I think from IPCC models and the upcoming ones, that there could be a couple of month period there in the summer, where it's actually ice-free, whatever ice-free means.

But I think all ships in the

Arctic Ocean in the future will be required to be a polar-class ship of some sort, even low class, because none of the Arctic states including our own are going to allow free water ships sailing around the Arctic waters. It's going to be tough.

CHAIR WELCH: One thing that we saw today, that I think impressed several people because the commented on it, is how that vessel is really part of a very intricate system and schedule and rotation.

And all container ships are like that, even things that are not just going from inner islands to California. The ones that are going across the Pacific Ocean, and all these systems are like that.

And but that depends on you being able to have a fairly stable operating environment in which you can be pretty confident you can make that schedule on a consistent basis, and this, to me it just seems intuitive that business people are not

going to put a system like that up in the Arctic Ocean, anytime soon.

MEMBER BRIGHAM: Well, of course the Russian Arctic, of course they --

CHAIR WELCH: Well, I'm talking about --

MEMBER BRIGHAM: Oh, our side.

CHAIR WELCH: -- the U.S. Arctic.

MEMBER BRIGHAM: Well, we don't -- I mean we have Merchant Marine here but we don't have a global Merchant Marine in the context of the rest of the world, I mean we have something, but I think you know what I mean. It's not -- we are not going to have a new fleet of ships, it could be someone else, Russian ships carrying resources to China, in the summertime again.

It's hard for -- we talked to Maersk, not Steve, but during the course of study we had Maersk strategic planners with us and it is hard to integrate their fleet with the seasonal nature of what the Arctic

might be, even if you have polar-class ships it's hard to do.

Then people talk about transshipment using the Arctic transshipment between Adak and Iceland and a lot of plans out there, a lot of vision. I personally think it's a misinterpretation of actually what the sea ice is.

It's a lot thinner, and there's a lot less of it at certain times of the year, but actually there's still a lot of it in the Arctic so that just as itself, as a barrier to high speeds.

I mean the ship we saw today is doing 27 knots. There isn't an icebreaker in the world that will do twenty -- even the nuclear icebreaker does 23 knots in the ice and we just can't go that fast because the pieces of ice that you create can clean off what you have astern. So it's a tricky thing.

So ship speed, of course, but then people correlate maybe lower missions with

shorter distances across the Arctic. Well, makes sense to us, shorter distance, lower fuel usage, but you better pick when the window of time, so correlating that with your schedules of cargo across the world is a hard thing to do.

I think we will see lots of large ships in the Arctic Ocean, some tankers, mostly bulk carriers, carrying stuff out of the Arctic to the global markets, a little bit year-round, in the Canadian Arctic, and the western Russian Arctic.

But it would be hard to perceive in the middle of the wintertime, year-round transits through Bering Strait, from an economic standpoint.

Physically, you can today probably take a nuclear icebreaker across the Arctic Ocean in the dead of winter, it would probably take you some, probably about two knots speed.

CHAIR WELCH: Now, the Red Dog

Mine, which is this mine in western Alaska, below the Bering Strait --

MEMBER BRIGHAM: No no, it's above.

CHAIR WELCH: It's right above, okay. But it's -- how many months out of the year is there marine traffic to it?

MEMBER BRIGHAM: It's about 60-some days with a -- it's a window of opportunity. It's managed tightly by the Coast Guard. And the ships can only come in free water and anchor offshore, because it's a barge operation.

So part of it is related to season. It's not as extended as it could be because of the weather and storms in the fall or early in the spring.

So it's limited. Could be extended were the sea ice to retreat, maybe that window of time could be extended, but what they do is stockpile what they produce in zinc. They stockpile it there and wait for

the summer to come.

CHAIR WELCH: And then run it out as much as they can, quickly.

MEMBER BRIGHAM: Yes, because we won't allow any non- -- well, we allow free water ships to come in.

CHAIR WELCH: But that is an example of what you are talking about, which is extracting and --

MEMBER BRIGHAM: Yes, yes.

CHAIR WELCH: -- an Arctic resource and then taking it south, as opposed to transit across the Arctic Ocean?

MEMBER BRIGHAM: But the notion of the different global industry, which is in the Arctic and so when you deal with it, is this cruise ship industry. It's a lucrative market. People want to go see the last polar bear and see stuff, last glacier, whatever they want to see, I mean, it's a lucrative market, both ends of the world we know, and is the International Maritime Safety System

up to the task of providing an envelope of safety for all that?

Ships themselves are pretty safe, but there isn't the infrastructure in the Arctic to respond to any -- no salvage in the Arctic within a week of transit.

And people think about --

CHAIR WELCH: Yes, I was up there a number of years ago at this beautiful, pristine lake right up at the Arctic National Wildlife Refuge, and about three years ago some guy taking his float plane in there and flipped it.

Well, here he is in this wilderness area, upside down in the lake and everybody is debating how in the hell can we get this plane out of here, and for all I know it's still there.

I mean, you know, there are just no resources to respond to something like that.

MEMBER JAY: A question about the

-- moving into the Canadian part of the Northwest Passage there, is there any feeling about what kind of -- I mean is there free water everywhere, it's you know, or is there --

MEMBER BRIGHAM: No, there are about eight different routes across the Northwest Passage. It's a set of routes. The shore -- the ones closest to the continent, the one that Amundsen used in 1903 and '06 are very shallow. It's only for yachts and small vessels.

The deep water channels are further north and they are a couple of hundred meters deep, and it's been charted, well we have heard briefings in Canada a little bit, they have charted it, but it's not completely to international standards, the whole of each of the routes.

So they are a real challenge. In Canada, of course, Nunivak and the devolution of some authority to the indigenous people

and the regional people, that will have some impact on the use of the area too.

So there's a lot of internal politics in Canada. Of course you know we disagree with their interpretation of international straits. While we say it's international straits, they say it's internal waters, just like the Russians say it's internal waters over there and not international straits.

That's a difference that probably will never be easily solved. Probably nobody wants to take it to the world court, or the International Court of Justice. Something we will just have to live with.

It's -- but it is interesting, we would deploy, I mean I say, the Coast Guard would, if we have an international polar code. In domestic law, we would accept that polar code and then apply that to our region of the Arctic, to mandate that ships sailing through the United States Arctic waters would

adhere to this international polar code.

How you exercise enforcement and security issues is a good challenge for the Coast Guard in the future, if you have got to have gear to go there and do it.

CHAIR WELCH: Gary.

MEMBER JEFFRESS: Lawson, last year I came across an article by some Danish scientist that pointed out the fact that the ground track for the GPS satellites goes up to around about 52 degrees or something.

Have you heard any concerns about the degradation of the accuracy of GPS up in the Arctic?

MEMBER BRIGHAM: Well, it doesn't work too well at 70 or 80 north where I've been on the Polar Sea. Of course this was in the mid-'90s and so maybe the capability is enhanced. I think not only GPS but all communications are degraded quite a bit when you are anywhere near the central Arctic Ocean, 75, 80 north.

MEMBER JEFFRESS: Right.

MEMBER BRIGHAM: So it's -- I think there are some questions.

CHAIR WELCH: Okay, I think at this point Lawson, this is a good introduction to us to this topic, which we certainly will be exploring in different ways at future meetings.

Also, many of you have met, particularly the new members that came into Silver Spring, Andy Armstrong, who is on the panel, and Andy has a lot of first-hand experience with recent expeditions up to the Arctic and can tell us a lot of first-hand observations up there. We will be able to take advantage of that at future meetings.

So let us go to Susan and Susan is going to bring us a perspective about recreational boating, particularly in the Pacific. So go ahead Susan.

MEMBER SHINGLEDECKER: I've been trying to think a way to segue from the

Arctic to recreational boating, and I think the only place that might have less recreational boating in the U.S. than Hawaii would be the Arctic.

