The Hydrographic Services Review Panel met at the Hotel Monteleone, 214 Royal Street, New Orleans, Louisiana, at 8:30 a.m., Ed Saade, Chair, presiding.

HSRP MEMBERS PRESENT

EDWARD J. SAADE, HSRP Chair
JULIE THOMAS, HSRP Vice Chair
CAPTAIN ANUJ CHOPRA
SEAN M. DUFFY, SR.
KIM HALL
DEANNE HARGRAVE
EDWARD J. KELLY
CAPTAIN ANN KINNER
DR. DAVID MAUNE
CAPTAIN ANNE MCINTYRE
CAPTAIN (ret. USCG) ED PAGE
GARY THOMPSON
NON-VOTING HSRP MEMBERS

CAPTAIN ANDY ARMSTRONG (ret. NOAA Corps),
Co-Director, NOAA/University of New Hampshire Joint Hydrographic Center*
JULIANA BLACKWELL, Director, National Geodetic Survey, NOS
RICH EDWING, Director, Center for Operational Oceanographic Products and Services, NOS

*Participating by telephone

NOAA LEADERSHIP PRESENT

REAR ADMIRAL TIM GALLAUDET, Ph.D. (ret. USN), Assistant Secretary of Commerce for Oceans and Atmosphere, NOAA
NICOLE LEBOEUF, Acting Assistant Secretary, NOS
REAR ADMIRAL SHEP SMITH, HSRP Designated Federal Official; Acting Deputy Assistant Administrator, National Ocean Service, National Oceanic and Atmospheric Administration; Director, Office of Coast Survey, NOS
CAPTAIN ELIZABETH KRETOVIC, HSRP Alternate Designated Federal Official; Acting Director, Office of Coast Survey, NOS

NOAA STAFF PRESENT

GLENN BOLEDOVICH, Policy Director, NOS PCAD
CAPTAIN RICK BRENNAN, Chief, Hydrographic Surveys Division, OCS, NOS
VIRGINIA DENTLER, Center for Operational Oceanographic Products and Services
LIEUTENANT DAMIAN MANDA, Chief Hydrographic Systems and Technology Programs Branch, Coast Survey Development Laboratory, OCS, NOS
LYNNE MERSFELDER-LEWIS, HSRP Coordinator
NEERAJ SARAF, Acting Chief, Coast Survey Development Laboratory, OCS, NOS, NOAA
ALSO PRESENT

THOMAS S. CHANCE, Former CEO, C&C Technologies and ASV Global (ret.)

CAPTAIN BRIAN CONNON (U.S. Navy, ret.), Director, University of Southern Mississippi's Hydrographic Science Research Center

MICHAEL J. STAREK, PhD, Associate Professor of Geospatial Engineering, Texas A&M University Corpus Christi; Director of the Measurement Analytics Lab (MANTIS), Conrad Blucher Institute for Surveying and Science
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P-R-O-C-E-E-D-I-N-G-S

8:37 a.m.

CHAIR SAADE: I'm calling the meeting to order. The first order of business is somebody left their phone in the other meeting room, and it's active, so we can send all kinds of messages and things. So you want to claim it. Okay, that one's taken care of. Sorry, we're a few minutes late. We got all excited about a topic we were talking about.

Welcome back to the HSRP meeting, Day 2. We had a great first day of speakers and discussion. We'll do a quick recap of yesterday from the members. As we don't have time to do audience introductions during the breaks, at each break I'd like to ask you to introduce yourselves to someone you don't know.

Today we're discussing the details of the matrix and continuation of the issue papers. The matrix is an evolving document that helps inform all the HSRP members on what NOS does and where HSRP can be most strategic with

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recommendations or for issue papers or sessions
and speakers.

I'm pleased to welcome Captain Liz
Kretovic for being our senior member on the NOAA
side of the delegation, and I'm going to hand it
over to Liz right now.

CAPT KRETOVIC: Thanks, Ed. Welcome,
and here's some housekeeping details. If you
haven't already signed up to make a comment or
signed into the meeting, the sign-in sheets for
both are coming around the room. The emergency
exits, again there's one, two, three and that one
there, and you'll just follow them out to the
lobby and then out onto the street. If we have
to evacuate the room for any reason, we'll just
meet out in front of the hotel.

Bathrooms are out these doors and
across the hall, and I look forward to today's
sessions and all of the speakers that we have
coming up.

CHAIR SAADE: Thank you, Captain.

Captain Kretovic and Julie, will you please lead
us with your comments from yesterday. We'll do a recap around the room from the members and what resonated with you and themselves, and to inform the recommendation letter and meeting recap, so you two can take it away.

VICE CHAIR THOMAS: Right. I did, I did come up with some comments yesterday as we mentioned, things that might be good to include with the letter to the Administrator. I have been jotting them down. I did capture Glenn's comments this morning about the meeting at the White House.

I will include that, and, yeah, I mean I learned so much yesterday from the presentations. Aside from that, I think the discussion about these issue papers is really interesting for me, and as we try to get a handle about what is the best process and the best way.

And I think it will be great to look at that prioritization menu, also to really go through that and fine tune it for this meeting.

That's all. Gary.
MEMBER THOMPSON: So it was good to hear yesterday cooperation between federal government and local governments and also other federal agencies.

As I pointed out yesterday about datums, recognition of datums and how important it is we make it through this transition. And then from Rich's presentation and then others, the importance of more gages out there and how that data is very critical for public safety.


MEMBER KINNER: Good morning. It was my phone that was lost, so my brains too. The key things I caught yesterday that -- and I said this then too, the key words I got from the Harbor Safety Committee summit in Houston in June, the national, was there were key -- two key words, resilience and relationships, and the ability for all of these agencies to work together, to share information so that problems can get solved in a timely fashion and things can move forward as they're needed to.
MEMBER HALL: I'll just echo what I said at the end of yesterday about efficiency, efficiency, efficiency, especially for our soybean friends. So I think the key there is infrastructure investment in the marine transportation system is obviously key to economic growth in the region. It's not just the region, but that's what we really -- I think we got a feel for yesterday.

And two, and it's -- Ed'll probably appreciate -- Ed Kelly will probably appreciate this, but it's a team sport for sure when it comes to PORTS and other sensors and things that we're trying to get in, but really who pays and where's the division of labor on that. So I'm going to take away from this meeting Sean Duffy's boss's comments about customers always want more and are willing to pay less.

But sometimes these seem to be truly inherent governmental functions, and so when you decide who pays when it should be a governmental function as well. So not just the consumer. So
those are kind of my two big takeaways.

MEMBER KELLY: I'm all about the three S's, safety, security and sustainability. I think by hearing what's going on here locally, just like we know in major ports, all major ports need NOAA services and data to operate safely, efficiently, to protect the environment. All of that comes together and it creates economic impact, as we've heard very dramatically here.

But however, every port is different and that's why I think moving these meetings around is very helpful. When we talk about precision navigation, it's not a generic term. It means being safer, more secure, and more sustainable. But what works in LA/Long Beach is useless to me in New York, and what works in New York is probably not going to be much help down here in New Orleans.

So although there's an old saying if you've seen one port, you've seen one port, there's a lot of similarities, but there's also very big intrinsic differences. So I think the
ability for NOAA to act in a way to produce a
suite of data and services that are uniquely
adaptable across the board and are useful with
adjustments downstream in individual ports is
very important.

Again, I think you know New York is a
big town, and New Orleans is a little bit
smaller. I was impressed by the way the
community seems to be very tightly knit down
here. We had 9/11 and that pulled our port
together, and you've got rain and storms and
hurricanes and a hell of a lot of water.

So you know I think those driving
factors really push the way the ports come
together and operate in established
relationships. I think those types of
relationships are absolutely essential, and I
think we have to look to see how NOAA fits into
those relationships in every port, and that we
can create a broad suite of universally useful
data and services, but have the ability to tweak
them as necessary to fit those individual pieces.
So I'm kind of excited to see the differences in the ports, and again perhaps here in New Orleans we talked about a little bit more than anyplace else, ports and marine transportation equal dollars. There are huge economic impacts. The U.S. is a trading country. We aren't an island. We depend on maritime trade, and I think, you know, we have to make sure that that comes forward also. Thanks.

MEMBER DUFFY: Good morning. So I will kind of change my recap notes based on some of the conversations that we had last night, and it was very good to hear that, you know, Mr. Steenhoek from the Soy Transportation Coalition, that, you know, that he showed and demonstrated something that I in some ways take for granted, because I speak about it all the time, is how the American farmers are kept competitive because of the waterborne transportation costs of the Mississippi River, being able to barge commerce down, barge grain cargoes down.

There was also a lot of positive
reports about the pilot presentations. You know, each pilot having their own real challenges. I did a story with a local reporter earlier this year, and when we went down in that first 30 miles of river there were seven dredges working. I don't think that happens in very many places, and there were seven dredges working and we were still not able to really keep up.

So that the challenges of our country, and I will always look at -- I remember an old saying of what's the competition doing. Well, we know the country of China is looking to dredge Argentine rivers to increase their soybean markets, as we have challenges here and of course some of the tariffs have had a huge impact on that ability.

But I was happy also with the reception of our ports members of Brandy Christian and Paul Aucoin, and the best economic number that's available for the impact of the Mississippi River to the nation is $735 billion on an annual basis. So it's big money. It's
very important for a variety of reasons, from
flood control to drinking water to environmental
tours, fishing.

So as we are here and I was very proud
to hear of some of the high points that those
presenters were able to make with you, and I will
be proud to tell them that they did a good job.
It's all about team work, right? Thank you.

MEMBER McINTYRE: Good morning. I was
super-happy to see the National Weather Service
included in the presentations. I think that
accurate forecasting is a critical component of
the precision navigation systems and the
effectiveness of that. And on a broader topic to
that, just the partnering.

I think that the partnering with the
other agencies and the private sector is super-
important, and I also like that we touched on
agencies not duplicating other people's work with
like the ten year cycles on the dredging, where
we're able to take advantage of whatever the
agency is doing.
The other thing that struck me too was with the VDatum presentation, the importance of getting every, all the datums on the same thing so that we can easily share the information kind of between the Army Corps information, the NOAA information, the USGS information so that we can get all across one broad platform I think would make things more efficient.

MEMBER MAUNE: I agree with what all the previous speakers mentioned. I was really impressed by the soybean presentation. I think my biggest topic of concern is what we have not talked about so far, and we're doing the -- NOAA is sponsoring a 3D Nation Elevation Requirements and Benefits study, and I commented to several people yesterday that of those that submitted requirements for -- that were concerned about sea level rise and subsidence, the comments came from Florida and the New England states.

But who is most heavily impacted by sea level rise and subsidence? I can't think of any state more impacted than the state of
Louisiana, and then North Carolina didn't submit anything and I know it's a big interest to Gary. I'm hearing that well, we're not allowed to talk about those things because we don't want to impact the value of the real estate along the coast and ought to let people know that their land's going to be under water in the near term. So I would like to see what we can do to work on the issue paper that Julie has going there on sea level rise and subsidence this week.

VICE CHAIR THOMAS: Right, and remember there is a panel tomorrow too. We have a panel on sea level.

MEMBER CHOPRA: Hi, good morning. I thought yesterday was a lot of good information we got, very valuable, resonate the comments already made. I just wanted to especially highlight the three pilot association, the economic impact of the river on the economy as a whole, and then the challenges faced by the three pilot -- the presidents of the pilots associations.
I thought that that was very relevance for us, especially look at Mississippi River, trying to identify those objects and trying to get that information out, because safety is paramount and that's today rather than a plan time for tomorrow. So I thought that was critical. Otherwise, a very informative day and looking forward to today as well. Thank you.

MEMBER PAGE: I thought yesterday was very informative for me. I've been to New Orleans several times and ridden vessels down here and what have you, but I've never really fully appreciated the impact and the importance to our nation of this whole river system, so and for that matter, the critical role that the federal government and obviously particularly NOAA and the National Ocean Service has with respect to ensuring that this is a viable transportation mode that impacts our country and the blue economy.

So I'm very impressed with NOAA's role, but also Army Corps of Engineers and all
the other agencies involved, Weather Service, all
pulling together to -- and FEMA for that matter
to make this system, the river system and
economic engine work efficiently and effectively,
and of course the maritime industry itself, the
pilot association, et cetera.

So it's very, very impressive and I'm
overwhelmed as far as the impacts of it, and very
much enlightened. So it was good and I remain
very impressed with what NOAA's services does for
our country and American industry.

MEMBER RASSELLO: Hi, good morning.
What I took from yesterday and I agree with what
Ed has said, that the importance of establishing
the order in the port who has been hit by a
hurricane, all the ports are not the same.
Waterways and ports are vital for the economy,
are vital for the sustainability of the country.

And I think probably ports more than
the airports need to be reopened as soon as
possible in a timely manner. What I have
experienced with Miami, and I can tell you that
without opening the port the city would never recover. The airport was ready to operate, but the first structure around the airports were shut down.

So the only way to get some support to the people was through the port. Not all ports are the same, so the resources should be allocated according to where the ports have very certain environmental changes, such as the Mississippi River.

We noticed a very dry month at the beginning of the month, and then when the storm came in we had -- floating. So this contrast of event, you don't have time to act if you're not prepared. We told the agencies and the National Weather Service to be included in the discussion I think is vital for our program. Thank you.

CHAIR SAADE: Rich.

MR. EDWING: Morning. So I thought in keeping with recent meetings, the opening remarks as well as the panels yesterday were excellent, really high quality, informative information, at
least up to the directors' panel. I won't pat
ourselves on the back.

But I think the thing I really took
away was just kind of the stagger -- Ed already
used my quote, if you've seen one port you've
seen one port. But I was -- yeah, I think the
scale of what we're looking at here is
staggering. We're really focused on Louisiana
and kind of the lower Mississippi River, but as
the soybean gentleman said what happens down here
affects up there.

If you think about it the Mississippi
River and all the tributaries, you know, its
reach from north to south, east to west just
really staggering just in scale and scope. Then
of course along with that goes the commerce that
flows up and down, and Mister is it Aucoin,
O'Quinn?

Aucoin, okay Aucoin. Yeah, he talked
about how largest seaport in the western
hemisphere. So, you know, those things are
always staggering. So, you know, along that,
with that goes all of, you know, all of the
organizations, you know, federal, state local
entities that are involved and have to work
together, and that's kind of good news and bad
news.

I mean the bad news is there's a lot
of people that have to play the team sport. But
the good news is there are a lot of people that
if they work together and work together well they
can make a lot of difference. So really I'll sum
up by saying how is this really taken, which is
kind of the scale of the issue here, you know,
even though we're focused on that lower, this
lower portion, it really affects almost the whole
nation.

MEMBER HARGRAVE: Yeah. I fully
agree. What I learned yesterday was really eye-
opening about the magnitude of the Mississippi
River and how it supports the nation. Pretty
much everything has already been said. The only
thing I would add is that I think there's a real
opportunity right now. There's a lot of data
that's being acquired, and the data is more
resolute and so the data sizes get larger and
larger.

And so part of the -- what I'm hearing
as needs are ways to disseminate that data in a
useful way to the users, and that can be all
kinds of different ways, and there's an
opportunity right now with the advancement of
artificial intelligence and machine learning.
We're seeing that in industry, and it is making
major leaps and bounds.