So there's nothing graceful about this transition. I apologize. Just a quick show of hands. How many people in the room consider themselves to be recreational boaters? Great, great. Good to see.

I was going to skip over this real quickly but since I have had a number of questions since I've been here, I am going to go a little bit more into who BoatU.S. is just so that you can understand my perspective, then I am going to go over an overview of recreational boating and boaters nationwide and how boaters interact with NOAA as a whole, and then specifically hydrographic needs of recreational boaters.

And then I will do my best to tell you a little bit about recreational boating in Hawaii. Joyce has been wonderful yesterday

giving me a little bit of a tour of some of the harbors.

I also spoke with our Vessel Assist captain here in Oahu and a couple of marine surveyors, the guys that survey the boats, not under the water hopefully, to get their perspective as well.

I grew up boating on the Great Lakes and the Chesapeake so sadly I don't have much first-hand experience, but I will work on that.

So who is BoatU.S.? BoatU.S. is the Boat Owners Association of the United States. We have about a half a million members around the U.S. who are recreational boaters.

Many people will say we are kind of like the AAA for boats. We provide membership. Through that membership, members get discounts at marinas, on fuel, transient slips and service.

They get premium discounts at West

Marine. We are a leading boat insurance company. We are the largest towboat fleet in the country.

On the east coast we are called TowboatUS. On the west coast we are called Vessel Assist, coming to the assistance of recreational boaters throughout the country. We also have inland coverage as well.

We also do on the road towing. If you are trailering your boat and your boat breaks down, if you call AAA they are probably going to leave your boat at the side of the road and take care of your car, and in case we insure that boat, we want to make sure that boat is not left at the side of the road.

We have a consumer protection bureau that looks at problems with boats and kind of is an advocate for boaters when they run into consumer problems.

We have a government affairs department and where I actually reside is in

the BoatU.S. Foundation for Boating Safety and Clean Water.

Obviously boating safety directly interacts with a lot of the hydrographic services provided by NOAA. I run all of our environmental efforts, everything from oil spills to sewage.

The foundation does a lot of -- we are really the arm that really educates recreational boaters how to be safer and how to be more environmentally conscious with their boating.

We offer a nationwide, online boating safety course and we are really an education resource for boaters. We are actually in the process of developing new advanced online courses for boaters, and this -- the last two days have got me thinking a little bit more about partnering with the power squadrons and some of the groups that offer navigation and charting courses for recreational boaters and how we can take

those online and make them more accessible to more boaters, is something that I had been thinking about in that area.

So who are the nation's recreational boaters? There are 17 million recreational boaters in the U.S. and that is one in 10 households owns a boat.

In 2009, 75 million adults or 32 percent of all adults went boating. I think that's a pretty fantastic number, I'd love to see it go even higher.

The most interesting bullet on this slide I think is that 79 percent of boat owners have an average household income of less than $100,000, and that's not the picture that Hollywood portrays of boaters.

I think the average sized boat in the country I believe is between 17 and 19 feet. So when you are talking the first day about the kayak charts, yes, those are the charts that some of those guys are needing if they have a chart on board.

Just a little snapshot of recreational boating and the economy. You know obviously we are not the kind of thing like the container ports are, but in 2009, over $30 billion was spent on sales and service alone.

I won't read through all of it. You guys can read pretty well I'm sure. But recreational boating does have a significant impact on the economy and on jobs.

Recreational boating especially impacts a lot of small businesses. A lot of the marinas and the service yards and the manufacturers, a lot of those are actually really small businesses and can be real drivers of the economy, especially at the local level.

This is an interesting snapshot once again, talking about the size of boats. And I put this up here to kind of give a perspective because Hollywood and the glossy magazines including the ones we put out like

to portray -- you know we like to show the pictures of the really pretty boats.

But this -- non-motorized boats represent -- this is registered boats in the U.S., so obviously there are a lot more non-motorized boats than are up there, but most states do not register kayaks and non-motorized boats.

So that number is actually larger in total. Forty percent of the boats are under 16 feet. And 47 percent of the boats are between 16 and 26 feet.

So really only six percent of the vessels are 26 feet and larger, and I don't think that that is the common perception of most boaters.

And I'll just run through, I'm lacking in pictures, so I'll run through a couple of pictures here. This is your boat under 16 feet, you know, and I don't -- I'm pretty sure these guys don't have a paper chart aboard. I am hoping they have life

jackets aboard. You know, your personal watercrafts.

Your boats 16 to 26 feet, oftentimes these are trailered boats kept in driveways, you know the family fishing boat, some on lifts, your small racing sailboats, that kind of thing.

And then this is getting up into the category of boats that you are saying oh, okay, yes, that's the boat I see in the magazine.

Well once again, here we are down to, I believe this was the five percent category of boats in the country.

And then you know, your nice boats over 40 foot. These are the guys that are going to have your more modern chart plotters, and they are going to really have that kind of data on board for more distance work.

Just, we were really fortunate. A week and a half ago, two weeks ago, Dr.

Lubchenco and some NOAA staff came to BoatU.S. headquarters for a marine debris project I work on, and I was talking and trying to think of all the ways that NOAA interacts with recreational boaters and we really had this epiphany that recreational boaters actually interact with almost every line office of NOAA in one way or another.

That first line, I have never had a line of a slide that was all acronym, I really apologize for that. This just kind of looking at the different line offices of NOAA and where recreational boating fits in with the National Environmental Satellite, Data, and Information Service, that's where the search and rescue satellites are housed, and EPIRBs are emergency positioning indicator radio beacons.

These are basically your beacons if you go offshore, you are outside of radio range, this is how you let the Coast Guard know you need help and it's NOAA that

maintains those satellites.

The BoatU.S. foundation actually rents these devices at a low cost for boaters, $50 a week for those boaters that can't afford to own one. We make that service available to them for a lower cost.

We register all our EPIRBs with NOAA and then when they go off, which does happen about once a year, we get a call from the Coast Guard and it goes through our 24-hour towing dispatch so we are able to provide really accurate information on the type of vessel that is in distress, how many people are aboard, that kind of thing.

Obviously, we work closely with National Marine Fisheries Service on any recreational fishing issues and issues related to protected species.

The National Weather Service is a huge component for us, as far as representing recreational boaters but also as a boat insurance company, we are really interested

in those marine forecasts and the hurricane forecasts.

As an insurance company, if you are insured with us, and your boat is in the cone of a hurricane, there are certain steps that you have committed to put in place.

Every one of our insureds has a hurricane plan if they are in a hurricane area and if they fail to put those procedures in place that they have committed to, that changes their deductible, should they have a loss.

So from a business perspective, that's very important to us. And then also on the research side of things, looking at invasive species, hurricane research, observing systems, all of that.

Now to the office most of you care about, NOS, I mean the list could just go on and on and on. You know, charts, tides, currents, water levels, ocean observing systems, marine protected areas, marine

spatial planning, oil spills -- we did a fair amount with working with recreational boaters on the Deepwater Horizon and making sure they were educated on where they could go, where they couldn't go, and how to kind of stay out of the way, frankly, and marine debris.

And it seems to me when looking at the three offices served by the hydrographic panel, depending on your size of the boats, if you are a larger boat, yes, those charts and having charts of areas that recreational boaters go to, beyond just the deep water harbors, is really important and especially from an insurance company perspective, we don't want those boaters to run aground either.

And then for the smaller boats, I see a lot of the CO-OPS products and the water and weather observations, the tides, the currents, as really vital to them.

While they may not rely on the charting products, they are possibly more

vulnerable to on-the-water conditions being a smaller craft. So those products are really vital to that larger population of small boats.

So that brings me to recreational boating in Hawaii. There are roughly 15,000 registered recreational boats in Hawaii, that's less than one tenth of a percent of all registered U.S. boats, and also I have heard anecdotally that per capita, Hawaii also, per capita population, has the lowest number of recreational boats per capita.

I don't think I have to tell you, if you were on the bus this morning, that the boating infrastructure in Hawaii is in disrepair, and every single one of our stakeholders that I have talked to to get information about recreational boating in Hawaii, has said the recreational harbors are just in shambles.

And I mean I don't know about you, but I am not going to go and spend a whole

bunch of money on a boat and put it somewhere where it is not going to be safe.

And then if there isn't adequate infrastructure, if there aren't adequate slips, how can you go out and buy a new boat, if there is no place for you to put it? And so that's really concerning when you see how can this market grow here.

Our tower tells me that the boats here are older and larger than the national average and that's not too surprising. I mean, recreational boating in Hawaii is kind of like jumping in the deep end of the swimming pool.

It is probably good that they have larger boats than the national average, and the older part doesn't really surprise me just because of the distance to get here and once a boat gets here it probably doesn't leave once it gets beyond a certain age.

And the type of boating people do out here is just different because I mean,

there's deep water so from a charting standpoint, for the recreational boats, I haven't heard much concern that oh, there's areas that need to be recharted from the recreational perspective, no.

The water is pretty deep. But it's the open ocean, the big swells, you know, you better know what you are doing if you are going out pretty far. Unless you are just tinkering around the harbor for Friday night races, you need to have some serious knowledge or you are going to get in trouble pretty quickly.

Our Vessel Assist Captain in Oahu, I believe he has been here now two or three years. He was going to try and join us but I am thinking with how windy it is, he might be out assisting someone right now.

He said he has seen his business grow and he feels that there is an additional sense of security by having a recreational towing assistance provider in the area, that

people know there is a little bit more of a safety net. So that's nice to hear.

As Joyce mentioned, there's few safe harbors. If you go out and you get in trouble, it's not like the Chesapeake Bay where you can just tuck in wherever. You know, you are really exposed.

She was telling a story about a couple actually from Chesapeake Bay that had chartered a boat and pulled into one little harbor and just figured there would be a restaurant right nearby, and kind of like the Arctic, that isn't the case.

So that's some of the reasons why recreational boating is just different and even though it's an island state, it's not full of recreational pleasure boats.

So as far as -- like I was saying, relative to NOAA products, the water gets deep quickly, the charting is pretty good with the exception of maybe a few small harbors, and I can get the names of those if

you are interested.

And the one thing, a lot of the stakeholders I talked to, they just really praised NOAA's work on the tsunami warnings and I know our tower, he got his boats out of the harbor, went pretty far out, and he said he never even felt it go by.

So, but he has been pretty busy, I think in the harbor that we saw immediately after Madison, raising some of the sunken vessels and trying to be part of the solution there.

CHAIR WELCH: Okay, Susan thank you. Comments or questions to Susan on recreational boating?

John?

CAPT. LOWELL: Yes, thanks, Ed, actually I liked your presentation there Susan. Obviously recreational boaters is an area that we typically don't put the resources behind that we probably should. But you know all the reasons for that. We are all

just resource-strapped.

To address that, I just want to bring up a couple of quick things, is we do -- we have recently put online our booklet chart product which is really the ability of anybody, anywhere to download any of our charts in 8-1/2 by 11 format and they can print it out and they have a fully, basically it's a somewhat cut up, chopped up, but fully updated nautical chart, and it's available free on the web.

We have also -- are starting up a relationship with chart vendors, so that they can put some face on the front of that should they want to, on orders perhaps, simply provide that as a product that they could put their stamp on it.

This is not for navigation but it's certainly a good situational awareness type product that was put in place specifically for the recreational boaters.

So they didn't have to buy a $20

big chart, they could simply get a little booklet chart.

MEMBER SHINGLEDECKER: That's great.

CAPT. LOWELL: So that's out there and it's online right now. I do want to get the names of those small harbors from you, so thank you for that. And if you would, obviously the towing industry for recreational boats is something that has developed over the last, I guess, maybe two decades. Can you quickly for the panel, review the relationship and the difference between the commercial tow, such as your service, and then the Coast Guard's role?

MEMBER SHINGLEDECKER: I'll do my best. I don't know the ins and outs exactly. I believe that the Coast Guard is only going to come and get you if life is on the line, and if your life is not on the line, they are not coming to get you.

So we come if it's -- and

sometimes even the Coast Guard will come and bring them in and they will cast them off to one of our towers once they are closer in and see that the immediate danger has passed. I think it was just determined that that wasn't the best use of taxpayer dollars.

And one of the things I wanted to point out, that just from a -- I was really pleased when I learned that as a company, BoatU.S. and TowboatUS' interests are aligned with that of the public and that of NOAA and Coast Guard and such that when one of our members gets towed, if someone gets towed, if they are not a member, they are paying the full cost to our tower.

If one of our members gets towed, we are paying the full cost to the tower. The tower gets paid regardless. But so as an association, it's in our interests, we don't want to pay for that, we don't want to have to pay for tows.

So we want to do everything we can

to make sure our boaters are educated about, that they have up to date charts, that they know what they are doing when they are out there, to avoid that situation.

I was recently talking with someone from Sea Grant and they thought well, you know, maybe you want people to get towed so then you make money.

And it's not -- that's not the case. We do not want to have tows. So it's -- I appreciate that our interests are all aligned in that manner.

CAPT. LOWELL: Okay. Thank you very much.

MEMBER HICKMAN: I can tell you that a business partner of mine has a recreational boat in Galveston. Tow was $500. Had he had his membership up to date, which had just expired, it would have been fifty.

And the operator he was trying to impress wasn't impressed. He wasn't impressed at all.

(Laughter)

MEMBER SHINGLEDECKER: It seems to me that you can't get towed for less than $500 almost anywhere, because you are paying for the time and the moment they leave the dock until when they get back to the dock.

Our basic membership covers a small amount of towing, and then we have up to unlimited towing for like $130 a year I think in coastal areas.

MEMBER CAROTHERS: This is Jeff Carothers. Susan, we had a customer that we helped rescue then he immediately got stranded on the beach.

But I think what I am hearing that I like a lot is the comparison between the Coast Guard and that is kind of what we were talking about yesterday. Where does the user start paying a little bit of money rather than the government paying the money.

I don't know where it leads us, right now, but I mean, your company is a

perfect example of where the Coast Guard doesn't have to do that work.

CHAIR WELCH: There were some pretty heated Congressional debates back in the early 1980s as to exactly where the line should be between private towing companies and the Coast Guard, and I think there still is a fair amount of discretion to Coast Guard officers, of you know, if somebody has run out of fuel and the weather is good and it's daylight, obviously the Coast Guard is going to say either you or we will call the local private towing company.

But there are a lot of Coast Guard officers who are loath, even if the weather conditions are okay, to leave people bobbing out, you know, their boats bobbing out in the water, if darkness is approaching.

So you know you might say there really isn't a life-threatening situation, but if it looks like that vessel is going to be out there in the dark, I think in many

cases, the Coast Guard will go out and get it then.

There's quite a bit of discretion given to whoever the local Coast Guard commanding officer is in a situation like that.

MEMBER SHINGLEDECKER: From everything I can tell, there is a great amount of cooperation between the Coast Guard and the towers in terms of who is responding to radio calls, who is hearing what, the relationship seems pretty good.

CHAIR WELCH: Susan, as you move to the higher, the larger end of recreational boats, is there any kind of legal requirement on those larger recreational boats to carry charts, like there is for commercial vessels? And where is that delineation?

MEMBER SHINGLEDECKER: There is a threshold. I don't know it.

MEMBER J. MILLER: I think it's Class 2 boats. We were required to carry

charts on our boat. It was 48 foot. We have recently sold it. I used to be a BoatU.S. member.