So I think that's something that we
should certainly focus on moving forward, to
bring this really good quality data to everybody
and make it more usable.

MS. BLACKWELL: It's Juliana
Blackwell. Just to follow on with what's already
been said, you know, the complexity of the area,
the importance of keeping the channels dredged
and keeping the levees high enough and strong
enough to prevent any other disasters from
happening with those being compromised.
I guess one of the things that struck me is, you know, we heard yesterday about the Missouri River and the things that go that are happening upstream, and I don't know that we've ever considered having a meeting inland anywhere where we can get a different group of stakeholders, but that thought crossed my mind too, and I don't know where that location is and I'm not -- I'm being half serious here, where I think maybe finding out a little bit more about what's happening in other parts of the industry where goods are being grown, and on their way down river maybe there's an opportunity there for us to reach a different group of stakeholders. Thank you.

CHAIR SAADE: I'll go next and then you. Thanks, everyone. Just a couple of points to summarize. Obviously we heard the term teamwork and multiple agencies working together, and a lot of good examples, and that's obviously something we want to keep promoting, and I think we're all completely in agreement on that.
Then the only other thing I'd bring up is we're starting to hear the term sustainability and resilience a lot, and we as a group ought to talk about that at some point, if we can squeeze it in. Maybe not this session but even if we have a discussion on one of our phone calls to talk about what's going on in the world relative to everybody tracking that kind of type of activity and the metrics involved in it. Captain Kretovic?

CAPT KRETOVIC: Thanks. Yesterday, I was really impressed with all of the panels, and every time we go to a new location I always learn some different way that our data and information is being used by stakeholders that I hadn't really thought about. So the presentation from the soybean industry was really eye-opening. It's such an economic driver, and what the Lower Mississippi provides to the rest of the country is really mind blowing.

Also just seeing how these federal partnerships are really working here is also
really great to know, that we have strong commitments from our federal partners to ensure that the waterway is safe and being navigable. So thank you.

CHAIR SAADE: Thanks, Captain. Okay. Next item on the agenda is Julie and Dave, for taking the lead on continuing some more discussions on Planning and Engagement Working Groups. So I'll hand it over to you, Julie.

VICE CHAIR THOMAS: You know, we could take this time to bring up the prioritization list, or we could look at the strategic plan for OCS too. Do we want to do comments for OCS? I think that Anne very nicely, succinctly grabbed our comments, and I think we can do that to get it checked off our list here.

How should we do this? Could we bring up those comments? We have them in our notebooks. We're going to bring them up too, flash them up.

I think we also have a printout of those -- we also have a printout of those in the
notebook, towards the very end. Lynne did these
great notebooks for us, so I know that it's in
here too. Anne, do you want to talk about that?

MEMBER McINTYRE: Yeah, I can start.

VICE CHAIR THOMAS: To bring it up
too?

MEMBER McINTYRE: There we go.

Yeah. So basically all I did was
collate the written comments that Panel members
had forwarded along. But the big one I think
that we should kick off with is that there didn't
appear to be any mention of cybersecurity in the
draft strategic plan, and with everything, you
know, I'm not a tech person so I don't understand
how the cloud works and everything like that.

But I mean clearly the direction that
things are moving is that I think that
cybersecurity is going to be an important aspect
of implementing most of the programs that are
there, and I just felt that there should be a
mention of that.

MEMBER KINNER: I just want to echo
that because that was something that jumped out
at me really quickly. The Port of San Diego was
hacked about a year ago with a malware attack,
and rather than paying the malware, they put in
an entire new system. But it meant for several
months things were not where they needed to be.

The cloud isn't something ethereal.
It's hardware somewhere in somebody's warehouse.
I don't know who maintains the various servers or
how they're interlinked, but I know that there's
vulnerability in any of these online systems.
We're seeing it with the GPS systems, with the
Coast Guard putting out warnings about hacking
and other places where there is known jamming
that's going on, which may be somewhat more
innocent than you expect, but it's still a
significant problem.

When the GPS does not work the way
it's supposed to, and you're trying to maneuver a
large vessel to a port dock and your GPS is off
by 25 feet maybe? I don't know how much it takes
to screw the whole thing up. But I think
cybersecurity is something that needs to be part of an overall plan.

MEMBER HALL: As somebody who works in this field, specifically maritime cybersecurity, I think the key and the strategy isn't necessarily about the tools and systems for which you can -- the solutions.

The strategy should address governance and strategy. So I completely agree after reading this last night and this morning, that that is something you have to take into account at the beginning, because if not you're constantly, and this happened to San Diego where they rebuilt their system completely, you're constantly in reactionary mode versus proactive.

The Coast Guard is one of the worst. They have some of the worst cybersecurity internally and they're probably likely to be hit. They like to tell us all about how we should be scared, and there's a plethora of solutions out there and everybody's offering them, but nobody's really concentrating on that like governance and
really understanding what you should do before you buy the -- the requirements before the solutions.

So I think that a simple mention of that works, yeah. I don't think you have to decide what your cybersecurity strategy is at this point.

CAPT KRETOVIC: Yeah. Thank you for those comments. For the precision -- I can speak to the precision nav program, and I know that as we start this exploratory work in the cloud, we are definitely considering cybersecurity. I just don't think that we put it in our strategic plan. But it is something that's in the plans as we move forward with building out this program in the cloud, and then turning it operational in the cloud as well.

And so the point's well taken and maybe we'll add a bullet in there somewhere to assure ourselves that we're addressing it as we move forward. So thank you very much. I appreciate the comment.
VICE CHAIR THOMAS: Kim, do you want to write like a few sentences and send them to Anne, that they might add in there? It seems like that's your expertise there and --

MEMBER HALL: Are we, are we -- so we're offering actual edits to the strategy?

VICE CHAIR THOMAS: We are.

MEMBER HALL: Happy to do it.

VICE CHAIR THOMAS: Yeah, just to include it.

MEMBER HALL: As long as the Captain is, yeah, would like it. I don't want to -- okay, cool.

MEMBER McINTYRE: Yeah. I mean I think within the -- a lot of the comments that we had were more kind of editing comments that we could pass along just as far as clarity and consistency throughout the bullet points. Another thing that kind of jumped out at me is how you prioritize the work that's within the plan, and you know, there's a lot of -- you know, when I look at the backlogs that are there that's
concerning to me. But then at the same time I
don't know if they are important things that need
to be looked at, or if it's just a matter of
having looked at and getting them cleared. I
mean after hearing more about the mapping of the
EEZ I understand why that's important now.

There was one mention in there about
getting all the Coast Pilot onto the electronic
-- into the ECS. You know, personally when I've
been actively navigating, I have never had reason
to look at a Coast Pilot. That's more of a
planning document, and I'm not sure how
integrating like a publication like that into the
ECS necessarily creates a lot of value. You
know, that's something that you look at before
you go in, and it's just when I look at all the
other things that are on there, to me that would
be a pretty low priority item. Again, I don't
see how things are broken out as to how you
prioritize them.

CAPT KRETOVIC: Thank you.

VICE CHAIR THOMAS: Why don't you wait
until you get Kim's comment, and then you could
send your file again to Lynne. Any other
comments on the strategic plan? Okay. So we
have three strategic plans, one from each of the
offices. Yes. Is there consensus on the
comments that have been submitted? Do you think
we need to have this for the public record?

(Chorus of aye.)

VICE CHAIR THOMAS: Yes. Any opposed?

All right, thank you. Next, let's
see. How much time do we have? Twenty-five
minutes. Do we want to bring up the priorities
matrix? So that is in the back of your notebook,
because it might be hard to see on the screen.

If you bring it up. So I think we
decided at the last meeting that we would
categorize our ideas that we wanted to discuss
somewhat. They're color-coded here as far as our
different categories we set up, and that this
would be a dynamic document. We would be
updating it for each of our meetings. So maybe
we can take a minute and just start at the top.
Does everybody have -- I can see Gary's. Keep going behind that. I see the color behind that. This is it. Okay, right. It's right at the back of your notebook.

On the left-hand side, right. Anybody not find it? Okay. So restricted -- I'm just starting at the very top. We've got restricted visibility, and this is ongoing. I believe we've already heard it. My comment on this is it's an ongoing issue. We've heard it mentioned already at this meeting. We have it tagged as ongoing. We're going to mention it again in the letter to the Administrator I believe. Any other comments on that one?

Okay. Relative sea level rise and high tide flooding. This I believe also is still a continuing, ongoing topic. We will have a panel tomorrow on this here, and certainly in Hawaii and San Francisco where our next two meetings are, they're both are having, particularly on the Pacific Islands, serious issues with flooding and of course in San
Francisco the airport is so vulnerable. So I see this as an ongoing issue. Any comments on that one?

MEMBER MAUNE: Julie, was it your desire to have an issue paper published this week on --

VICE CHAIR THOMAS: I think that decision will be after we meet and we go through it, and then we'll send it back out to the Panel and that will be a Panel decision.

MEMBER MAUNE: Okay, after tomorrow's sessions on --

VICE CHAIR THOMAS: Yeah. So well I think maybe we'll have time later today to meet and talk about it in our groups, and then we can decide and it will be a Panel decision whether or not we publish that.

MEMBER MAUNE: Okay.


MEMBER CHOPRA: Julie, sorry.

VICE CHAIR THOMAS: Yes?
MEMBER CHOPRA: One comment on the sea level rise?

VICE CHAIR THOMAS: Yes, of course.

MEMBER CHOPRA: Would it be possible to get some sort of statistics region-wise, to see what sort of trends are happening? That may help us make that decision and strengthen, put some more material onto that issue paper what we're doing. Just to see the trend analysis in different regions, and how it's separated from subsidence, subsidence.

Because in many of the measurements, both of them are listed together. So just a request for that.

VICE CHAIR THOMAS: Right. I think some of that might come out in the panel tomorrow, but I also -- there have been some really good documents published, and Audra has been advising on this somewhat too through CO-OPs. And I think there's a lot of good statistics out now of coastal cities around the U.S. I was reading before I left for this
meeting. So I'm sure we can get together some
more statistics on that.

    National policy issues. I think this
was put in here perhaps with Admiral Gallaudet's
chair of CMTS. We wanted to see if there were
things that he wanted to bring up. Is that your
recollection, Dave, that that's what the national
policy -- okay.

    So as you know, Admiral Gallaudet's
chair of the CMTS. It is an excellent
opportunity to give him suggestions or ideas
about what might be helpful, that this Panel sees
helpful going forward. So we can certainly talk
about this one again tomorrow.

    Maybe in the recap at the end of the
day at the meeting, we might come back to this
and see if there is -- what hot issues we want to
make sure -- what message we want Admiral
Gallaudet to back to the CMTS from us. Is there
something or items that we should put out there
for him?

    MEMBER MAUNE: And I think Admiral
Smith also listed this as a topic that he was interested in.

VICE CHAIR THOMAS: Oh, for the IHO?

MEMBER MAUNE: Us pursuing the national policies.

VICE CHAIR THOMAS: Yeah, I think you're right. That's actually where it came from wasn't it? Okay. So let's come back to that one, try to take a little bit of time tomorrow and see if we can get together some comments for that one.

Okay. Hardening of offshore observational sites. This was something that Larry Atkinson had brought up. I mean coming from the observing world we are always thinking about, and I know Rich does this with his PORTS system, many people around the table. Any time you put an instrument in the water you think about how to harden it or on the edge of the coast line.

What do we want to do with this? Any thoughts? I'm not sure we -- do we -- I'm not
sure it is one that we want to leave in there as a priority. I don't know if anybody on the Panel is going to be addressing this. I don't know if we would have a panel addressing this.

It seems like it's an ongoing issue every time in all of our worlds. Do we remove it from the Panel or from the list?

MEMBER MAUNE: I think we should. I don't know enough about it to --

VICE CHAIR THOMAS: Okay.

MEMBER MAUNE: To know who to talk to to proceed.

VICE CHAIR THOMAS: Okay. I'm going to take this one out unless there's any other comment. Gone. Artificial intelligence. Well that one has certainly been coming up, and it says follow up with Lindsay Gee. I know Lindsay's having a hard time making these meetings due to conflicts. I know we also have lots of expertise. I know Neeraj is sitting over there, works with AI, you know. Yes, Kim.

MEMBER HALL: I think this was a very
specific. So I know that it says just artificial intelligence. But I think that's why we wanted to talk to Lindsay because there was something very specific that he was talking about, kind of like specific to what Gary is talking about in his paper.

So I don't think it was a writ large -- if we want to do that, I think we should cut out, put in several different areas we're looking at. Specifically, this one was related to disaster recovery. But I think we shouldn't -- AI is not just one large thing. There's a couple of things that we think it applies to.

VICE CHAIR THOMAS: Very specific.
MEMBER HALL: Yeah.
VICE CHAIR THOMAS: Okay. So I'm going to take out the comment "follow up with Lindsay," and do we want to tie this directly into emergency response?
MEMBER HALL: That's what it says currently, but I don't know if there's other things that we wanted to look at.
CHAIR SAADE: I'll jump in. I think it's a lot bigger than all that.

MEMBER HALL: Yeah, but I think we should list --

(Simultaneous speaking.)

CHAIR SAADE: Everything that has to do with data processing and you're going to see later on it has to do with unmanned vehicles and the like, it's all about artificial intelligence.

VICE CHAIR THOMAS: Maybe we should have a panel session next -- in Honolulu that specifically is on AI.

MEMBER HALL: In all the different ways.

VICE CHAIR THOMAS: Right.

MEMBER HALL: So I mean I think that's what it is.

VICE CHAIR THOMAS: All the ways --

(Simultaneous speaking.)

MEMBER HALL: -- but we were dealing with it in small ways.

VICE CHAIR THOMAS: Back to these
three offices.

    MEMBER HALL: Yeah.

    VICE CHAIR THOMAS: Okay. Well let's leave it in, and I think we will change the comments here. We'll definitely take out Lindsay's comment, related -- should we just say and how it relates to the three offices right now or something like that in the second column? I mean we need to --

    MEMBER HALL: And suggest that either at Hawaii or San Francisco that you have a panel --

    VICE CHAIR THOMAS: Okay. I'm going to put Hawaii next to this one. We're going to move this down to the Hawaii section.

    MEMBER KELLY: Yeah, Ed Kelly. I think this -- as we've just said, this is a very broad topic and it's a very important emerging technology that has to really find its home and proper place in the strategic platform of NOAA. I don't think we want to address this in little pieces or chunks. It's going to be -- it has to
be overall, yeah.

VICE CHAIR THOMAS: All right. Do we think it's an appropriate subject to maybe think about getting a panel for Hawaii? Or San Francisco.

CHAIR SAADE: And I'll say we should -- we'll try and do something with the Technology Working Group in between then and now, just to get a good briefing on it.

VICE CHAIR THOMAS: Yes, Liz.

CAPT KRETOVIC: I was just going to say, you have a great opportunity being in San Francisco, which is such a hub for technology, that it might be worth pushing it to San Francisco just because of the location and the --

VICE CHAIR THOMAS: Expertise that will be available.

CAPT KRETOVIC: That will be available to you there. It seems like it would be more appropriate, and then that would also give everyone a year's time to really plan for it and hone in on exactly what you want to see in this
realm.