MEMBER SHINGLEDECKER: I think I remember hearing above 45 feet.

MEMBER J. MILLER: Yes, I think that's what it is. We certainly are required to carry it on our 25 foot survey launch that -- so.

MEMBER SHINGLEDECKER: I think it's interesting in looking in the context of the panel of we have done some tests on different phone apps and things like that, and I would be interested in having you know, a meeting that focused a little bit on that chart of the future, because you know, even those little -- even the bubbas in that little fishing boat, you know, they might have a smartphone that could access some information. It's kind of what you said, it may not be the most detailed, but it might be able to give them the information that they

needed.

And so finding ways -- what people can get on a smartphone nowadays just really amazes me, and that for the recreational boater, that's really accessible technology.

MEMBER DIONNE: Just a comment about the guys out in the marsh area, you can get lost easily in a marsh like that at low tide. You can't see where you are and probably the charts aren't detailed enough to tell you how to get out of there, but if they were, and you had your position, you could do that.

MEMBER J. MILLER: Yes, one thing, in '98, we went down the intracoastal waterway, and it was before NOAA had the flipcharts, but there were commercial ones available, and they were just invaluable in being able to control your chart.

I mean you were going down a long, linear waterway, and they were really excellent tools. You know, we had the big

chart and everything, but it just was really hard to handle and those waterproof flip things are really a good product for that kind of boating.

MEMBER SHINGLEDECKER: The foundation has actually tentatively scheduled -- we test various products, usually about two a year, and on our list, probably in the next year or two, is various ways to access charting products, in looking at different commercial products as well as you know, free products, government available products, to see, you know, which applications work best for different types of boating.

CHAIR WELCH: Gary.

MEMBER JEFFRESS: John, I got a question for you. Has like Google shown any interest in like getting all your electronic charts and putting them out as a layer in Google Earth or Google Maps? And would you do that?

CAPT. LOWELL: Actually a number

of aggregation-type websites do that right now. Google has approached us on bathymetry but they have never approached us on you know, like raster, a quilted together type of a product.

But that exists in many, many different websites right now. As long as they don't put the NOAA logo on there, it's once again, the data is all freely available and they can do it.

MEMBER JEFFRESS: Wouldn't it be better if you left the NOAA logo on it?

CAPT. LOWELL: Then they can't use it for commercial purposes. That is actually a registered trademark.

MEMBER JEFFRESS: But if they are giving it way for free, it's not for commercial purposes.

CAPT. LOWELL: If they are charging somebody to access that quilted data, then it's -- they are making money out of it. There are a few that are doing that

though.

MEMBER JEFFRESS: I'm sure they could figure out a way to take it off for the lines of their charge and leave it on for the rest of us.

CAPT. LOWELL: People are very inventive, yes.

CHAIR WELCH: Lawson?

MEMBER BRIGHAM: Just a quick question about it. I know you have an effective relationship with the Coast Guard, the Coast Guard is -- the active duty Coast Guard and the reserves and the auxiliary, I wonder if the Coast Guard auxiliary, how your relationship is, and if you overlap in training programs et cetera?

MEMBER SHINGLEDECKER: I think we have a great relationship with the auxiliary. A couple different services we provide for them. We provide online education but we also provide what we call our course line online.

It's a tool to help anyone find

in-person boating safety courses. You can go onto our website and enter a zipcode and you can find a boating safety course in your area, and we put all the auxiliary courses into that.

We do provide some free brochures and things like that and the auxiliary seems to love that, to take out to boat shows and things like that.

We have -- I'm saying we, this is all the foundation -- the foundation has a small grants program that we provide grants of up to $4,000 to small, volunteer-based groups around the country, to do boating safety and environmental education to their stakeholders.

We just -- this year we are doing Pepsi Refresh style. We are going to have online voting on Facebook and you, the public can choose who we fund.

But there are a number of flotillas that are in there with their

applications. I believe that this year we are going to be a partner with the Vessel Safety Check Program as well, BoatU.S. on a corporate level sponsoring, getting auxiliary and power squadron folks out working with the public, inspecting their boats for mandatory required equipment, things like that.

So we do a number of things with them.

MEMBER BRIGHAM: The Coast Guard auxiliary are an extraordinary volunteer organization integral to the boating safety of the country.

MEMBER SHINGLEDECKER: Absolutely.

MEMBER BRIGHAM: And kind of amazing that it's all voluntary. There's 40,000 Coast Guard auxiliaries I think, I'm not sure of the latest number, but a lot of people.

CHAIR WELCH: Yes, did you have a comment John?

CAPT. LOWELL: I actually, it was

a follow up on one of the comments that Susan just made having to do with iPhones or that type of a thing.

One thing we did two years ago, or maybe it was three years ago at this point, is we -- all of our charts have been available free on the web for many users for quite a while now.

But one of the things we did two years ago is we created a product catalogue that is computer-based, XML catalogue that allows these ECS electronic charting system builders, the people who write the software, you know, the Rose Points, Captain type programs, to easily integrate in an automatic way, to reach out to our website, look to see what has been updated, what has not been updated, and download specifically only what they want, and it's all in an automated format at this point.

And we noticed maybe about a year ago now, that we had a big spike in

downloads, and we were kind of scratching our heads going well what the heck happened there?

And almost the entire spike, which was probably about 10 million downloads, was attributed to iNav net. So somebody had created an app for an iPhone and then everybody downloaded that, you know, for some reason, and then immediately started downloading the charts.

And so we just got a big spike in one month and it was all for navigating on -- well I don't know what they are navigating on the iPhone, but they are certainly downloading a lot of charts.

And so we kind of -- every once in a while we check to see how many charts iNav has been responsible for.

CHAIR WELCH: We had, about three years ago, when I first came on the panel, and I'm sorry Susan, I'm forgetting the gentleman's name, but one of your leaders

from Florida who used to write the column in the BoatU.S. magazine and passed away about a year ago?

MEMBER SHINGLEDECKER: Chuck Husick.

CHAIR WELCH: Yes, he made a presentation to one of our meetings in Florida about asking for the panel's help, actually with regard to the Federal Communications Commission and AIS systems.

Now, you saw automatic identification systems on the bridge of the container vessel we were on, but there are much cheaper, less sophisticated versions of it that provide lots of information for recreational boaters, and the FCC was being slow in giving some kind of regulatory approval that would make those things more accessible to the recreational boat community.

So he came and made a presentation and we debated whether it was appropriate for

our panel to contact the FCC but I think eventually we decided, hey, you know, what's anybody going to do if we did, so we did.

Because those simplified AIS systems, AIS B systems, are much -- even though they are relatively unsophisticated for a commercial mariner, they can enhance safe operations of recreational boats.

And there's -- I think there has always been at least one active recreational boating person, member, chosen for the HSRP and many of us know Elaine Dickinson who just finished her term, and so Susan, we are glad to have you fill that role as part of the panel.

MEMBER SHINGLEDECKER: Thank you.

CHAIR WELCH: All right I think perhaps now it's time to go to Joyce Miller and have Joyce make her presentation to us.

MEMBER J. MILLER: Okay so back to the Pacific from the Arctic, well, we were in the Pacific with the recreational boating --

I put in the title, I added to the title -- the title that the HSRP sent me was how can NOAA navigation services support coastal science in the Pacific, and I put management there because it's virtually impossible to separate the science and the management. Without sound science you can't do management.

And so I put that in just to remind, and I'll come back to it in the talk.

The primary drivers for mapping out here in the Pacific region, Pacific Islands region, Coral Reef Conservation Act, they somewhat I would say optimistically in the National Action Plan to Conserve Coral Reefs, said produce comprehensive digital maps of all coral reefs in the U.S. states and Trust Territories within five to seven years. Notice that was said in 2000.