VICE CHAIR THOMAS: Any comments on that? Can I move it from Hawaii to San Francisco? All right. Public-private partnerships. This actually came up when in discussion with -- way back from with Russell in Miami, but we have some people on the Panel like Deanne who are really connected with public-private partnerships. And I think that's a really, a really good topic because we see it in everything.

I mean we've seen a lot of the industry partners, a lot -- through shipping there's a lot of industry partners, through the pilots association. Yeah, Ann, so the pilots association, that's private also, right? Or is that --

MEMBER McINTYRE: It's kind of a hybrid.

VICE CHAIR THOMAS: It's quasi --

MEMBER McINTYRE: It's private. Most pilot organizations are privately held but
they're publicly regulated.

VICE CHAIR THOMAS: Right, okay. So what do we want to do with this one? Comments?

MEMBER CHOPRA: I was going to say I think it's time to expand this as individual states are getting into it. Just to give you an example, state of Washington, the governor has started a blue economy initiative, which is now scheduled to meet again in October. And it's a regular cycle where all the players in the field, all the stakeholders are got together to look at holistically rather than create bottlenecks.

So maybe as HSRP we want to reach out to these folks and see how we can be of assistance and even participate in that. Personally, I do participate in part of that group but it's just to -- put it that states are getting involved. They're looking, they are realizing the advantages and the holistic nature of trade for their state, the economic well-being.

VICE CHAIR THOMAS: All right. Gary.
MEMBER THOMPSON: I serve on another federal advisory committee and we currently are doing a public-private partnership study. So I don't know if two -- I don't know if we can, I don't know if that's allowed or not. There's already an ongoing effort with the National Geospatial Advisory Committee on public-private partnerships.

VICE CHAIR THOMAS: I imagine it's allowed. What would be interesting is to either collaborate or complement what's being done.

I definitely see public-private partnerships happening all over the place within these -- yeah, Rich. Through PORTS, I know you have public-private partnerships, right?

MR. EDWING: Yes, we call it a public-private partnership, yes. It's one type, one type of a --

VICE CHAIR THOMAS: Okay. Yeah right, and I think there are several of those that we could actually go through the three offices, and
maybe what -- yeah, Ed.

MR. EDWING: I was going to say, I'm trying to figure what the goal would be. I mean what I do see is a lot of examples of public-private partnerships with these meetings. So I think they're already up and running. I guess, as Gary mentioned, they're looking into it. So maybe there's some areas where there's some obstacles that prevent from further going on public-private partnerships.

I see that on occasion, where we can't interact with you because you're a private entity and we're a government type of thing. But so I'm thinking what we're trying to fix. Is there a problem we're trying to fix? I mean right now public-private partnerships are well underway in many different areas.

VICE CHAIR THOMAS: Right.

MEMBER PAGE: I like to use that term a lot myself, but I guess if we can -- if we get smart and maybe look at some other study in a public-private partnership to identify some
issues that need to be fixed or addressed or refined, then maybe that would be something to sink our teeth into. But otherwise, all we can do is endorse, which is a good thing. We can endorse public-private partnerships as a way of being more efficient in government and more agile and what have you.

Just, I'd just encourage continued public-private partnerships, because that is probably a more cost-effective way of getting things done. But I see a lot of this happening. So I'm just trying to figure out what do we accomplish when we do a position paper and then they go yeah, well we already do public-private partnerships. What are we adding value here?

VICE CHAIR THOMAS: Anne.

MEMBER McINTYRE: Yeah. You know, so much of that I think relates back to the funding issues, because I mean really there's two things. There's funding and then what Ed said. A port is, you know, there's only one port. So you have to have to public-private partnerships in order
to meet the unique needs of all the different stakeholders.

But at the same time a lot of it really just goes back to the funding issues, and what we're hearing is that it is, you know, it's possible on the federal side right now to kind of support the establishment of the infrastructure but not to maintain it, and that's why maintaining the public-private partnerships are so important, is because if you put a system in and you can't maintain it, then it's a problem.

So I mean I think it's something that needs to stay on the radar, but I think the funding is a big part of it.

VICE CHAIR THOMAS: Okay. For right now, I'm just going to capture some of those comments, and we'll just continue to endorse and encourage and leave it in our priorities matrix, and then we can think about what we want to do with it later.

Let's see. NOAA's application of IoT, AI, and M2M, enhance the process of receiving and
disseminating navigational data. Do you want to talk about this one, is that something that --

MEMBER THOMPSON: It's Ed Page.

VICE CHAIR THOMAS: Oh, it's Ed Page who did this. I-O-T. Thank you. Do you want to talk about this Gary?

MEMBER THOMPSON: Well so, it falls into the AI we've already talked about. So we've kind of talked --

MEMBER HALL: We've been dealing with it as kind of separate issues, which is why I want to make sure that that one was specifically for something. But if we decide we want a bigger issue, that's great. But I think we can merge them now.

VICE CHAIR THOMAS: Okay, merging. Okay. Moving on to the orange-colored section, incorporating non-authoritative sources into hydrographic products. So this is the citizen science product, projects that come out, products. Crowdsourcing, satellite-derived bathymetry. We're still -- improve access issue
paper. Finalize to May 2018.

So there was an issue paper that was submitted for this and it's being tracked, okay.

Any other comments on this?

MEMBER HALL: I don't know who's tracking it. I think that's -- we have to track, we should be tracking it and asking the question, and if there are any updates at each meeting from NOAA. That's what that means or was meant to mean.

VICE CHAIR THOMAS: Right.

CHAIR SAADE: So this is a big part of Seabed 2030 as well, as a means to start to fill that bucket up with data, both from satellite-derived bathymetry and crowdsourcing. So maybe as we track it, it's a good extension to re-look at it and see how it fits into Seabed 2030.

VICE CHAIR THOMAS: Ed, do you think that in Honolulu we could just have an update on that?

CHAIR SAADE: I think Seabed 2030 is a great topic for Hawaii.
VICE CHAIR THOMAS: Okay, yeah.
Thanks. All right. Arctic Charting Plan. I'm not so sure we didn't replace this one, Ed, with the Arctic issue paper. Is that what happened?
MEMBER PAGE: I think so, yes.
VICE CHAIR THOMAS: Okay. I will delete it from here then?
MEMBER HALL: Wait. Do we remove it or we leave it there because we'll be continuing to track it, because we're still working on the issue paper.
VICE CHAIR THOMAS: Right. I almost feel like all of these issue paper ones we'll put in one and call them issue paper track or something like that.
MEMBER HALL: Okay. I just saw you cross it out, so I want to make sure you don't delete --
VICE CHAIR THOMAS: I crossed out the charting plan.
MEMBER HALL: Gotcha, okay.
VICE CHAIR THOMAS: But I was actually
going to suggest just listing all of our issue
papers at the bottom, all of our issue paper
things that we've submitted and just put tracking
on there. Yes. We're okay? Everybody okay?

All right. I think -- yeah, is Rick
here? Where is Rick? He's behind me. Lynne is
asking whether or not this is anything to do with
the OCS charting plan here, but I think that was
specifically Ed Page's Arctic plan. Are you --
do you have the priority matrix? Okay. We can
touch base afterwards, just so that we're not
eliminating something that should be included.
No. All right, okay.

The Army Corps-NOAA partnership,
track. This was an issue paper, wasn't it,
before my time?

Two minutes? That's okay. If we
don't finish it, that's fine, you know. We'll
have more time to come back to this. Yes.

MEMBER HALL: Sorry. As the
originator of all of this, that one was we
decided that, and we were kind of waved off by
Shep for a while as he is trying to actually improve the relationship. So it wasn't just about the paper that, we gave that as fodder for him as he took over from Gerd Glang, and so that's really what that is.

I think it's something that we're still very interested in and want to keep track of. So I wouldn't necessarily put it into the issue paper section because it's more, it's bigger than the issue paper.

VICE CHAIR THOMAS: Right.

MEMBER HALL: But we'll hold off until Shep or anybody in OCS says okay, now we need a little bit more, more from the agency. But I think it's always going to be something this committee looks at.

VICE CHAIR THOMAS: So it kind of falls into that continue to endorse and encourage area?

MEMBER HALL: Exactly, absolutely, yes, yes. But we didn't want to lose track of it, because this is also kind of our corporate
knowledge in one place, so we didn't really want
to lose track of it.

VICE CHAIR THOMAS: Okay, yes.

MEMBER HALL: And so the other thing
about that is if you're going to start deleting
things, I might put that into a separate page,
just so we know what we have worked on in the
past. So take that column and put it into a
separate sheet, and that way again, when we're
all dead and gone, somebody's got an idea of what
we worked on.

VICE CHAIR THOMAS: Yes. Well I
definitely -- that's why I think it would be good
to also list -- I mean this can be listed twice.
It can be listed as an issue paper to track, but
it can be kept up here as a priority too, to
endorse and encourage.

MEMBER HALL: Right, but those ones
that we're kind of shuffling away, that we're
kind of -- where it's no longer a priority, I
think it should still go --

VICE CHAIR THOMAS: Put them down in
the archive?

MEMBER HALL: Yes, exactly.

VICE CHAIR THOMAS: Thanks.

MEMBER DUFFY: So I appreciate those comments. I'm going to come back to some of the discussions that we've had yesterday, and I will say this is a top priority for the folks along the Mississippi River, and that it ties into a bunch of things.

I'm happy to report that Shep has indeed made a lot of progress. Being a member of the Mississippi River Commission is very important, and you know, I refer to my team sport approach is sometimes we all, like, may wear different jersey, but underneath them we're all red, white and blue, and that we need to work on continuing that and I think some of the discussions about datums.

I mean I'm telling you right now there's a lot of smart people in the room that I'm counting on to figure out some of the problems we have. But it is very complicated.
It's comforting to know that we have the Corps and NOAA engaged at a very high level working on those improvements.

So continuing to track it and I'll defer to the issue paper. But this is very, very important to the folks along the Mississippi River.

VICE CHAIR THOMAS: Okay. Well you know, I just wanted to say it's really good to have the feedback on this, because it helps with the tracking notes. So I did make a note of that.

CAPT KRETOVIC: And I'll just say that the relationship that NOAA has with the Army Corps is important no matter what district we're in or where we're located. And so I see this as a topic that should be --

VICE CHAIR THOMAS: Ongoing.

CAPT KRETOVIC: --ongoing through the whole time that this body exists.

VICE CHAIR THOMAS: Okay, all right.

Do we want to stop here Ed, and then we'll just
pick it up. Thank you. That was a great
discussion.

CHAIR SAADE: Okay, thanks everyone.

We're going to take a 15 minute break and we'll
get into the next panel discussion on autonomous
systems. See you in 15 minutes. Thanks.

(Whereupon, the above-entitled matter
went off the record at 9:33 a.m. and resumed at
9:49 a.m.)

CAPT KRETOVIC: Welcome back
everybody. I'm thrilled to have HSRP members Ed
Saade and Deanne Hargrave, along with OCS staff
member Neeraj Saraf as the chairs of the
Technology Working Group session. Speaker and
HSRP member bios are in your materials and posted
publicly. We'll only do very short intros. Ed,
Deanne and Neeraj, I'm going to turn it over to
you.

CHAIR SAADE: Thank you, Captain.

We're going to get going here. We have a lot of
material and a lot of really smart people.

They're going to be talking about it, so it's
going to be -- I probably you a really exciting session. So Neeraj, if you want to take it away and get us all introduced.

MR. SARAF: Okay, thank you Ed and welcome back. So this is going to be a very interesting and diverse panel. We're going to talk about unmanned systems for hydrography. Now there's -- in the last couple of years, there's been a lot of movement towards of course the marine side, but also now the aerial side. So drones and things like that, and we're going to hear from an academic partner from Texas A&M on that, and then kind of a survey of various projects and efforts going on across government and industry as well.

So we're going to kick it off, we're going to do some introductions here with Admiral Gallaudet, U.S. Navy, retired, and current Assistant Secretary of Commerce for Oceans and Atmosphere and Deputy NOAA Administrator. We have Dr. Michael Starek, Associate Professor of Geospatial Engineering from Texas A&M Corpus
Christi. You've got some fans in the back.

(Laughter.)

MR. SARAF: I spent a couple of years at UT Austin so I don't know. But I have no allegiance, no allegiance to that.

Captain Brian Connon from the University of Southern Mississippi, U.S. Navy Retired, currently director of the University of Southern Mississippi's Hydrographic Science Research Center. Welcome. Mr. Thomas Chance, former CEO of C&C Technologies and ASV Global, and Lieutenant Damian Manda from NOAA, from Office of Coast Survey, Coast Survey Development Lab, Hydrographic Systems and Technology Programs Branch.

So we're going to kick it off with Admiral Gallaudet, who's going to talk to us about the NOAA strategy and we're going to take it from there.

RDML GALLAUDET: Thanks Neeraj. All right. So this is a great, great topic that I'm excited to speak on. I have a little bit of
history here. In the Navy, I worked and oversaw a pretty large increase in our unmanned systems development and operations, and then before that I had experience working with the Naval Special Warfare Command, the Navy SEALs, and stood up their small drone program, both underwater and aerial.

And so this is just sort of doing the same now, but at a larger scale for all of NOAA. So let's see here. I will drive, and thank you. All right. So why are we here? Why are we talking about this? Well, you know, if you look at the capabilities as they've advanced, the unmanned systems and autonomous systems are going to transform how we do business, and the bottom line is it's not just because it's neat and cool and technology; it's really because they will allow us to make major improvements in our coverage, our accuracy and how we do our business.

So that's what's really important here. So for us it's about predicting the
environment, observing it and all the decision support we provide. These systems are going to help us end to end. Now the kind of high level motivator comes from the White House. The White House released an executive order on artificial intelligence and autonomous systems are part of that, and at the same time we have the new White House Science Advisor, Dr. Kelvin Droegemeier.

He's a Ph.D. severe storm meteorologist, great guy, and he loves us and so that's why he's great. But he is -- at his first kind of public speaking event, he called for a second bold era in American innovation. Some of you have heard me talk about this, and what he was referring to was the first bold era which immediately followed World War I.

You had technologies like those depicted here being developed, nuclear power, super computers, space exploration. And those major advances were funded by and large by the government, ONR, NSF and that. Nowadays the landscape has changed and actually it's sort of
flipped. The major R&D investors are in the private sector.

Now look at SpaceX, and so this is where we need to turn, and we really need to up our game in ocean partnerships, ocean science partnerships. We're doing it already in a great way and I think Damian will talk a little bit about that. We contract a large amount of our hydrographic surveys out to really solid private sector firms, and that's only going to continue and most likely advance. So that's the motivating piece here.

Next, I wanted to talk about what we're doing today, and interestingly we have about 100 of our own drones of all types, surface, underwater as well as aerial, and they're helping us do every aspect of our mission as in fact, we leverage a lot more of those from our partners like in IOOS and elsewhere in the research community.

And so you have for our fisheries we're right now prototyping the use of a
Saildrone with acoustic sensors to do fish stock surveys, and we're calibrating the data against known survey methods using ships, and that's a really exciting area right now, and we're going to expand that dramatically. We also use aerial drones to survey marine mammals and meet our Marine Mammal Protection Act mandates, and then that's actually quite exciting.

And then of course we've actually flown aerial drones from P3s, and meanwhile gliders collecting underneath hurricanes, and in fact that has allowed us to improve our intensity forecast, as well as just the nature of the track with respect to the small drones from the P3.

We have done different types of ecosystem assessments. One of the most interesting projects was using a long-range AUV that was doing sampling for harmful algal blooms and actually doing DNA and environmental DNA collection. That was in the Great Lakes, and we partnered with MBARI on that one.

And then all sorts of mapping, and
that's the reason we're all here is all the
mapping applications, both the hydrography using
AUVs and USVs, as well as some of the important
feature identification using aerial drones that
we're actively doing today. So it's been really
exciting to watch us move forward in this area.

Now some of the motivation behind this
program. We have an active UAS Research Program,
and in FY '20 we are standing up an operational
program in the Office of Marine and Aviation
Operations, and this program is actually directed
in the FY 20 budget. So we have a moderate
increase of $4 million and the House looks like
they want to mark it up by potentially $14
million.

We'll see what the Senate does but
that's -- they've indicated that they want us to
pursue this path. Additionally, Senator Wicker
has drafted the CENOTE bill and the President
signed it, and it stands for Commercial
Exploitation of, I think, Ocean Technology. But
basically it directs us to partner with the Navy
down in the Mississippi area to grow our unmanned maritime systems, and so we're doing just that.

And then also you know I've talked about our blue economy priority, and actually both our weather and water priority and blue economy priority are going to advance and be really further enabled by unmanned systems.

Lastly, I have to acknowledge that this isn't like a new game. Our researchers have been doing fantastic things with UASs and UVs and USBs, and so that's just, we're just building upon that.

Now the difference, the thing that's different is that we're making the program more operationally focused, and that's why it's an OMAO, and the idea is right now all that unmanned systems work I talked about was basically smart scientists, you know, doing a pickup game.

I had really, you know, great, bright microbiologists and biologists basically acquiring their own UAVs and doing these marine mammal surveys, and then trying to do some of the AI data processing all on their own. You know,
biologists should be doing biology, I think, or
maybe a little bit of other things, but
centralizing the functions with professionals
like those at OMAO and the NOAA Corps Officers
really makes a ton of sense.

Have them do the certification
acquisition training and standards development,
and that's what we're going to be doing. We'll
have a major hub at Lakeland for UASs, where our
AOC is, and then we'll have one in the Stennis
area or the Gulfport area for the maritime
systems being surface and underwater.

This is our strategy, five main goals.
You can read them. They're all fairly
straightforward, and we're in the process of
finalizing the strategy which will have a number
of supporting objectives for each one of these.
So you can see the idea is advanced research,
advance the transitioning of research, and
strengthen our partnerships and our workforce to
do it. So we're going to be putting this out
sometime in the fall.
So this is it. This is why we're doing it. It's part of three main technology focus areas, the other being AI and the other being omics or basically microbiological big data, and these three together under my position as chief scientist, we're rapidly advancing again to transform the way we do our business in ways that are smarter and improve our skill, and at reduced cost. Thanks for letting me be on this panel, and I will take questions at the end.

MR. SARAF: We have Dr. Starek next.

DR. STAREK: Oh, very sorry. Thank you. So, hello, everybody. Mike Starek. I'm out of Texas A&M University-Corpus Christi. Thank you very much for having me here. I'm a professor in the geospatial engineering program there, and also affiliated with the Conrad Blucher Institute.

So, today I just want to give a little overview on -- I'm going to talk about small UAS. At the end, time permitting, I'll show a big small UAS for lidar, but really just the small
UAS and the standard kind of commercial grade
drones like the TGIs or the senseFlys or those
kind of things that we're using to map.

But briefly about our institute, so,
we had one of our directors, Gary Jeffress, serve
on the HSRP Committee. If you're not familiar
with it, CBI's an endowed surveying institute.
It was actually endowed at our university before
it was part of Texas A&M, and it supports -- the
main primary objective is to support our
surveying and geomatics program. We have a
bachelor's, a master's and then we now have a
Ph.D. in geospatial computing, which is heavily
AI-focused.

So, we're well-known for our work in
costal observations and modeling and the Texas
Coastal Observation Network, those kind of
things. We do a lot of GIS, et cetera. In terms
of our use of NOAA products, NOAA Tides and
Currents is a huge value product that we use.
Elevation research. Myself and my students are
huge fans of the NOAA Digital Coast, especially
lidar data. We use VDatum all the time. It's actually one of our integral products in our UAS workflow, OPUS, et cetera. So, thank you to NOAA for all the products that you provide. We really appreciate it.

So, just quickly, I know the folks here know about this, so I'm going to go through this very quickly. But some advantages of why I might want a small UAS for coastal mapping. Again, I'm just going to talk about mapping. We do other things with it. But, again, the ability of rapid deployment so we can target events.

I think the biggest value is temporal repeatability, but we're really at local scales. Technology's evolving, et cetera, but we're talking about local areas. When you scale up to regional areas, the price difference or cost effectiveness changes a lot. So if I want to do all of Mustang Island, for example, in Texas, I would say it's not conducive for small UAS. If I want monitor a beach nourishment project, it's excellent. Or, you know, we can do long linear
stretches of coastline, but there's different issues there with it.

The other advantage, I think, is what we call hyperspatial, or yesterday I heard high definition. It just means we're using pretty cheap cameras. The technology's evolving so it's getting better and better. But we're flying so low. We're talking about if you want centimeter to subcentimeter resolution, if you want that. So, very detailed imagery using full cost consumer-grade cameras, but at the altitudes we're flying.

Limitations. The number one limitation where we're at using electrically-powered small UAS is endurance. So that's one of the biggest things with high winds in that area. Now there are platforms that can go a long ways. They're gas-powered, all different kinds. But even if you can, regulations, again, if you don't have a waiver and you're in line of sight and you want to abide by the rules, you have to march along.
And then there are also challenges in terms of accuracy where we have lay out these long control networks, or we can equip a better, you know, a differential GPS on the platform to improve that. But those are some of the biggest challenges. And weather. And, again, the number one thing where we're at, we have one of the highest average wind speeds in the country, is, again, endurance issues with the wind.

Briefly, the main advantage of a fixed wing in terms of mapping is, all things being equal, you cover more area more efficient. Rotary vertical takeoff and landing. You can better control your flight. You can, you know, zoom in/zoom out. So those are kind of advantages, but the technology's changing.

As an example, at the bottom here we have a hybrid platform that's a vertical takeoff and then it goes to fixed wing. So a lot of options out there in terms of these platforms.

So, very quickly, what we're doing with this, at least in the mapping sense, it's
called Structure from Motion. It's just photogrammetry. So we're trying to map with cameras. But the basic way it works is, a lot of different software out there to do this, but you're essentially overlapping a bunch of images. These software go in and automate how it matches features between images, and then it can basically -- when it does that it can reconstruct the camera position orientation. You get kind of a point cloud and then it can densify that.

Really the end product you get out of this is kind of like the lidar survey. You get a dense, what we call a 3D point cloud or a textured point cloud. But it has different behavior than the lidar point cloud. We'll talk about that in a little bit.

Then what we do with this, or the software, the main products we get out of it are a digital surface model that's tied to vertical data and a digital elevation model. You can correct the imagery, you can drape on top of it, and you get these nice GIS products, very low
cost. I mean, this is incredible. You know, when I was in grad school it was kind of unheard-of, so it's pretty amazing. And lot of this has been pushed by the algorithms from computer vision robotics and stuff.

It's a culmination of inertial measurement units, GPS, autonomous systems, algorithms to create these things and classic photogrammetry in one. I will mention that one thing about this, this Structure from Motion is very powerful. Anybody can pump in data, but to get consistent, good data, accurate data is challenging, especially along coastlines. We still it. There's a lot of uncertainty in SfM. But it's incredible what you can get, but you have to be careful.

So, quickly, I just want to show some examples of what we're using it for, for one of our projects called Regional Geospatial Modeling Project. That's with NOAA NGS and our partners at the University of Southern Mississippi.

One thing we're using is wetland
monitoring. So at Mission-Aransas NERR, we have a bunch of different surface elevation table study sets or wetland sites. And so we're flying these routinely quarterly, yearly, et cetera, at different sites along the NERR. As an example of what we're doing with it, we've been using terrestrial laser scanning quite a lot. It's a $100,000 scanner. We've started integrating small UAS. Here's the same port cloud. We can fuse the two together, and if we do it right we can get very similar accuracies, but we're getting the aerial perspective, and we can take that data and do stuff with it.

So, for the sake of time, I won't cover this very much. But one thing we're doing is this Hurricane Harvey. We had a before survey and we went quickly after, and this is one of our wetland sites and we're able to basically quantify how much erosion, et cetera, that happened in that wetland site.

AI. We're doing more than just the point clouds. We have algorithms that actually
work on the point clouds to separate. But this
is an example of using the imagery, which is
another valuable product in just doing land cover
mapping. But in this case, we're using a
technique called deep learning, which is a type
of machinery learning AI well-suited for RGB
imagery. Very powerful, everybody's going to it.

But this is showing land cover
segmentation. We built an architecture, my
student, for wetlands specifically, and it's
breaking up into tidal flat, vegetation water, et
cetera. But we're at three centimeter
resolution, so very detailed. So, the kind of
things you can do with this data.

Hurricane Harvey, another example. So
we're not just mapping natural environments,
built environments. So we went with a team of
structural engineers from Notre Dame. We flew to
an area in Rockport that had some of the highest
average wind speeds in the region, hit really
hard for wind damage, called Salt Lake
neighborhood, and this is just an example.
We were able to use Google Earth products before when it was out there. We flew the small UAS and we were able to quantify, for example, roof damage, how much percent loss, and then we had the three dimensional information as well to help with these engineers to quantify and look at building codes, why did this structure perform better than another, very cost effectively.

Another example, this is a Port Aransas jetty where we're doing -- it's a 3D point cloud where we image structural damage you can see coming up here. We're looking at some of that damage on the jetty. So this is very detailed information that we can get with it.

I think this next example's pretty interesting. This is actually in Florida. We go out to Apalachicola NERR at Little St. George Island, if you're familiar with it, and do a lot of surveys on wetlands along the shoreline. In this case, we used a small UAS equipped with what we call an RTK GPS onboard, which greatly speeds
up our workload because we don't have to lay out
dense control networks. We still need control
for QA/QC, but we can lay out. But we were able
to map out nine miles of linear coastline in two
days with it.

It just so happens that we went -- in
this case we mapped out the whole beach basically
two months before Hurricane Michael came through.
And what we're able to do, then, is take that and
then the USACE JALBTCX group flew their survey
post-Michael and were able to couple a digital
elevation model from our small UAS before the
storm and then the airborne lidar, traditional
airborne lidar after, and we can take that and
quantify damage. And it's just an example of
looking at fording loss, et cetera.

I have a student looking at this right
now. One interesting thing is JALBTCX just
released a paper on their assessment of change
out there using a prior airborne lidar survey
three to four years ago. So it will be
interesting to see the difference in their
results versus what we've got with basically a
two-month before-storm assessment. So it's a
fusion of the two different data products.

Well, what about mapping below water,
since this is a bathymetric group, a hydrographic
group? So, we term that UAS photobathymetry, and
there are ways to do it. In terms of Structure
for Motion, it's very challenging because of the
algorithms rely on this feature matching.

So what you want with Structure for
Motion is you want basically all the motion from
the platform, absolutely no motion from things on
the ground. So, in water it's dynamic, because
you're flying back and forth and you rely on this
overlap. Things change, you get glint, et
cetera, so it confuses these algorithms greatly.

Of course, it relies on, you know, if
it's clear and you can see through the water, how
much clarity you have. These software have
issues with texture sometimes. You have
refraction and other things. But in certain
cases you can actually do pretty well with this.
There's a lot of research in this.

I know NGS and NOAA's Remote Sensing Division, Mike Aslaksen's group, is doing some neat work in this. So, early on, we started exploring this. Just as an example very quickly, this is a campus beach we have. This is the aerial image. It looks very clear. It should have done really well in Structure for Motion, but this is what we got.

So this is only about a meter deep, very shallow area. We got no returns under the water, for whatever reason, on that flight. So similar to when y'all mentioned satellite-derived bathymetry, we took the Structure for Motion data and then did a technique called optical inversion. We were able to get depths, and we confused to two, but the bottom line is what we get out is a topobathy DEM off the shallow area, small area. But we have a RMSE or an error of about eight centimeters. So it's an example of what you can do.

Another example that's kind of
interesting, particle image velocimetry. So this
is a group of students as part of an NSFS
project, so they're undergraduates that come to
do research. This is in Corpus Christi at Bob
Hall Pier on our island, and this is a little
different approach, and we're not the only ones
doing this, Corps of Engineers does a lot of it
with static cameras.

But basically we're just hovering and
recording video. And then in the air what we can
do is, if we can track the particles of the wave
velocities, we can get wave velocities values and
we can stabilize the image. Then, from that,
there's a relationship to the depth. So we can
basically invert the water depth.

So here's an example of just showing
the wave velocities. So we're hovering and we
can use the pier to kind of stabilize the
imagery. But the nice thing about this is you
don't rely on water clarity. Accuracies we're
still working on. It's challenging, but what
happens is here's an example of looking at
different video speed rates between -- we're
getting basically point clouds underwater.

So these are the kind of things that
folks are working on and different ways you can
go about it. It's an interesting problem.

Finally, lidar. So the technology's
rapidly expanding. Just to give you an idea,
this is what we would call a survey grade UAS
lidar. So this is still a small UAS, but it's
pretty big platform. So our operations with this
are quite different than with the ones you saw
before. We have a very strict protocol on how
we fly.

This is an example of a 2006 airborne
lidar survey at an airport in Sinton, Texas.
It's the only one we had available. So it's a
little bit outdated, but still you can see the
structure and what it would look like with a
point density. Here's the UAS lidar example of
how detailed the data you get.

We have very strict flight limitations
with it. We actually took this system, as an
example here, and went out to the Apalachicola NERR and flew some of our wetland sites. You might say, well, we both get point clouds from this technology. What's the advantage of lidar to Structure for Motion?

One thing, I think it's much more well-behaved, at least from a surveying perspective. The other thing is you get what's called multi-return detection. So you don't need to get multi points that can -- basically, you can penetrate better through canopy and different things like that, where Structure for Motion is photogrammetry. It's what we'd call a single return-type point cloud. So if you have vegetation cover, this is where you have a big advantage with lidar.

So I'll stop there. Thank you again to NOAA for being here. I'll just mention a few things. There's still a lot of work on best practices, especially in coastal surveying. You'd be surprised just with good flight design how much better data you can get. UAS is big
data. It's ripe for cloud processing and it's ripe for machine learning. Thank you.

(Applause.)

MR. SARAF: Thank you, Dr. Starek. I think next is actually me. But I'm not me today; I'm actually going to be Andy Armstrong, director of the University of New Hampshire Joint Hydrographic Center, unfortunately unable to join us this week. But he might actually be on the webinar, so if you notice any comments or you guys have anything to add, I'd be happy to add those in.

But just about me, I'm the acting chief of the Office of Coast Survey, Coast Survey Development Lab. So, there's many parts of NOAA that have grants with the UNH Joint Hydrographic Center and all other parts of UNH, as well as us. So I'm happy to represent this work this week.

So, I'm going to run through a bunch of scenarios that the Center has as examples of their work with autonomous systems, and I'm going to touch a bit on the artificial intelligence as
So, one of the main things, you know, beyond prototypes and testing things out, I mean the Center really intends and strives to further, you know, the actual mission of Coast Survey in terms of some of the mapping, the hydrography that we do, and they're taking the scenario-based approach with that.