And David Kennedy was head of the coral program at that time. The Magnuson Stevens Act, a variety of things in the

fisheries realm, the Essential Fish Habitat, EFH, HAPC, ACLs, Endangered Species Act, if any species is declared endangered or threatened, you must define a critical habitat.

So it's very hard to -- these are management acts but you have to have the science behind it.

Back to the Pacific Islands, one of the things that occurred to me after I finished the presentations pretty much after the panel this morning, was to define -- I'm going to be talking about benthic habitat mapping and so the question would be what's the difference between benthic habitat mapping and charting?

And I would say, primarily two things: time and tides. Out here in the Pacific, vast and remote, 50 islands. In the state of Hawaii, and then the Northwest Hawaiian Islands, which are also a monument and a World Heritage Site -- the main

Hawaiian Islands here have, I believe eight permanent tide gauges.

There's been a tide gauge at Midway and a sea level gauge at French Frigate Shoals half way up the chain. There's one tide gauge in Guam. There's one in American Samoa.

With that level of tide control, it's very, very difficult to do actual charting without the underlying tide stations that you need.

You rely on predicted tides. So in this region, in the Pacific remote islands, that's also a monument declared in 2009 I believe, Samoa, there's the Rose Atoll, and in the Commonwealth of Northern Marianas there is the Mariana Trench Marine National Monument.

Because of this, these acts and the realities of mapping, the mapping that has been done over the last decade, in the Pacific region has been very coral-centric,

basically looking at zero to 150 meters.

It has been very remote and that means dedicated ships and launches are just absolutely critical for it.

And also, I set up on the coral-centric side, whereas Michele over there in Maine, has a lot of estuaries and that type of environment, this is what we have been surveying a lot of times. This is Uracus, active volcano up in CNMI and these are landslides.

And so these are very steep, it goes deep very quickly in many areas, even around some of the coral atolls.

So back to habitat maps. To make habitat maps, you are looking at a variety of things. First of all, you need the baseline data, collected in a reasonable manner, and here I'll come back to the tide.

Habitat maps -- or not to the tide, but the time it takes -- habitat maps, you don't necessarily need 100 percent

coverage. You can, to some extent get by without it.

To map just as an example a small harbor in Saipan, we mapped for a habitat map in about six hours and we spent two weeks doing a chart of it. That's the difference between what it takes to do habitat mapping and what it takes to do charting, complete coverage, resurveys et cetera.

Then the other thing, habitat maps, a lot of science is down out here by the fisheries science center and by the coral program looking at the species. And then you look at the interactions.

All of this put together and you hopefully come out with a reasonable habitat map. I won't read all of these. The first four have been very important for the benthic habitat maps that we have been doing.

Identify where the coral resources are and from a scientific standpoint, it's important to design statistically valid

random stratified sampling, biological monitoring protocols, for fish, for corals, for whatever.

And these protocols are based upon depth and bottom types so you can see if you don't have either of those, it's going to be very hard to create a statistically valid sampling plan.

The maps also support site locations for biological and climate change monitoring, and the design and evaluation of the MPAs.

And then the rest of them are more specifically management-orient. A lot of this has to do with Magnuson and the Endangered Species Act.

And then down here, there are very specific management needs that then come into it and Dr. John Rooney will be here from the Pacific Islands Benthic Habitat Mapping Center tomorrow to talk more about management needs.

What does it take? A lot of data. One of the first things the coral program did was they collected at that time, 2000 to 2002, ICONAS. Now there's GOI satellites world view that Dr. Polhemus talked earlier.

And they created shallow benthic habitat maps in this area. That does not necessarily give depth. In some cases, very limited, if the satellite data are good enough, you can get what we call estimated depths.

They do not replace solid bathymetry data that you need to get with either LIDAR bathymetry or launch-based in the shallow waters.

Typically LIDAR goes down to about 30 meters in Pacific waters. A lot of LIDAR people like to claim deeper, but I haven't found it to be the case very much.

We have done a tremendous amount of launch-based survey. One of the things in these very steep areas as you can imagine, it

is very dangerous to get in these real shallow areas, and it's very time-consuming.

So that's the reason the combination of the LIDAR and the launch-based multibeam is important.

And then the ship takes the deeper data, and one thing that a lot of people miss in all this, is this is all -- we are talking imagery or bathymetry, the optical validation without it, these are acoustic and optical sensors up here. They don't really tell you what the bottom is. It takes observations.

Divers, in less than 30 meters, AUVs, ROVs and sonars in the deeper waters. That's a tremendous amount of data needed.

We have been very lucky in the Pacific. We have a variety of resources. On the upper left is a UH boat, the Kilo Moana, she has two sonars.

In the upper right the -- I'll just say K-O-K, we saw her out at the harbor today. She is a -- she supports submersibles.

And then a variety of NOAA and university assets down here, the Hi'ialakai, and the small boat, the 25 foot launch, AHI, have been the two workhorses.

Hi'i carries two very capable sonars and the AHI has a dedicated multibeam. We have also used that multibeam on the Oscar Elton Sette. She is more a fisheries boat but she supports a lot of diving.

The Okeanos Explorer, which is from the ocean exploration group, has done some mapping out here, and then these are just two examples, this is a sea bed AUV and a towed camera system.

From these different sensors, we get a variety of products. And these are not -- this set of products is not what you call a benthic habitat map. It comes from primarily either the sonar -- primarily the sonar, and it gives a bunch of what we call derived products: hard-soft maps, backscatter, this zoning is a feature map,

ridges, valleys, bathymetry, slope, rugosity, and then a small amount in many cases, a very minor amount of the optical data to ground-truth some of this.

However, to really get to a full, integrated mapping product from zero to 150 meters, you need almost everything: satellite data; bathymetry, hopefully complete bathymetry from zero to 150; and dense optical ground-truth data. Only then can you really come to the picture on the right, which we call a seamless benthic habitat map.

This comes from a report that a group that I was part of has worked on for the last year, NOAA mapping accomplishments and unmet needs. This includes both the Pacific and the Atlantic Caribbean because this report covered both. I am not going to go into detail.

What this graph shows is that in the Pacific, we are heavy on MPAs. In American Samoa and CNMI/Guam it's less than

10 percent. Otherwise there's two areas that are under 100 percent protection. In the Atlantic/Caribbean it's 74 percent.

It also shows the difference between approaches in the Pacific because we have had these multibeam assets, we have really concentrated on bathymetry and that derivative product.

And as you see we have very high percentages everywhere except the Northwest Hawaiian Islands. We have got over 80 percent mapped in most places, the PRIA is 70, whereas in the Atlantic/Caribbean, that's 14 percent.

However, total Pacific, because size-wise the northwest Hawaiians dwarfs everything else, our only total is about 38, so overall we have got about a third of the coral reefs of the United States mapped in a decade.

And I wont go through the details on the products. It's just the

Atlantic/Caribbean has concentrated more on fully integrated products in small areas, whereas in the Pacific we have concentrated more on bathymetry and large areas and are now switching to the more integrated products.

The integrated ocean and coastal mapping we have been a part of for a long time, basically since its inception, and I have to say, I was just really very sad to see Roger -- after 10 years they are finally getting a budget in 2012 and it was really sad to see him pass away.

But in the state of Hawaii and first of all, I said it's coral-centric, and this gives you an idea of what it takes. These figures are for the United States overall, so Atlantic/Caribbean, Coral Reef Conservation Program invested $26 million in the last decade for mapping, and other NOAA groups such as Coast Survey, OMAO and external partners have contributed about 37

million.

So that includes ship time and things like that. So a total of, what's that $53 million has been spent to map, let's see, well, a third of the coral reefs. So that is about a third of 40,000, however many square kilometers that is.

And by the way those were all in square kilometers. So partners here, University of Hawaii, the Pacific Islands Bethnic Habitat Mapping Center which is a joint NOAA/UH concept, as well as the Joint Institute for Marine and Atmospheric Research.