So, here's a couple of examples to start with, ways you can do that. So, you can increase productivity by adding platforms. So, adding an unmanned system to the larger NOAA vessels can expand your capabilities and tools onboard. You can also operate, you know, these vessels which are smaller in areas of higher risk to either humans or equipment, such as even the photo on your right there.

Closer to shore, you know. We talked about this last year in Juneau as well about, you know, areas of heavy ice and other geography that makes it harder for the larger ships to get to.

So that's one example there.
All right. So this, as they say, is one not drawn to scale and is not a final design. But I wanted to give you an idea, kind of notional idea that the Center developed in terms of what a future NOAA ship could look like. So, imagine the Fairweather and its next generation, or even now we're doing projects to outfit existing ships with launches that could have this capability.

But imagine, you know, this variety of devices or configurations here, including like the C-Worker. So, the ASV C-Worker IV, as you can see, has been a key part of that portfolio. The iXblue DriX is kind of a newer one in the last couple of years that the Center's also tested and we'll talk about. And, of course, Seafloor Systems EchoBoats.

But, as you can see, there's various ways to imagine these ships being able to have this capability and being able to drop them in the water in an optionally unmanned fashion and what have you. So, while this is not a final
NOAA design, I think this is something that we're
definitely keen on looking at developing and
pushing forward, and Damian will be talking a lot
more about that in his talk as well.

Okay. So here's another example of a
project in the Great Lakes. So, Thunder Bay.
This was a collaboration between the Office of
Coast Survey and Office of National Marine
Sanctuaries in NOS, as well as the Center at UNH.
So, this was very interesting. So, a small team.
This was what we called more of a Navigation
Response Team scenario. So, trying to figure how
this technology could be used in a response
operational capacity. So, fairly limited. It
was about a ten-day mission mostly sent out of
the harbor and brought back.

So not really a concept of a chase
boat here, but it actually allowed us to, and UNH
to, you know, test out a lot of the technologies
listed there. So there were a lot of new
technologies kind of folded in there.

And also the last bullet I wanted to
highlight is a bit of a start of some AI sort of research. So, here's one idea of a type of application for artificial intelligence. It's object detection, classification. The Office of Coast Survey, you know, will also probably talk more, and especially probably in San Francisco, about some projects and ways that we could use that in mainstream processing. And we're also in line and kind of coordinated with Admiral Gallaudet's committee in NOAA, so we're happy to help there.

So, Andy is on the phone and he would like to give a comment and probably correct something I said, I'm sure.

(Laughter.)

MR. SARAF: These are big shoes to fill, I'll tell you, literally big. I mean, his shoes are really big.

(Laughter.)

MR. SARAF: All right. So, next example here, and you see ASV Global there. This was a really neat one. This was actually a
collaboration with National Geographic on attempts to find wreckage of Amelia Earhart's plane. I'm sure many of you probably know more about this than I do. I learned a lot about it in researching this. So, of course, Robert Ballard, who's famously known for discovery of the Titanic, was involved with this.

So, the ASV shown here, or one like this, was sent out at various parts of the mission when they may have something to dig deeper into. So if you don't already know, I don't want to spoil it too much. But I think they found some wreckage. It wasn't Amelia Earhart's airplane, it was something else. But that still was a pretty neat kind of process they went through to go through that and see what this could do. So there's links there with a lot more details on that. It's really cool.

All right. So one of the latest collaborations has been with iXblue, a French company. It is a diesel powered vessel but, you know, UNH has done a couple of things with it.
So initially they trialed it up in New England last December, and then some operational trials on the NOAA ship Thomas Jefferson, this in the last year.

So this again, they had another tool and another platform that we're looking at, and we're going to hear more about -- with USM, we're going to hear another type of technology with that in the same vein.

Okay, and so this is an example of -- there's Larry there and who actually -- this is a previous mission in Greenland, and ironically enough that is where he is this week as well, probably on a Swedish icebreaker at this moment is what I understand.

But this was with the EchoBoat. So this is another icebreaker and, you know, basically a scenario in terms of surveying ahead to find out what's coming and how to plan for that and avoid mishaps. So that's another type of application there. So that's just, you know, kind of a general survey of various projects
they've been working on, you know.

The Center has been there, as you know, about 20 years. We have a few of the graduates from the graduate school in the room in fact, and so it's been a very important pipeline for Coast Survey and NOAA in terms of, you know, kind of resources for continuing this kind of effort. So to tie it all up, I was going to talk a bit about the Coast Survey Ocean Mapping Plan.

So we talked a bit about the Coast Survey strategic plan earlier, and so as you read these bullets, you'll notice that there are definite overlaps there. So mapping the entire EEZ. So that's definitely a major goal here. That's also tied in here. So this plan goes into a lot more detail of how we're going to plan to accomplish a lot of these things.

Definitely there's a focus on unmanned systems and other automated processes, and I think as you'll see as this goes forward, definitely a lot more artificial intelligence, machine learning applications to that.
Specifically, Coast Survey. You know, we've done a couple of projects over the last couple of years just to kick the tires on machine learning, and so more to come on that as time goes on.

But you know, with that, of course you'll have access to all of the information and Andy's on the line as well. So I understand he would like to make a comment.

CAPT ARMSTRONG: Hi everybody, and Neeraj, thanks for doing this presentation for me. I'm really disappointed I couldn't be in New Orleans. But anyway, I'm happy to have an opportunity to participate here. So I think Neeraj did a great job. I just want to make a couple of other comments, particularly about the DriX trials.

Those are actually coming up in October, and in those trials what we're doing is trialing the sort of -- the wing man approach and we're doing so by making some adaptations to the Thomas Jefferson's davits, and we'll be able to pick up and retrieve the DriX in the davits much
the way we do with survey launches.

But the DriX is particularly seaworthy, a high speed and long endurance ASV. So we'll be able to operate that around the clock in tandem with the TJ, and only bringing it aboard every couple of days to refuel and then send it back out. So we view this as an opportunity to -- with one DriX double the ship mapping capability of the TJ in a rather straightforward and efficient way.

So that, that's the -- I think that's the main point I want to make. Those trials are coming up in October and we're really looking forward to that. So thanks for the opportunity to add in here.

MR. SARAF: Okay. Thank you Andy, and so with that thank you very much. I'm going to pass it next to Captain Brian Connnon from the University of Southern Mississippi.

CAPT CONNON: Good morning everyone. Thanks again to HSRP for having us, allowing us to talk. First up, I think hopefully what you're
gaining from this session as well is the
importance of your academic partners. So between
University of New Hampshire, who has a position
on HSRP, universities like Texas A&M and Southern
Miss, we provide I think a vital role to what
you're trying to accomplish from both the
academic of training the next generation of
hydrographers, as well as on the research side,
of trying these new technologies and pushing the
envelope and helping us get to where we need to
be faster, to accomplish things like Seabed 2030
and getting these technologies quicker to the
agencies and to the industry partners.

So I'm from Southern Miss, but the
campus I work at is actually Stennis Space
Center, which is only two miles across the border
from Louisiana. So we are close. We are, you
know, I live in Louisiana. So this is a great
opportunity for us to be able to talk to you, but
to talk a little bit about Southern Miss' hydro
program started back in 1999 by a guy you all
know well, Rear Admiral Ken Barbour.
So unfortunately with Ken's passing last year, we're all missing him. But that gave me an opportunity to come down and assume the role here at Southern Miss. But we are one of the two Category A programs in the U.S. with University of New Hampshire. But we also have an undergraduate program now in Marine Science, with an emphasis on hydrography that is the only undergraduate Cat B program in the U.S. for hydrography.

We graduated our first graduate this past summer and where's John? And David Evans snatched her up and he's put her to work. So we're trying to hit both the undergraduate and the graduate level folks. Most of our graduate students are either from NOAA, Navy, NGA and others or international.

So but in the 20 years we've been going, we've graduated over 200 graduate students out into the hydrographic industry. So really something for us I think to be proud of as a group, that we have these two institutions in the
U.S. who could provide that level of hydrographic expertise out to both government and our industry partners.

I'm going to kick it off with a video we did for the U.S. Hydro Conference that was held this year, so you'll get to see me again in the video. But it tells our story and then I'll go into more after that.

[VIDEO PLAYS.]

CAPT CONNON: So the Center that I lead, the Hydrographic Science Research Center was established a couple of years after the academic side, and again in partnership with the Navy, to try and support the Navy's efforts to advance their hydrographic efforts through the Naval Oceanographic Office and the Fleet Survey Team.

You can see some of the previous work that we've done there. A lot of work on the multibeam side for the NAVO survey ships. For a long time we had an ECDIS lab when S-57 was first coming online, and also the digital nautical
chart that the DoD uses. One might look at that and go it might be time for another ECDIS lab adventure as we go into the S-100 and all of the overlays that we've talked about yesterday on who's going to be looking at those, producing those and coming up with how we're going to use those new overlays.

Then the big one was CZMIL, which is the Coastal Zoning Mapping and Imaging Lidar that was mentioned by Mike that JALBTCX uses. Naval Oceanographic Office also uses that. So we were a big player in the development of that system. Right now, we're working with them on how to help them better process through automation machine learning that lidar data, and we're working on some potential projects with the Army Corps there.

But how we're supporting NOAA specifically with our unmanned systems projects, I'm going to talk about these things. So first one there, upper right, you see an L-3 ASV Global C-Worker 5 we've called the Sea Eagle. We're the
Golden Eagles at Southern Miss if you didn't know that. So everything's got to have an eagle something in there.

Saildrone project, I will go into that, and then we're going to be procuring an unmanned aerial vehicle this year under our NOAA grant. So I'm going to be talking to Mike a lot to get all of his lessons learned so we don't have to relearn them. Then under OER, we have our two AUVs, the Eagle Ray and the Mola Mola.

So the Sea Eagle, again built up in Lafayette by our good friend Thomas Chance before he retired. He made sure we got a good one, so thanks for that. Five meter diesel powered. UNH runs the C-Worker 4, so a little bit smaller version but again very similar. We do have an A frame and a wind sonar so we can tow either sidescan or do other operations, drop a CTD with that.

The goals of the project for NOAA really isn't about the sensors. We know how the sensors can work. It's more about how do we use
them, developing standard operating procedures, looking at the training and certification of operators and how do we integrate some of these COTS sensors that are out there and make them work on board platforms such as the C-Worker.

We'll be taking it aboard our research vessel the Point Sur in the spring to start looking at using it from a ship at sea as well.

Saildrone. So we have a rep from Saildrone here, Matt Paulson in the back, a former Navy guy as well, Fleet survey team. So this is an exciting project. We're using a wind-propelled solar-powered drone to do surveys in remote areas, and we wondered could we do this. Saildrone is a service, so you do not buy the vehicle, you buy the service from them.

So we have been working very closely with them. They've been a great partner along with Norbit, who's our multibeam manufacturer, to install a high end multibeam sonar in the bulb keel of one of these Saildrones, and then take it out on the Gulf and say could we actually survey
to the standards that we're looking for with this.

So you can kind of see our first lines there. You can see, I think we got a laser here. You can see here it was tacking a lot, all right. So a lot about this is understanding your wind and adjusting your survey plan accordingly. But as you can see for the most part, these things can hold a survey line really, really well.

So we were very impressed with how well it can hold it. But it doesn't have -- as long as you have some wind you can hold a line. If you have no wind, well then it's a buoy. But it's still collecting data, so that's a good thing.

Just to kind of some examples, so here's an area we were looking at. You see those two charted wreck positions that were there. Here's where we ran over those with the Saildrone, and then you'll notice the wrecks were exactly where they were charted, well done NOAA.

But this is the definition we're seeing from the
sonar, and I've got to point out this is not corrected for anything. This is just the raw sonar.

So we didn't have sound velocity collection available to us there. We also haven't corrected for tides. But this as you can see, these systems can collect good hydrographic data. So we're very excited about where this might go, where this could be used, places like the Arctic or the Western Pacific, you know, in our EEZ where it's either hard to get to or it's only accessible certain times of the year.

So you've heard NOAA's using Saildrone for many things, you know, fisheries, survey, those types of things. This is the next step. So we've got some lessons learned from it and from our ASV work. Autonomy? We're getting there, but it's not there yet. These things can go do some things on their own, but as you increase the technology of these sensors on board and the amount of data they're collecting, the interaction with the human operator has to be
there and that's where that kind of quotes of
unmanned.

So these are not unmanned. There's no
one riding them, but you still have to monitor
them and be looking at the data, and the
communications are really key. So one of the
problems we have with the Saildrone that we're
working through is how do we get some indication
that the sonar is actually working back from the
Saildrone during its mission.

There's got to be a way for that
software to talk to the command and control
software on board the drone to be able to come
back, similar onto the ASV as well. These
sensors weren't built to work on their own in the
hydrographic sense. So we've got to work with
industry on how do we integrate those better, how
do we make those connections between the command
and control and the survey software work for us,
so that we can understand how well our systems
are working without having to go out and check
them physically.
The data quality, we're impressed with data quality, but again we want to be able to see that in near real-time, so that we can make adjustments if we need to. And then maintenance. Upper right there, as you can kind of see, this was -- we had it in the water for what, Matt, about a month, and during nice algal bloom, very nutrient-rich waters in the Mississippi Sound. So there's a lot of growth on there.

So if you think about our survey boats now, we pull them out of the water at night pretty much, put them on board. You can clean things off. These things are going to be out there hopefully for 30 days at a time. So we had to start thinking about how do we protect those hulls and sensors.

So actually we've got a project with our Polymer Institute at Southern Miss, looking at some new coatings for these types of things, to reduce the amount of marine growth.

That last piece I'm going through very quick is we are now part of the Ocean Exploration
Cooperative Institute with URI, UNH, Woods Hole and Ocean Exploration Trust. So we're part of the team that will be doing exploration type surveys here in the Gulf of Mexico.

We're scheduled to go out to Flower Garden Banks National Marine Sanctuary. That's where we'll be using our AUVs to go down and do some mapping efforts for a potential extension of the marine sanctuary, and using our imagery AUV to look at what's growing in those areas. And that's it for me. Thank you very much.

(Applause.)

MR. SARAF: Thank you Brian, and just to add one note, that getting that Saildrone from USM to the port there was quite an engineering feat. I'm very impressed with that. It was a nice hot day, and we pushed that thing to the water and that was neat to see as well. Thanks. Next is Thomas Chance.

MR. CHANCE: Okay. I'm going to be radical. I'm going to stand up. I was one of the people in the back, so I can appreciate
somebody getting closer. Okay. So I'm Thomas Chance. I had a company called C & C Technologies. We did hydrographic surveying. We did hydrographic surveying for NOAA Coast Survey for many years, and ended up selling that company about five years ago.

But we had like 600 people and we did hydrographic survey and other maritime type survey all over the world, and we did a lot of UUV stuff, AUV, autonomous underwater vehicle stuff. We also started doing unmanned surface vehicles stuff back in the 90's. Ended up starting another company called ASV Global, and we sold that last year, about a year ago now.

So got lots of experience in the hydrographic area, hydrographic survey area. Lots of experience with unmanned boat and unmanned underwater vehicles. So it's -- and have had the opportunity to work with NOAA. So it's my honor to be here and share. I'm completely retired now. I want to tell you a year ago when I was working for ASV, I would have
told you the same thing today, you know, last
year that I will tell you today.

    So I just lay it out on the line,
good, bad or ugly, so that's what I'm going to do
here today again.

    All right.  So the content, we're
going to talk about unmanned, optionally manned
or optionally unmanned, minimally manned
conversion to optionally unmanned, converting an
existing boat to unmanned, force multiplier
decomposition and how that works, line of
sight versus beyond line of sight on unmanned
boat stuff.  Everything here is really about
unmanned boats.

    Examples of USVs that NOAA could
consider for unmanned plus, and then unmanned
lessons learned, and I'll talk about that.  So
from an unmanned boat perspective, here's some
examples and if I find the right button here.
Let's see, right there.

    Okay.  So you can see in the top left
we have this is the Ocean Alpha.  This is a
Chinese boat and here's a sea hydrographic. So these guys, these are small battery-powered systems. The one beneath it here too, Martec, these are battery-operated systems.

The most you're going to get are about four hours really, and if you get bad sea conditions you're going to have a challenge, especially if it's -- if it's a monohull unless you're in a flat glass, where you get some aeration problems that you sometimes have to deal with.

If NOAA Coast Survey's in a very protected area, then something like that would work if they know, hey look, we've got a survey that's going to take us three hours, then that would work. But for by and large, what you really want to do for NOAA Coast Survey is do like diesel or, you know, something not batteries.

Here's some other examples here. This is like the C-Worker 4 and C-Worker 5. This is, those are diesel-powered. This is electric. So
you have those constraints on them. Maritime Robotics out of Norway makes a jet drive one. Here's the AutoNaut, used like the wave glider, used as a wave to propel itself forward.

They have been, like the Saildrone, has been able to run lines, you know, to a pretty good degree. But when you don't have any real power, then you have to really limit the payload that you have on there, right. So you have to -- and then you have to worry about Mother Nature cooperating. You know, I need waves to run or I need wind to run and that kind of stuff.

So Sea Robotics, that's another -- oops, sorry. Pushed the wrong button here. Sea robotics is an electric system. This is another diesel powered. Kongsberg has a system, I just sold one of their systems. Kongsberg makes good stuff, you know, and it's expensive but it's good. And there's iXblue DriX, which was talked about earlier, unique as a survey rental house and they make --

So a lot of people will start off with
a system like this, right? They do a catamaran, they put some publications on it. What the first thing you'll find out is it works great if you're in Scandinavia, but if you come to the Gulf of Mexico, the heat kills it real quick. You almost have to have an air conditioner in an unmanned boat. I mean you really need an air conditioner in an unmanned to keep the electronics cool, unless you're going to work in Alaska all the time, huh?

Optionally unmanned means that in general you're taking an existing manned boat and you're adding software to it to make it work unmanned, which is really a very valuable thing because now you can work either way. If you want, hey I've got somebody. I need to get them off this big boat. I'm in anchorage and I need to run them to the dock. I need to go pick up something.

Well, if it's a totally unmanned boat, you can't do that, right? So there's -- and of course if you've got existing assets and I know
NOAA is converting some of their launches, manned survey launches to have that optionally unmanned capability, and that is certainly the right step forward.

This is a conversion of a Canadian Hydrographic Service boat. You can see a sea robotics system. Dynautics, they did -- that used to be H Scientific over in the UK. They've done a lot of systems. There's some other vessels that you see here. This vessel here, this is an ASV vessel. It's working in the Gulf right now doing hydrography.

Minimally manned. So the concept of minimally manned. Like one person told me, he said Thomas I do these ROV operations. I need 130 foot boat to do ROV operations. Usually it takes me 25 people. Really what I want to do is make a minimally manned boat, and I want to run, I want to monitor that boat over the satellite link and control the boat over the satellite link.

I want the ROV operations to be done
over the satellite link, but I want to have six
people on that boat, three for the day shift,
three for the night shift. Their job is to just
fix stuff that breaks, you know. I mean it's
part of the reality guys, and the payload can be
more complex and have more issues than an
unmanned system.

So you've got -- you know, when we
talk hydrography, that's kind of like the open
court lay up on unmanned boat, right? It's like
a sensor. It's pretty passive. It's not like
you're towing a bunch of stuff. So it's a lot
less stuff to break.

So here's -- in this example here, you
can see this Kongsberg is working with a company
called Yara on this 260 foot boat they're
building now, and that will be an all-electric
boat, and then in a couple of years they'll have
that running back and forth the exact same track
in Norway to carry stuff.

So it kind of shows some of the way
forward. M Subs, which is now Automated Ships,
they're attempting to do this. I haven't heard
that they've made a lot of progress. Ocean
Alpha, a Chinese company and then ASV came up
with this hydrographic solution, where you have
an AM-124 in the bottom and a 712 multibeam with
two C-Worker 5's in the back.

And so it's a picture, right. When I
was at ASV, we pushed that to help get it funded
by Congress, but haven't heard anything on that.
Conversion to optionally unmanned. There's a lot
of companies here that do conversion. Sea
Machines has a system, Sea Robotics has a system,
Dynautics.

Kongsberg has K-MATE, and actually in
this picture you see this vehicle which is --
their news release, press release just came out
the other day. They're going to try to cross the
Atlantic next year with the SEA-KIT, unmanned,
while monitored over the satellite link, and ASV
has a system.

As a force multiplier, this is a
TerraSond boat working in Alaska. This is an ASV
unmanned boat working the adjacent survey line. You can't really see this chart, this bar graph. It shows for the last five years the production. So the first year there wasn't much, but after that you're looking at one manned boat, one unmanned boat and they're both doing about the same.

Actually the last three years here, the unmanned vessel is doing more survey work than the manned vessel. So that's one unmanned boat. So if you get a big vessel like the Thomas Jefferson, you know, and you put two or three, I mean you're going to double or triple at a fraction of the cost of the big ship, right?

So that's really the big advantage of unmanned is that for a fraction of the cost, you can dramatically increase your production.

Line of sight versus beyond line of sight. Most of everything has been done so far using line of sight. Radio links to a mother ship, radio links to shore. But now you're getting more and more where you can do it over
the horizon, and when you're doing it over the
horizon over a satellite link then boy, that's
when the dam bursts, right?

I mean that's when you can do all kind
of things. When you leave the dock, you can go
out for long periods of time. You can get data
and you can monitor it. You don't have to worry
about crashing. I mean we're getting there,
right, and in some cases you can. Examples that
can be used for NOAA, the Kongsberg system that's
come out.

I mean Kongsberg has done some good
stuff over the years. The DriX is still a little
young, needs to be flogged. You know, work with
them. I mean hey, they're a good company and of
anybody that NOAA works with, they just need to
work with. I mean it's not like you're going to
go Walgreens to buy a calculator and it's going
to work, right?

You need to iterate, and then these
three systems are all ASV systems. Fugro system
just being delivered now. Two systems is really
the latest ASV system. It's a high productive, a high productive system.

So lessons learned. For real-time survey production a cheap USV can be very expensive, right? When you start to, you know. Oh yeah, we got, we really saved some money on a USV. So we got cheap radios that we're going to find out we're going to have to change. We have cheap connectors and anybody who's been in the commercial survey world or the hydrographic survey world or any of that, connector is like 30-40 percent of your problems.

Don't get cheap connectors, don't get cheap radios, you know. Have good network switches. All of these things will kill you and from a cost standpoint. So you might as well do it right, as opposed to trying to save money and costing yourself a fortune. Don't go with batteries, they just don't cut it. Go with diesel.

Smaller monohulls can have variation problems like I mentioned. One good strategy for
NOAA going forward, get an unmanned boat, just one. Don't order five, order one. Work with the contractor to debug it, then order four more. So that, that's what my recommendation would be. Beware of heat as I mentioned, all right?

You've got heat on your electronics, you've got heat on your -- maybe you have keel coolers, keel coolers. I mean hey, look. If this thing is built in Europe, they've got cold water, it works great. You know, maybe in Alaska it works great. You get it down to the Gulf of Mexico, a keel cooler it's like man, we need twice as big a keel cooler.

So I mean you really have to watch that. Beware of water. It's hard to keep the water out and especially in electronics. Beware of connectors as I mentioned. Launch and retrieval system is obviously very critical. If you can't launch and retrieve it, then it doesn't help if you're trying to use it off of a mother ship.

As I mentioned, don't expect that it
will work like a calculator from Walgreens. You'll get there, but it's -- you're going to have to work on it a little bit and at least recognize that. Hydrography is one of the easiest applications of unmanned boats. Don't get confused between good USV graphics and pretty paint versus lots of years of experience, because you have to have all those years of experience to really learn your lessons.

     Make sure your USV manufacturer has extensive maritime experience. If you go hey, look. Here's an unmanned boat company and they're all from MIT. Nobody's been on a boat, but they're all smart as heck but they've never been on a boat. That's a problem. COLREG autonomy has not been perfected and you must supervise them. You really need to be supervising them, or else you've got to expect that you're going to have an issue there.

     The last thing is check with other USV users before you buy. If you want to buy a USV from these people say hey, tell me all your
customers and then go talk to customers. Hey, does this really work, right? That's all I've got. I'm out of time and that's my contact information.

(Applause.)

MR. SARAF: All right, thank you.

Last presenter is Lieutenant Damian Manda from Coast Survey.

LT MANDA: All right. I was also sitting in the back so -- is this one on? Yeah. So I'm Lieutenant Damian Manda. I am the chief right now of the Hydrographic Systems and Technologies Branch under the Office of Coast Survey. Just to give a little bit of context of where that is, we're responsible for development and testing of new ocean mapping technologies and supporting existing ones.

We're part of the Coast Survey Development Lab within the larger Office of Coast Survey. Our main customers are within that, so the Hydrographic Surveys Division, the Nav Services Division and to some extent the Marine
Chart Division. But we also support a lot of other NOAA entities that are outside of that and also use their data and their expertise to support our operations.

But here I'm focusing primarily on our autonomous systems and a strategy that we have for Office of Coast Survey in using unmanned systems. So overall on the strategic plan that was discussed a little bit earlier, there's a bullet point for integrating new and innovative technologies into our mission priorities. So that's where we're focusing in this UxS vision, to develop and utilize unmanned systems for more efficient and effective acquisition of data to support NOAA's navigation products and services.

That comes from another kind of white paper that I believe the HSRP has seen in its iterations. So kind of going through some of the use cases that Mr. Chance touched on as well, there's a number of different types of vessels that have different applications for which they're best suited.
So for unmanned surface vessels, the small platforms are good for shallow water mapping, putting them into dangerous or unknown situations, and then for the bigger diesel powered platforms for the long duration missions, on really augmenting a ship. For unmanned underwater vessels, we've kind of shifted that to more of a small response scenarios, for the man-carried versions, and then for deepwater high resolution mapping for the larger systems.

The conversion type that we're doing with our launches, those are great for utilization of existing platforms and a lower cost conversion to be able to start integrating autonomous technology, as well as preparing the workforce that's on our ships for these next generation technologies, and knowing how to handle those systems.

We're also working on unmanned aerial systems. That goes towards better shoreline acquisition and some of the stuff that was talked about by Mr. Starek. The strategy is kind of
broken down into four main points on where we're focusing, so the first being developing enabling technologies. I'll go into each of these a little bit more in detail.

There's a lot of points on the slides as well that are kind of left just for reading, but I'll touch on the main points. Building and maintaining operational expertise. So this is the personnel development. Operational innovation. So this is the actual new platforms and sensors and the integration of them, and then collaboration.

A lot of the work that we've done has already been presented by the other partners, and they feed a lot into what we're able to do as a whole for Coast Survey. We have a lot of different steps in our data collection process. So this is kind of what goes on in some of our field platforms.

I'm not going to go into every single section, but the idea behind this is we're really trying to enable automation in processing,
because if you start getting an increased volume of data from unmanned systems and you have a force multiplier with more data coming in than you have people to process it, that's not going to work. It's going to slow down our bandwidth.

So we've kind of innovated all up and down the pipeline, from initial raw data collection to the delivery of reports where we can speed up that process, with our eventual goal of reducing that very significantly. Another enabling technology is the wireless data transfer. Our optionally manned launches have one system for this, and we also have procured another system that's been installed on the Thomas Jefferson and is getting rolled out to the other ships in the hydrofleet for monitoring and some low level control of the launches.

For the optional platform, operational platform expertise, we've stood up the Navigation Response Team in Stennis, Mississippi as a Center of Expertise for Unmanned Systems. The Admiral touched on that, and we also have a platform, the
Bay Hydrographer that does a lot of system
testing and has helped with qualification of some
of these systems.

So this year we've officially
transitioned all of the unmanned assets that are
owned by Coast Survey over to that NRT, as well
as done some training activities on board the
NOAA ship Okeanos Explorer to help facilitate the
operational expertise.

For the optionally unmanned launch,
this has been a big focus of my office through
the last couple of years, and this year was the
first year of field testing for the launches.
The NOAA ship Rainier has two that have been
retrofitted right now. We have a contract for
one more on the Thomas Jefferson, and plans for
up to three more that will be converted
throughout the fleet.

So this really allows us to start
building up that expertise like I said within the
personnel, and develop the CONOPS that are
necessary for running unmanned systems. As Mr.
Chance talked about, kind of deployment and recovery is a large part of this as well, so we're trying to figure out some of those systems and how they can work with vessels that were originally designed to be manned operation.

Right now on that -- right now we actually have our second round of testing going on in Hawaii between two of the launches being able to operate, one from the other and from shore, for some of the first true unmanned operations with those platforms. For the other innovation that we've been pursuing, we have shoreline via unmanned aerial systems.

We were able to do field operations this year in Michigan to support NRT acquisition, which also fed into the Coast Pilot, as well as some of the structure for motion processing that's been discussed. We're working on being able to train people. We have in a couple of weeks the first full class of training going for personnel to be able to certify in the operation of these types of UAS.
We have collaboration partnerships that are able to facilitate a lot of more rapid development. The Navy, as was mentioned, the CENOTE legislation directs us to leverage their expertise in development and transition of unmanned systems. We also have a memorandum of agreement that facilitates coordination and collaboration on both hydrographic survey initiatives overall, as well as specifically targets unmanned systems.

Right now, the Navy is undergoing a very similar autonomous launch conversion and actually using the same vendor, so we're hoping to leverage that directly for improvements to our systems through the additional parts of their contract. With the University of New Hampshire, some of this has already been discussed in that presentation. We had the first deployment of an ASV off of a NOAA ship for specific survey work.

They've also been advancing the DriX and this year, as was mentioned coming up very soon some tests on the Thomas Jefferson doing
that. Also the C-Worker operations in Thunder Bay earlier this year, as well as the Pacific Islands. In addition to the Earhart project, they've done some mapping in the marine sanctuary out in the American Samoas and for the DriX, just the retrofit with the Thomas Jefferson.

UNH also has a separate, slightly separate effort for Saildrones for integrating a deepwater sonar system into a large Saildrone, a 72 foot model that would be able to map deeper water than kind of what's the application for the USM investigation, which was already discussed pretty much in detail so I won't go into that too much. But that was tested in the Gulf of Mexico this year, as well as the continued development with the C-Worker 5 at the University of Southern Mississippi.