And there is also a group, Hawaiian Mapping Research Group. And I would point you -- I forgot to put on these slides the websites. All of the bathymetry that has been collected in the Pacific, except for the last six months, is available in gridded from on two websites.

And so -- and the data that the

habitat mapping center has collected has already been turned into NGDC and so there's just a tremendous amount of data there.

So state of Hawaii, DLNR, and DBEDT, there have been some surveys, they showed the -- the guy from ESRI showed the cable routes. That was a joint project.

Dan's here from Naval Oceanographic. We have done a fair amount of work with Naval Oceanographic in the Mariana, sharing data there.

NAVFAC, Military Sealift Command, USGS, Army Corps is here, I'll say a bit about that in a future slide, Fish and Wildlife Service, and then a lot of local and state agencies in the Caribbean and Florida.

NOAA collaborators are legend here. The Pacific Islands Benthic Habitat Mapping Center has worked with the Office of Coast Survey. We had the small boat asset in Saipan, Tinian and Rota, and Coast Survey came out and joined us, and we spent two

weeks mapping those harbors.

Two years ago, they sent representatives out and mapped Honolulu Harbor, as we were -- I used it in some training for our group as we were readying for the cable survey.

Coast Survey and OMAO have also shared with us excessed equipment. Our sonar is older though still very functional. But having a backup in your pocket is a big deal out here.

So they had some excessed equipment and have sent it out to us. The monuments, sanctuaries, you can read it for yourself, there's just any number of NOAA agencies that have been active in mapping out here.

And one of our big challenges is keeping all this data together. We have five different synthesis efforts going. And these grids are huge.

So what's missing? I wanted to

show this slide when the fellow from the monument was talking. This is the central section of the monument, this is UTM zone 2, it's a third of the monument waters.

You see these big areas here. In 2002, we mapped a lot of the boundaries on the university ship, these sort of doughnut things around them.

In the center, you see some estimated depths from satellites and then the rest, these are all shallow banks, shallower than 50 meters, these are huge areas. This is probably about 500 miles wide, and it's the boundaries are -- Dan, 50 miles out?

Yes. And so -- and just to give you an idea, we have spent about two months with ship and small boat, this is French Frigate Shoals, surveying this area and this ring out here.

So that gives you some idea of -- we have an estimate, to finish the multibeam mapping, without the LIDAR, so in greater

than about 15 meters, about a year's worth of survey between boat and ship. So it's big and it's just -- and as Dr. Polhemus was saying earlier, there are plans to get upgraded satellite imagery. The existing imagery is often of very, very poor quality, and there is under way a plan for bathymetric LIDAR as well.

Probably not until 2013, okay. So that's huge for this group. This is the main Hawaiian islands. Looks pretty complete, I mean, it gets kind of scrappy out to the edges.

And I will say, this is a synthesis effort that the university, the Hawaiia Mapping Research Group, this is also online in a 50 meter grid, and it is used widely.

But what's missing here often, you don't see it in that big blow up, this is a map I sent to Army Corps a couple of weeks ago, they need to survey Mahukona here for

possible piers. They wanted to know what data was there, but that big 50 meter grid doesn't really show you the detail you need for shallow mapping.

So this is Army Corps LIDAR. This was a line we ran with a small boat as we came down that -- and we were trying to follow the 20 meter contour in very rough water so it's kind of snake way, and then this is the offshore.

In the main Hawaiian islands we have LIDAR in most areas. The only other place that we really have a lot of LIDAR, there is some in Saipan, some in Guam, and a little bit in Tinian.

So in most places, we will have what we call the bathtub ring, and that's a ring of data here in the shallow water that is important for management, that has not been filled, and really can't be filled by a ship. LIDAR can only get so deep and so launch-based multibeam is about the only way

to go after that.

This is Saipan. Again, we have got the bathtub ring. We have done a lot of work. This is the raw data, the deep blue is deep bathymetry, the light blue is 30 to 150, and the very light stuff is in less than 30 meters in the lagoon, and this is one of the bigger lagoons in the Pacific.

And so the red and, you can't see it very well, and yellow dots are the optical data. So this has been combined into a bunch of different products -- like I was talking about, shallow habitat maps, deeper coral cover maps. But the basic fact is in the shallow water that is so important for coral conservation, there's -- we are missing key elements of the data.

And so finally, this is a reiteration of many things that you guys have heard me say, and I would say I am not just saying NOAA navigation services, it's more NOAA overall.

Because we need -- we have to have ship time to do this work. There's just -- the small boat can do a little bit from shore base, but it's deep and nasty out there and you really have to have a ship for support.

So ship time, the fact is, it's steadily shrinking. The budget process is very uncertain. And it just, it makes the future of getting the other two-thirds of the corals mapped very uncertain.

Also, we have different assets, the small boat, the other equipment, the AUV and so forth, as everybody knows, funding for everybody is going down, and we are really hoping to -- we have used the boat for many different purposes, we have used the equipment for many different purposes, but we really are looking to form partnerships to better share the cost of maintenance, not necessarily use, but just keeping those things maintained so they remain assets out here.

And that is very much, and I would ask what I think Michele said something about different partnership methods, one of the things that has been the case out here for a long time, we have done some collaborative stuff, often through the university, but one of the really, really difficult problems is sharing, even if you have three groups that need a survey in the same area, getting funds in between those groups is sometimes impossible.

You know, to do a small project, you have to have six to eight months of negotiation to get a contract in place to do it, and that makes it very untenable.

So there's -- I actually did this survey. These are the conditions we survey in. This is the north coast of Molokai, Pelekunu I think is the valley. Those are 2,000 foot sea cliffs, and there's some pretty impressive surveying out here.

So questions or suggestions, you

know, of how to get things done like this. You can -- you know if you have got an asset in a place like this, I know the commercial folks often really hate to hear oh well, you know, NOAA can do it because it will -- it's just that I mean, truly, the assets will go away and the personnel will go away if there's no funding.

There's just no way to run it anymore, the small boat takes about somewhere between $60-80,000 a year in maintenance. That's how it is.

CHAIR WELCH: Okay, thanks, Joyce. Comments and questions?

MR. MORRIS: I have one. The data that is --

CHAIR WELCH: You might want to talk on the mic for the reporter.

MR. MORRIS: Oh, I'm sorry. The data that is collected for your programs, does it meet the quality requirements to go in the nautical charts produced by Captain

Lowell?

MEMBER J. MILLER: Actually, Kyle, how many charts have we contributed to now? Do you have that stat? I don't know where we stand. I mean we have certainly taken data that was collected for benthic habitat mapping. For instance Ofu and American Samoa, there were two lines of soundings on the chart that were about 300 meters deep around this populated island.

And that was the first joint effort we did, was putting those -- so, yes, that boat is perfectly capable of collecting data that is to that standard. But, Kyle, how many are we working on right now?

LT. RYAN: I think currently there's 11 charts -- right now, so they're trying to do -- and the issue is that maybe what they are already doing isn't exactly to specification, 110 percent all the way, but the fact of the matter is, is that what they are collecting now is better than what's on

the charts when it was collected back in, prior to 1939.

MEMBER J. MILLER: And, again, it's not full coverage because we have got -- the ship goes there, we might have two days at an island. We get done what we can get done, basically, and the other thing is, well, Molokai isn't bad because it's in the main Hawaiian islands, but Uracus, the nearest tide gauge was over 500 miles away. I mean, you are not going to have accurate tides.

The thing about it is though, if the swathes match that you go around at different times, that means that you have corrected the data with predicted tides enough so that they don't have a mismatch. Now is it absolutely accurate? So.

CAPT. LOWELL: Actually, I think Kyle hit the nail on the head. We struggle with -- well to answer the short question, is the data is not what we would consider

charting quality. It doesn't meet our specs and deliverables. We would certainly not contract for it, and we would certainly not collect it ourselves.