So kind of in summary for all of these, we have a lot of things that are going on within Coast Survey and among our partnerships. We've been working on these towards -- the goals that are on here are the ones that come from that
strategic plan. We've met almost all of them for
2019 that were designated. We've reduced our
shipboard data processing efforts significantly.
We don't have any exact metrics on that, so that
might be kind of a fuzzy checkmark but we're
definitely close to that.

We've staffed our NRT. We will have
the OCS training coming up very soon for UAS.
We've got the operational use of our launches and
shoreline field acquisition with the UAS, and we
have the DriX testing as well as the integration
of the mapping sonar on the Saildrone through USM
and UNH. So we've made a lot of progress on all
of these initiatives.

So going -- where does that go to
bring us forward with the strategy. 2019
activities is what I've summarized. In 2020,
we're looking forward to having additional
optionally manned launches. Continuing our
reduction in data processing, we have some
initiatives to continue innovating on the
reporting side, and we keep refining kind of our
data processing pipeline. Some of that also is
getting the shoreline data acquisition through
the UAS dialed in and getting that pipeline
developed.

I had an intern this summer working on
some of the initial development for that, and we
were fairly successful in starting that model.
And then also testing kind of navigation and
situational improvements for USVs. This will
hopefully also leverage some of the development
that the Navy's doing, which requires a level of
COLREGS autonomy in their unmanned conversion.

And then rolling out the shoreline UAS
to the fleet. So getting that training in place,
but also procuring the UAS themselves and getting
operational expertise with those. Then moving
into the years beyond that, kind of the bigger
goals to start supporting multiple deployments
from the UxS team, different types of deployments
and different missions, and then testing kind of
the more advanced mission behaviors, where you
have multiple autonomous vessels deployed at the
same time from a field platform, as well as expanding the use in more complex environments with more traffic, more obstacles to navigation, as well as kind of the persistent deployments that might be good in the river-type scenarios or ports where you have a vessel that will go out and routinely resurvey an area automatically.

And that's what I have. So we have a lot to look forward to.

(Applause.)

CHAIR SAADE: Thanks. Thanks everyone. That was a great amount of diversity and a real wide spread of how far we've come. We've been seeing a few of these presentations at the HSRP over the last several years, and we just keep moving forward. Okay questions. There have got to be some questions. Okay, I'll start.

So I see -- we at Fugro, I'm going to take my HSRP hat off, talk about as an operator and a contractor. We see the biggest problem at Fugro is the inability of the global Coast Guards or marine operators throughout the world to be
able to set a standard for being able to operate
these things over the horizon.

    We feel that until you can operate
them over the horizon and set them free and go do
massive amounts of collection for days on end,
we're never really going to see the benefit of
the fact that we have an autonomous vehicle. So
I don't know what anybody can do about that,
extcept we can keep complaining.

    But it doesn't seem that the U.S.
Coast Guard's getting anywhere, the UK
authorities or the Canadians or the Australians,
or anyplace else that we operate that anybody's
making any progress on this. So I don't know if
anybody's going to comment to that.

    RDML GALLAUDET: Those things operate
over the horizon, gliders. So I think hybrids
are something we should be looking at. So I know
there's these authorities and concerns, but you
know if you can -- maybe part of the mission
involves something where C2 and data
dissemination and download is done on the
surface, and then there's a near surface type of hydrographic mission.

I certainly think the technology is moving in that direction. But before you -- anyone else answers, I do want to point out that the good work the Thomas Jefferson did in demonstrating some of the unmanned systems, that was done through the leadership of a NOAA captain in the room, Chris Van Westendorp, who commanded the ship at the time. So I just wanted to acknowledge that and thank you Chris.

(Applause.)

CHAIR SAADE: Okay. And then along those lines, I'll give a shout out to the state of Louisiana, because as Thomas' old company and the Fugro Company, between the two offices that are based in Louisiana and the AUVs that they've been operating, we're probably close to a million line kilometers of collection since the inception of using these things.

All of that is driven from the headquarters in Louisiana, the technical people...
and the staff that do those things. Yes Thomas.

MR. CHANCE: Let me comment about running over the horizon and legal aspects of that, because when I was with ASV, we talked to the Coast Guard and different groups about that, and we couldn't get a square answer, you know. We've had Coast Guard headquarters people say hey, after 12 mile limit we don't care what you do, and we have other Coast Guard people say oh no, you can't do that.

And it's like -- and I would say that for the over the horizon stuff, which you've got to really make sure for unmanned boats, is to have, you know, that remote VHF capability, because when the Coast Guard pulls up and starts talking to you on a radio and you don't answer back, they don't like that, right? So you know, I know there's being efforts on that, you know, to have.

So somebody back at shore has got that satellite lady at the radio linked to a local VHF on an unmanned boat, so that if they call you on
16 or whatever, you can answer them and say yeah, there's nobody on the boat. That's why you don't see anybody. But it's still -- you're right. I mean it's unresolved to a large degree, but there's -- you know, from my ASV days we never had seen it.

You know, it's not like you can't do that. There's nobody ever really stood up and said don't do that. No, you don't -- you get in a wreck and it might be different, right?

CHAIR SAADE: Yes.

CAPT CONNON: So I think going back to what Admiral Gallaudet said about kind of having these underwater systems that can go out, if you look at companies like Ocean Infinity, Fugro's doing some of the same, of being out to do these huge ocean searches using multiple AUVs with potentially an ASV as a calm relay in an updating position and getting health status of the vehicle themselves.

That's a very expensive proposition.

The vehicles that are being used out there are
three to five million dollars apiece, and the longer that they can stay down and thankfully guys like Elon Musk are making our batteries much better. So now we can get underwater vehicles going for tens of hours, approaching hundreds of hours underwater.

Well then you've got to worry about well what's their positioning like? Is the data going to be good enough? You know, for a search it's probably okay. But when you start looking at ocean mapping requirements, you know, are you going to be able to maintain that navigation quality of data for that length of time?

And for the companies, now your data risk increases every hour you're under water. So if at Hour 99 of an 100 hour mission you lose that vehicle for some reason, well you've also lost 99 hours of data and how much is that worth to you?

So I think that's an interesting thing to look at as well, is how do we improve the ability to retrieve data or at least, you know,
processing on board as you're collecting, so that you can offload data to reduce your risk from an industry standpoint while you're getting these longer-lived missions out of the AUVs?

CHAIR SAADE: Thanks. Thanks Brian.

MEMBER HARGRAVE: So there are a lot of ancillary data sets which you can acquire with these autonomous systems, and for an example would be if you have a camera on a system then you probably have a turbidity meter. But are you recording that data and are you doing something with that?

Another example would be using the Doppler velocity to record the currents near the sea floor. Are those data sets being looked at, and would some recommendations of what those could be or how they could be used, would that be helpful from the HSRP?

CAPT CONNON: So I will say yes, we've looked at other things with our ASV other than mapping, and one we've looked at is with the winch and the A frame that we have, we could do
oceanographic stations, if you will, to map hypoxia in the Mississippi Sound by using a CTD with an altimeter so we can get down. We've used gliders for that, but we tend not to be able to get the vertical structure that we really want.

We are looking to get some microscale turbidity as well. It really depends on what your customer wants and the specific missions. So I think from the academic research side, we're willing to try anything as long as someone's coming to us to ask us. But to get to your other question of where does that data go, that's a great question and I think you've got NOAA data centers where that information should be going.

But a lot of it again is how is the research funded? Is it a standard requirement in the collection? You know, when I was in the Navy and we did mine warfare surveys, we didn't collect -- we were collecting bathymetry and side scan and those kind of things.

But we weren't collecting the water level information or the positioning well enough
to be able to then use that as a, you know, part of the hydrography mission that we should have been doing.

So yes, I think that is something to think about. There are a lot of things like on the Saildrone mission they were out mapping for us. But they also have an anemometer, a sea surface temperature and all those things. So they are able to contribute to that, you know, global modeling effort, that in situ data.

With the number of them out there, well that's a lot more data and especially if we're going to remote areas where you don't have anything else.

MEMBER DUFFY: Ed? So it's a little outside of the topic of discussion, but if you were here yesterday, you heard a lot of comments about multibeam surveys. You know, what I take from this is that the new technology coming out may see us with options on how the lower river is surveyed, you know, whether through better technology, unmanned vessels.
The challenge -- I mean one of the improvements to the single beam data the Corps has done over the last couple of years was related to the fact that they -- there were gaps between their lines, their survey lines, the single beam data, five to seven hundred feet. So they do a center line survey which -- I mean the truth of it is you have a survey vessel in the middle of the channel with vessel traffic altering, because they want that center line done.

So as these topics come up, I'll always bring it back to the local application. So looking at that in a different realm, and of course Mississippi River currents are a little different, turbidity, visibility, all those kind of things. But hopefully there's a business set and idea for looking at that application, which would be huge for at least this river system, and I imagine it would carry over to many others.

CHAIR SAADE: I mean I could answer. I can say yes to that, but it's -- the newer
generation that Thomas showed, they're starting
to get up to the eight, capable of achieving
eight knots. So the faster they can go, the more
they might be able to withstand the challenges of
the currents in the Mississippi.

MEMBER DUFFY: I remember the Jetsons.
I'm ready.

(Laughter.)

CAPT CONNON: Yes. I think Thomas'
point of, you know, battery versus diesel, you
know, that's a big part of it. But you know,
with the multibeams that we have now, you can
angle the sonar head and account for that.

So you don't have to run center lines;
you can still get the center line measurements
there. So but being able to do it faster, being
able to process data as it's being collected so
that there's very minimal cleaning to be done
once it comes back in.

But how do you make that something
that either it becomes an organic asset to the
pilots or to the port, or is it a contract out to
one of the companies who can do that for you. I think there's that scenario to look at as well, and then getting that into the concept operations that you have for that vessel traffic.

   How do you integrate hey the survey that's coming through, and it's going to be at a set time or whatever. Because I can tell you, yes they run a center line of that single beam and that's great. But they still have that 600 feet separation on either side. Nothing ever falls off a ship, right, never have a container go down or anything like that.

   So yeah. You're not going to see that. So that was, you know, for the Navy we used jet skis with single beam and side scans for beach surveys, because we were running single beam but we would miss the big rock that's going to punch a hole in the bottom of the landing craft, right? So similar kind of idea. You need to see everything down there. For you, it's not about seeing an object necessarily; it's about are you getting buildup of that sediment and
reducing your draft?

MEMBER DUFFY: So and I agree. I want to be careful and just that I am not complaining about what we have. It's the best we have, but knowing that there are advancements that we can. Some of the things that will drive the government agencies there are having the private industry show what is possible, you know.

When we prove what's possible and, you know, it's also wonderful if what's possible can be done better and cheaper, that's a big sell. So you know, I don't understand all of the technology, but I know what the applications we're looking for are. As we move forward, it would be great to keep in touch and thank you.

MR. CHANCE: So I would just tell you that look, the multibeam stuff came in like 25 years ago. Whoever's doing single beam, like bless their heart, right? I mean -- and the processing improvements have come along so far that it's not like -- it used to be really a challenge to process the multibeam data, and
that's gotten a lot easier.

So and then so unmanned boats and, you know, you've got to be careful of hot traffic area. You got ropes, you've got garbage bags, you've got -- I mean that's a reality, right? Trees, stuff floating all over the place. But at the same time and look, regardless if it's manned or unmanned, the cost of multibeam over single beam is going to be, you know, it's going to be nil, right?

So you might as well go with multibeam and you might as well -- in the unmanned stuff it should be less expensive, you know. You'd probably want like a Zodiac or something that, you know, if you hit something it's not going to be a mess, right?

CAPT CONNON: And I would say that the nice thing about the multibeam is you start building up a knowledge that you have never had before, and then you start tying in events of well we know when this happens, we are going to start seeing buildups, you know, this many days
later. You can start modeling when you will need
to go and dredge or when you need to go check to
see if you've got sediment building up.

Without having that kind of, you know.
So maybe you don't have to survey every day, you
know. Maybe you have to survey every week and
then as needed based on the flow of the river and
what might be coming that way. So but that's
going to take some time and effort and study to
kind of come up with what's that going to take.

MEMBER DUFFY: Didn't mean to
sidetrack the panel, but it's very relevant here
and I'd like to continue that discussion. Thank
you.

CHAIR SAADE: Admiral.

RDML GALLAUDET: So a little bit
different topic, but I neglected to mention two
important developments that are relevant to this
board. The first is we are with the White House
hosting a Ocean Science Partnership Summit in the
fall, and this is focused around all sorts of
ocean technologies.
So mapping is -- there will be a session, one of probably eight, that are dedicated to developing and advancing partnerships with the private sector, and that one will be on mapping and there will be some on some other areas too.

But that's going to be pretty exciting, and we expect to make some big announcements when we have that summit.

The second is the White House has also asked us to develop a National Strategy for Ocean Exploration that will involve mapping, characterizing and exploring. So that's going to be a major interagency effort. We'll lead it, and this strategy we hope will be the sort of foundation to grow our NOAA program as the lead program for all the interagency. So more to follow. Thanks.

CHAIR SAADE: Thank you. Did you want to ask a question?

CAPT KRETOVIC: Okay. Thank you for a very engaging panel. At this time, we're going
to open it up for public comment. So those of
you on the phone or in the room, if there are any
public comments, we'll be taking them at this
time.

MS. MERSFELDER-LEWIS: If anybody in
the audience would like to ask or make a comment,
we would welcome that.

MS. LUSCHER: Thank you very much for
your presentations today. My name is Audra
Luscher. I'm hosting a session tomorrow that's
focusing more on taking a look at the
hydrographic services related to sea level. But
I think we see a very interesting application
related to coastal mapping and to what seems more
of a sea level perspective for communities from
Brian talking about your program, you're
communicated that and the need for that.

But I definitely see our unmanned
systems are focused on more of our navigation
portfolio. Do you see any disconnects that we
need to be kind of looking across, outside of the
navigation spanning into the studies around
coastal risk, and how these unmanned systems
could be -- are being used so they can meet both
missions? I just wonder if you have any thoughts
or suggestions.

CAPT CONNON: So I would say yes. Due
to time, I wasn't able to go through all the
things that we're attempting. So NOAA has also
funded us to look at some VDatum and subsidence
work that we've done off -- in the Mississippi
Sound tied into this as well, you know. Using
multi-GNSS constellation type work to try and get
better measurements is part of that
understanding, you know. Is it subsidence or is
it sea level rise? That's always a good
question, so we're trying to help answer that.

So I won't say there's a disconnect.
There always can be better collaboration, but I
think forums like this and our conferences.
We're seeing -- in the hydrographic side we're
seeing more of the coastal resilience and those
types of issues coming up. So that's all tied to
that. So yes, I think from the Southern Miss
side, we are seeing that in Mississippi, that especially.

MS. LUSCHER: Thank you.

CAPT KRETOVIC: We have one public comment from the webinar, and so we'll be reading that here momentarily.

MS. MERSFELDER-LEWIS: Okay. We have -- we actually have two. We have -- or this is all from the same person. It's all from Vitad Pradith, who by the way used to work for us. He's an awesome guy by the way.

Okay. He asked if -- is there a current strategy for shallow water areas, 60 feet or shallower for USVs? What are the needs for NOAA from this perspective? Then he asks is there a current strategy -- it's the same. Some of these platforms are too large for these really shallow areas. So if you want to comment on that.