Now if you have no other information and you have some pretty darned good quality data, although not charting quality data, that is -- the approach we have been taking now, it's a whole lot better than anything else we have and let's utilize what we have.

And we do caveat it in our electronic products. We can put a data quality association with it. I'm not sure how much the users pay attention to it, and that's kind of the problem that we have with that is, you know, if they see a depth, is they think all depths are accurate of course, and we need to -- and we associate the same quality to every data point on a product, and that's obviously not the case.

And so we do struggle with a few

of these things conceptually and in the execution phase. But we do use a lot of these data sets where we have no other information.

MEMBER J. MILLER: And you're not likely to get out there in the next 50 years, I mean, these are just very low priority areas.

CAPT. LOWELL: I would like to also add is specifically like Saipan, where we knew that the vessel had done some work in there before for the Navy, the data set actually created a little bit more confusion because now we had a LIDAR data set, and it had some uncontrolled, multibeam data set, so there was just a little bit more confusion in there.

And we solved that by going the next year, is we actually put in a tide gauge, and we used the same set but we put in real charting standard data, and then we pretty much solved that problem, and that was to meet a Navy requirement, and that worked -

- obviously it worked out very well as we had an asset in place, we planned for it, we did it right, Navy got a much better product, and, well, hopefully the chart's better, too. Thanks.

CHAIR WELCH: Other comments or questions for Joyce? Gary?

MEMBER JEFFRESS: Joyce, we have the same problem everywhere, there's just not enough resources to get the quality of the data we want for good management, onshore and offshore.

But I was wondering, what is the status of the coral reefs that you are talking about? Are they degrading, is like the pH of the ocean destroying them?

MEMBER J. MILLER: Well, I'm not a coral expert by any means, but I'm very close to, you know, I work very closely with the scientists. Actually the Pacific coral reefs, because so many of them -- many of them are very remote, they have at least got a better

chance than the Caribbean ones that are all in very heavily populated areas.

And there's actually currently an Endangered Species Act asking for protection of 82 species of coral, and that is in process and I'm not going there, you know, are they.

But we have seen bleaching, and one of the surprising places we saw bleaching that nobody every expected and that's part of the power of doing this monitoring and doing this mapping, was in the farthest northern of the Northwest Hawaiian Islands, they are up about 30 degrees.

And what happened was, it was a very hot summer, there were trades down here up to about 25 degrees, and the trades weren't blowing north of that, and so Midway, Kure, and Pearl and Hermes bleached heavily that year in 2002, and nobody expected it. Everybody was saying the last place that would ever bleach is those northern islands.

And so we are seeing some coral bleaching. And this is part of a huge overall coral reef conservation program to, you know, to monitor, map, and understand what is happening in the corals.

MEMBER DIONNE: So the bleaching would have been something that was visually observed by divers or because your sonar is not going to tell you that?

MEMBER J. MILLER: No, the sonar is not. I mean one of the questions is can sonars tell the difference between, say, algae beds and live coral and dead coral.

And that's -- those are research areas. No, that was strictly diver observations that there is a cruise up there almost every year with divers, and they got in the water and bleaching was extensive.

This past year they went down to Howland and Baker which are two of the islands right on the central Pacific, and there was pretty severe bleaching at Howland

and Baker. They won't get back there until, at the earliest, next spring, and so they won't know what the after-effects are until then. So --

MEMBER JEFFRESS: So that bleaching was caused by temperature right?

MEMBER J. MILLER: Yes, and ocean acidification, that's one of the things that the coral program is looking at very closely because ocean acidification is -- it's kind of the rhinoceros in the room, and nobody really knows what is going to happen with that.

And so -- but one of the amazing things is if you are interested in coral reports, a Reefs at Risk Revisited report just came out, and it's scary. It is really scary. They were much more willing to talk about a scary scenario, so it's on the web, Reefs at Risk Revisited, and it's a very excellent report. There's a webinar on it, too.

MEMBER JEFFRESS: Is anyone measuring pH?

MEMBER J. MILLER: Oh, yes.

MEMBER JEFFRESS: On a regular basis?

MEMBER J. MILLER: Yes, they are -- the biannual, so every two years they go to these different reefs which may change because of budget to a three-year cycle. They have got -- they are taking water samples, and they are doing -- they are putting out what are called calcification plates to see what the rate of calcification is.

Yes, it's -- you know, but it was -- I was at a 2008 coral reef conference in Florida, and in 2004 the conference had been talking about coral bleaching, and in 2008 nobody could talk about anything except ocean acidification. That is kind of how fast coral science is changing with the climate reports and things.

MEMBER JEFFRESS: Okay, but with

the temperature, we have got satellites that can tell us what the ocean surface temperature is. Do people monitor that?

MEMBER J. MILLER: Yes, but not -- they don't give you the detail that, you know, there are really severe fluctuations about that in patches, in back reefs and things, and you don't have the resolution in those to really get, you know, get the whole story.

So, yes, it's a -- there's a group called Coral Reef Watch that is watching, that does the satellite, and they send out coral reef warnings periodically, bleaching alerts basically, based upon the satellite temps.

MEMBER JEFFRESS: Not that you can do anything about it, right?

MEMBER J. MILLER: They're trying. They're trying to figure out ways to mitigate, but, yes, it's tough. Does anybody have any suggestions, I mean, any experience

with sort of local partnerships and how you get money in between federal agencies and, I mean, is there any -- or even state agencies?

I mean that's really been an issue out here. NOAA seems to be particularly difficult to -- how does IOCM do it? Gary? I mean do you have any --

MEMBER JEFFRESS: Well, Joyce, in Texas we have probably the densest tide gauge network on the planet. We have like 30 odd tide gauges including seven NOAA gauges.

And those tide gauges are all to NOAA standards, and it's funded by the Texas General Land Office, Texas Water Development Board, and the U.S. Army Corps of Engineers and NOAA with their gauges. So it -- and we have a lot of local governments putting in gauges as well for various projects.

MEMBER J. MILLER: So is each group buying their own gauges? Is that how it's going?

MEMBER JEFFRESS: No, each group

puts in money into the pot, and they get the benefit of the whole thing.

MEMBER J. MILLER: Who runs the pot?

MEMBER JEFFRESS: We do, well the general land office hands it to -- but we do all the work.

MEMBER J. MILLER: Okay.

MEMBER JEFFRESS: Yes, it's a good model.

CHAIR WELCH: Other comments? Michele, do you have something?

MEMBER DIONNE: Well, I know that depending on how your organization is set up some organizations can receive money and distribute it through subcontracts fairly easily and that -- our organization, we are a state-federal partnership but we were set up as a quasi-state agency. We don't have to go through any of the state sorts of rigmarole to use, to spend money, to receive and spend money --

MEMBER J. MILLER: And you don't have to go through NOAA rigmarole?

MEMBER DIONNE: Well, we get our NOAA -- the NOAA funds that come to us, we can make all the decisions internally about how they get used. We don't have a state -- we don't have any other bureaucracy to go through.

So often, we will receive funds for other reserves who find it easier to send us the money and have us give it back to them than go their own state.

So non-profits often do this kind of movement of federal dollars. If you can find a non-profit who's willing to help you by receiving money from multiple partners and then redistributing it, that can work through subcontracts or whatever.

But we have never really had a problem cobbling together partnerships, but it's because of the way our organization is structured so you just have to find somebody

who can launder money for you.

(Laughter.)

CHAIR WELCH: Okay, I'd like to --

MR. MORRIS: Can I make one follow-up comment

CHAIR WELCH: Sure.

MR. MORRIS: Dan Morris again. As a follow up to the question I posed before, we have a real problem with source data, hydrographic source data in a lot of the charting in the South Pacific.

And I applaud the fact that the data from this program, which was not collected to IHO standards, is still being used to provide navigation service on NOAA charts. Where possible, you can replace them.

Lead line soundings with multibeam soundings, GPS, even they are not fully IHO certified surveys, that's probably within, although I would be concerned about the legal liability issue and I'm sure your lawyers are, my question to the Council here is that

what can NOAA do to improve the quality of the data that's collected during these, without driving the costs up exorbitantly by making them full IHO-certified surveys?

For example with the inclusion of better tide gauge systems in the Northwest Pacific Islands, improve the quality of the data, in an absolute reference to the vertical datum, and make it better for integration into the NOAA charts for the area.

So I think that's something that you ought to consider. If NOAA is going to support this program already with resources, perhaps you ought to go one step further and provide the tide gauges or other support to improve the quality of the data it's collecting so that it is better for the nautical charts.

CAPT. LOWELL: They are all good points, Dan. And I don't think there is any simple answer to that. You know, if Rich had

more money and he could densify his tide network he certainly would. If Joyce could fund third order tide gauges in all of her areas both in time and money, I am sure she would.

The problem is I think everybody is caught in a bind where they have a specific requirement that they are trying to meet as cheaply as they can. And so Joyce, to map coral, has a requirement that doesn't require IHO quality data collection. Does she want to pay for that? Well probably not.

I mean IOCM is kind of put together to try to address these things in some sort of a holistic way, and understand that, you know, at any decision point there's going to be tradeoffs. But at some point, I think we end up chasing our tail by saying the solution is a higher density tide network because we might want to survey somewhere once every two decades, which is kind of the way we have been operating, certainly out in

the Pacific, and probably a lot more than two decades.

MEMBER J. MILLER: Well, a lot of those places didn't have a single sounding.

CAPT. LOWELL: Yes, and a lot of it is really, really old. And let me caveat the way we use data that isn't to standards is we only use it in areas where the risk to surface transportation is very low and it's just going to be a lot better than anything else out there. We would never do it in a tight under keel clearance environment. It just wouldn't happen, and we wouldn't use it.

CHAIR WELCH: Lawson you get the last comment or question.

MEMBER BRIGHAM: Well, it's off-message so you can finish this -- I wanted to say something else about the Arctic.

CHAIR WELCH: Go right ahead.

MEMBER BRIGHAM: Well, I should have said but of course the Arctic Ocean is a

strategic waterway for a number of reasons, and you all know that our number one international maritime issue policy is freedom of navigation, and so I might have not have said that but that was woven in this Arctic marine shipping assessment because we had countries like Denmark and -- and there was some notion in the NGO community to close the place up as if this new phenomenon of shipping and routes and offshore development was a new use of the Arctic Ocean and had to remind everyone in history that not only millennium use but whaling, industrial whaling, industrial sealing all happened in the Arctic Ocean.

So this is not necessarily new. It's different. And the notions of monuments, MPAs, PSSAs, closing the place off for business, ain't gonna happen in the Arctic because of the tremendous resources.

Some of it will, so tension is coming, and the marine spatial planning

issues are related to that, but some people believe we can have a PSSA for the whole of the central Arctic Ocean, and I'm not sure the Arctic states, Russia, Canada and the United States would go for that, not forgetting marine safety and protection issues done at IMO, but the notion of restrictions on navigation in one of the world's oceans in a very tight way ain't gonna fly in this country, I would think, Dan, nor for the marine world, or the marine industry.

So there is going to be tension coming, not necessarily going to provoke a war, but there will be lots of politics and the marine spatial planning, I think, is right in the middle of that trying to adjudicate some of the use of the place but somehow protect the place and the people.

CAPT. LOWELL: Actually, we can tie this right back to the monument that was here. We were peripherally involved when we

put that on the chart obviously, and we went to several meetings with the State Department, Navy, and such, and the whole idea about this freedom of navigation, freedom of the seas, was a big deal when they started to create this monument because if you look at, I mean you saw the graphics, you had this 1,000-mile chain which you were about to put a big old wall across. I mean the whole PSSA and all the call-ins, and so there were very tightly controlled discussions as to what they were going to be allowed to do and protect and how the freedom of navigation was going to be in there.

And so that doesn't go away in any of these discussions, and I think that we didn't talk about it here, and we didn't really focus much of this discussion on the monument issues and all the issues surrounding that, but the freedom of the seas is a big deal and we can't just willy-nilly shut everything down because it does -- and I

personally believe the one reason the Navy really bought off on the monument idea, and then all the protections, is they put in some clauses in there, well the Navy ships don't really have to call in and check in, should they be operating in the area and they really don't -- there's not a whole lot of commercial traffic cutting across the center of the Pacific with the exception of perhaps Matson. Everybody else is looping way high above it, so.

MEMBER BRIGHAM: But in a place like Bering Strait it's just going to be --

CAPT. LOWELL: But at Bering Strait --

MEMBER BRIGHAM: A challenging place to manage. It's the only waterway to cross into the Arctic Ocean and out, but there is some sense that we can manage that by shutting it down somehow, which is pretty bizarre, but because of the whale migration and the impact on indigenous people.

And so there's different notions of what the place is, and, I mean, it's never going to be shut down.

CHAIR WELCH: That shows a lack of understanding of the legal regime for things other than territorial waters because there is a process in the International Maritime Organization that could possibly get to something close to that result, but countries just can't do it unilaterally.

MEMBER BRIGHAM: Now we go in the place with the Russians, and it has to go through IMO for routing, but the notion of even a sense of you can't go through that waterway with an icebreaker or something, is going to be tough to sell in the world community.

CHAIR WELCH: Sure, of course it is.

MEMBER BRIGHAM: And in our country.

MEMBER J. MILLER: Well, one of

the only reasons that they could do the monuments in the Pacific is most of those places, nobody ever goes and there's no resources to extract per se, I mean not many, and so it was a pretty easy thing to do and get environmental credibility, I mean, it you know -- there wasn't any oil and gas up there.

MEMBER BRIGHAM: But there's a lot in the Arctic, tremendous resources all around, on the land side, which require marine systems to get it out, not too many pipelines going to go to the Canadian archipelago or to Greenland.

So I think we are going to see lots of marine activity and some conflict in how to manage the multiple use of these areas -- the marine spatial planning, whenever it is, is timely, but how you orchestrate it in the Arctic is going to be pretty interesting.

CHAIR WELCH: Well, and that brings the whole question that to me is the

thing that is not discussed much about marine spatial planning, but which is its real vulnerability, is that if you get outside of territorial waters, which is -- it's very difficult for the federal government to make any kind enforceable decisions about marine spatial planning. They can say we want this area to be reserved for this or that, and there are very few federal authorities to enforce it.

You can enforce fisheries regulation out beyond the territorial waters because of the Magnuson act, and you can enforce a couple of other laws out into the EEZ, but it's pretty darned hard to impose navigation restrictions using federal authority unless you are willing to go and lobby the International Maritime Organization. And I think there are lots of folks in Washington at senior policy levels that don't understand that.

Okay, I think let's thank all

three of our fellow panel members, Susan, Joyce, and Lawson, for their presentations. We will certainly be talking about this subject at future meetings.

We do have time now for public comment if we have any of our guests that want to address us even though we have been letting folks address us as part of -- the whole time, but let me provide that opportunity for any public comment.

(No response.)

And apparently everybody has exhausted themselves with their prior public comments. So let's wrap up for today.

(Whereupon the above-entitled matter went off the record at 5:22 p.m.)

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C E R T I F I C A T E

This is to certify that the foregoing transcript

In the matter of: Hydrographic Services Review Panel

Before: NOAA

Date: 05-05-11

Place: Honolulu, HI

was duly recorded and accurately transcribed under my direction; further, that said transcript is a true and accurate record of the proceedings.

Neal R Gross

Court Reporter