LT MANDA: I think we kind of mentioned that a little bit. If you're talking about like near coastal areas that are really
shallow water, that's kind of the realm of the Navigation Response Team. So that's where having the unmanned, the small unmanned assets tied to the Navigation Response Team out of Stennis is the intention for those assets.

So those are the -- they have Z-Boats and EchoBoats, kind of two meter long vessels that are capable of going in less than a meter of water, up to -- and the EchoBoats are equipped with multibeam EchoSounders that should be capable of going beyond 60 feet as well. So as long as the operational parameters are there, so not too many waves or current or that kind of thing.

Those solutions are intended for that. Also for shallow water up to the shoreline type mapping, certainly to some extent the Structure for Motion from UAS. As has been mentioned, there are some challenges with getting bathymetry out of that. But it is possible in some regions for shallow water as well as the lidar systems that can be mounted on UAS.
We don't have any trials of that right now, but it certainly shows promise for near-shore mapping. Then for kind of ship-supported activities, certainly some of the -- like the C-Worker has been used in very shallow water, I believe both by kind of our contractors, TerraSond and the like, as well as the UNH operations in the Channel Islands.

I think there was a picture shown in one of the presentations where it was right up against one of the rockfaces basically. So that's kind of where it might be dangerous for a manned vessel to go in there, but we can use some of the smaller to mid-size unmanned vessels that are ship launched for that as well.

CAPT CONNON: Yeah. I would just add to that that, you know, surveying -- we've said team effort I think a couple of times here. But you know, using all of your assets available. I think the use of airborne lidar is probably an under-utilized asset to do a lot of that shallow water work, because there are areas where the
water is clear enough, where the lidar can get in and do that close-in work very, very quickly.

So then you would only have to then manage your assets to determine what's the best available asset to go back in. Small USVs like the EchoBoat I think are also useful from the Corps perspective in their canals and locks.

I got a call a couple of weeks ago from the New Orleans Sewage and Water Board asking if I, we had any students who wanted to come down and survey some canals, and a couple of days later they found a car shoved in underneath of one full of beads, of course.

But when you start thinking about the canal system and those type things, these small USVs are great assets for that, because you can stand on the bank and you can just remote control and run them around. But that, someone's got to put that into place. So I really think the answer to that is it depends on the situation for which asset you want to use to tackle the problem.
DR. STAREK: I'll just follow on for comment on the lidar side. So the bathymetric lidar, which is blue green, there's been a lot of involvement on the small UAS side. Even Riegl, which is a well-known big airborne lidar maker has a bathymetric lidar built for smaller UAS. There's a company, I think they're called Aster. ASTRALiTe. They have one.

I haven't again, tested myself. But that technology keeps miniaturizing and miniaturizing. Now of course clear water is always a challenge with bathy lidar. Like there are technologies like the photon counting lidar you might hear about and really sensitive detectors, different things to try to get through that.

But a lot of developments on the lidar side. And then we can thank the auto-navigation industry and autonomous cars for really pushing it on the topographic side, because a lot of those sensors were built for just basically autonomous vehicles. They've pushed the cost
down. So there's a lot of interesting things in lidar.

There's SLAM UAV lidar, which basically in theory we do it a lot in indoors, but you can just fly and seamlessly construct the point cloud. It will have challenges in moving environments, but there's a lot of push towards that.

Some of the advantages of lidar too are real-time, you know. The system we use can actually get a real-time point cloud. If you had a need for it, that wouldn't be a survey grade quality data product but if you just wanted to do rapid assessment. But anyhow, some interesting developments there.

CAPT KRETOVIC: Okay. Thank you very much. It was a great panel.

(Applause.)

CAPT KRETOVIC: Now with the remaining time before lunch, we're going to go back to the priorities document, thank you. So we'll just -- everyone stay seated and we'll continue on with
the discussion. That way we can maximize our time.

(Pause.)

VICE CHAIR THOMAS: Thank you, thank you. Virginia's putting up -- I did take a minute to just reorganize what we had already discussed about. But it's hard to read off the screen, so if you have your written copies, all the better. Do we want to take five minutes and talk to the panel people?

(Pause.)

VICE CHAIR THOMAS: Five minutes?

CAPT KRETOVIC: Okay. So we'll take a quick five minute break.

(Whereupon, the above-entitled matter went off the record at 11:28 a.m. and resumed at 11:34 a.m.)

VICE CHAIR THOMAS: Okay, all right. I think we're ready. So let's start in. We're onto the Identify and Quantify the Benefits of NOAA's Services, Hydrographic Services. Do you see that row?
MEMBER MAUNE: I can address that. I am currently evaluating the preliminary results of the 3D Nation Elevation Requirements and Benefits study, and one of the things I alluded to earlier this morning is that I am seeing great big holes in the input, where I don't think we have reached all the right people.

I just talked about the holes in the sea level rise and subsidence, and that we're missing major areas. But the same is true. There's a total of 30 different business uses in this study, of which sea level rise and subsidence is only one. But there are other areas in which I'm seeing major holes. So one of the things we're going to --

I'm working with Ashley Chappell at NOAA and with somebody else from USGS and others, and we're trying to plug in those holes. So we're still keeping that study open, and people can still submit their requirements to it, so that we can better prove the value of these NOAA products.
VICE CHAIR THOMAS: All right, shall we put it on the -- what fits better, the track or the ongoing?

MEMBER MAUNE: We can track it.

That's fine.

VICE CHAIR THOMAS: Track. We'll just leave track there then, and I'll just make a note that you're reviewing with Ashley.

MEMBER MAUNE: Yes.

VICE CHAIR THOMAS: Okay. Next one, Enhanced Navigational Assistance, and this one really I think is focused on PORTS, continued rollout and expansion of PORTS types of observational data needed for safe port/harbor operations. Oh, I know. We did have that precision nav paper, so I can list this down. I started an issue paper section at the bottom. Is there anything else that we need to other than track through the Nav paper, through the issue paper? Anything else that we need to do here?

Rich, do you know whether there are any ongoing issues that the HSRP should be
looking at? A multitude probably.

MR. EDWING: So you know, I guess it was timely I did the PORTS overview and status yesterday. But I think, you know, one of the biggest concerns is it's continuing to grow and at some point it will exceed capacity, you know, internal capacity of the support. You know, we need to be looking at that, you know. But I think the HSRP has been weighing in on that over time.

VICE CHAIR THOMAS: So maybe make a note just about the tracking growth and capacity thresholds or something like that?

MR. EDWING: Yeah.

VICE CHAIR THOMAS: And then shall I move that down to the issue paper section, or do you think we need to also have a bullet for this one up here, to keep it in there? Or do you think if it's in the issue paper tracking that that's enough?

MR. EDWING: I think that's enough, yeah.
VICE CHAIR THOMAS:  Okay.  So that will go to issue paper.  You can just put "issue paper" there Virginia.  All right.  Marine and Geospatial Information Infrastructure.  This was also an issue paper from May 2018.  So unless anybody has any comments here, I will move that one down to issue paper to track, and it's an issue paper.  Comments on that one?  Are we all good?

VICE CHAIR THOMAS:  Okay.  Moving on to Rick Brennan on the Fleet Update.  Do you want to give us a five minute update on the fleet?  Maybe not right now, but maybe some time before we break tomorrow afternoon?

CAPT BRENNAN:  Certainly.

VICE CHAIR THOMAS:  Okay.  I mean that way we are tracking, and it's an issue paper,
right?

CAPT BRENNAN: Right.

VICE CHAIR THOMAS: It's nice to have an update. We haven't really had an update on that, so it would be great just when we have five minutes in this session, okay. Next one is information dissemination, getting a wealth of information collected, aggregated. Recommendation. This is also an issue paper from 2018. So track an issue paper, okay?

Oh, you're right. It was not an issue paper. It was in the letter to the Administrator. So I think it was related to public-private partnership, and maybe we can merge this one. We have one up above that talks about our encouraging -- I think we said continue to encourage the public-private. Maybe we can merge it in there. Everybody okay with that?

All right. Then we have this AIS one, and this was also in our letter of recommendation to the Administrator. This is kind of an ongoing issue I believe, right? Ed, you want to comment?
MEMBER PAGE: Admiral Gallaudet

mentioned that it's going to happen in 2020.

Didn't you say that?

MR. EDWING: Yeah. So we've been

tracking this issue. An officer named Kurt

Zegowitz is a Coast Guard liaison, a NOAA-Coast

Guard liaison. Anyway, so since the letter,

we've been working with Coast Guard and provided

him technical information. The work's really all

on their side to kind of make it happen. But

they've recently let us know they've put some

funding towards it. There was a software issue

where they were having trouble integrating PORTS

data with other kinds of data that was being

integrated to AIS there.

Put some money towards developing a

software solution to fix that, and they expect to

have that done I believe February of 2020. Once

they fix that, then they can start moving on with

an implementation plan, and start putting PORTS

data out over AIS.

VICE CHAIR THOMAS: Right, okay. So
I'm going to put track. Is that something that we want to mention again in the letter, to thank him for the progress that's been made on this issue?

MEMBER PAGE: Yeah, I think that's good, because Admiral Gallaudet's keeping a close eye on this and he brings it up with his Coast Guard counterpoint. So he's made, you know, he's paying attention to it.

MEMBER PAGE: But Ed, this is something that really kind of firmed up at that meeting up in Alaska this last summer, where Michael Emerson was there --

MR. EDWING: Yeah, yeah. That's really -- yeah, when Michael Emerson heard that.

MEMBER PAGE: Yeah.

(Simultaneous speaking.)

MR. EDWING: It really, you know, flipped his switch.

MEMBER PAGE: Yeah, and in fact they were just here at my office last week at NAVCEN.

People talk about headquarters, about
implementing this and the pressure that -- or the
interests of NOAA and how the Admiral says do it
type of thing. So it's all good. It's moving in
the right direction, so I think if we just track
it --

VICE CHAIR THOMAS: Okay. So we'll
put a thank you note in the letter.

MEMBER PAGE: Or we just say we're
pleased with the progress --

(Simultaneous speaking.)

MR. EDWING: Little too early to
congratulate, but yeah, appreciating the
progress, yeah.

VICE CHAIR THOMAS: Okay. We're down
to Autonomous Vehicles Surveying. Well, we just
had a great panel on that. Do we -- what do we --
- Ed, do you want to talk about this a bit, Ed
and Deanne? Do we want to do anything more with
this in Hawaii, like an update or --

CHAIR SAADE: Seems to me we've been
updating about once a year.

VICE CHAIR THOMAS: Okay. So you
think that maybe San Francisco?

CHAIR SAADE: And maybe yeah, and San Francisco's got a whole bunch of suppliers there, right.

(Simultaneous speaking.)

VICE CHAIR THOMAS: Or visit Saildrone. Why don't we visit Saildrone?

CHAIR SAADE: It's probably the right space.

VICE CHAIR THOMAS: We have to invite Saildrone people here? Yes, okay. So we will table that one until San Francisco and I'll put down there possible visit to Saildrone. All right. Chart of the Future, Supplementary Navigation Data Management and Distribution. Ed, do you want to talk about that one a bit?

MEMBER PAGE: It's a passion of Lindsay's in terms of where we're going with all this, but it's also part of what Admiral Smith has shown a couple of times and -- do you want to --

VICE CHAIR THOMAS: Yeah, go ahead.
CAPT KRETOVIC: Yesterday during the precision nav session, you also were briefed on the HD chart and kind of where we're going with it. So I mean that was a good update I felt like for the Panel.

VICE CHAIR THOMAS: Okay. So should we call it ongoing tracking, ongoing? That comes under our, what are we calling it, encourage? Endorse and encourage, how about that?

MEMBER PAGE: I might add, I mean isn't that part of also the new strategic plan talks about that, right? Did I recall that correctly? So I mean there's definitely movement in that direction, and just track it I think makes sense.

VICE CHAIR THOMAS: All right. What's left here? Okay, Disaster Response. Gary, right. So this is issue paper. I'm going to create a bullet under issue paper. But then an additional do we want to keep anything up here? Let's see. Neeraj gave a nice presentation on the importance of accurate observations and
modeling during extreme events.

Like do we want to -- we do mention under AI section the disaster response topic.

What do you think?

MEMBER THOMPSON: We do, and then there was other things in the draft of the Emergency Services paper that were related to AI, but dealt with PORTS products. So I think those fit more in with this.

VICE CHAIR THOMAS: Okay, all right. So do you suggest keeping this line there?

MEMBER THOMPSON: I do, uh-huh.

VICE CHAIR THOMAS: Okay, and maybe encourage and endorse and track, you know, ongoing?

MEMBER THOMPSON: Correct, uh-huh.

VICE CHAIR THOMAS: Okay. So Virginia, we're going to do two. We're going to put one, an IT one down below in issue paper, and also the Endorse and Encourage.

You can take out New Orleans. Oh okay. Yeah, that's perfect, that's perfect.
Okay. Education, oh wait. All right. Under Education, Promoting Hydrographic Education, including students, et cetera. We've had academia on our Panels. Anything else? What do you think Ed on that one? Inviting academia. It's Promoting Hydrographic Education. Does anybody have any feelings about that?

I mean I think we always try to include academia in the technical issue, but I'm not sure we need really a priority bullet for this.

MEMBER MAUNE: Sometimes we've not had anybody, but this time we had two universities in addition to New Hampshire.

VICE CHAIR THOMAS: We have Texas A&M here.

MEMBER MAUNE: We really had three universities.

MALE PARTICIPANT: Three universities.

CHAIR SAADE: So we've talked sometimes of having students or at least young people be more directly involved with sitting in
on the Panel, sort of mentoring them to get into this.

VICE CHAIR THOMAS: Right.

CHAIR SAADE: And we haven't, we haven't done much with it. The point of it was, not being discrete, we've got a lot of old folks here, and we don't have much input of the very much younger generation in terms of what do they find that's important. We're not getting any feedback at all on things like that.

VICE CHAIR THOMAS: Right, right. So Lynne is telling me it's really not in the mandate for this advice, because since we're advising -- but I think what we can do, I'll move it down to the archives section.

CHAIR SAADE: Okay.

VICE CHAIR THOMAS: But I think as a group we always -- I mean I think it's great to have university input coming from a university, you know, and certainly the more we can encourage young people to attend and be part of the program, I think it's better. Maybe in Hawaii we
can think about that when we're forming the
program.

Oh, and there have been grad students
involved in this one too. Yes.

MEMBER KELLY: Question perhaps to
Lynne. Do we send invitations or notices of the
meetings to targeted universities maybe in the
areas that we're going to be meeting?

CAPT KRETOVIC: She said you might
have grad students on the line. Oh we do
definitely on the webinar, yeah.

MEMBER KELLY: And perhaps, you know,
as an action item on this, perhaps we could
actually do something and not talk about it.
Let's maybe try to see if we can formulate a list
of universities or grad programs that we could
target that might be in the area, so that they
would have a chance to attend in person and
perhaps have some forum.

VICE CHAIR THOMAS: We did, we did,
and then in the University of Hawaii I've already
talked with Melissa. Barb just left, but Melissa
Iwamoto is Barb Kirkpatrick's equivalent over in Hawaii. She's fantastic. She's very tapped into this meeting. She wants to help out. PacIOOS is very connected to a lot of young students that are right at the university. So we will -- in Hawaii we will definitely also have a broad distribution there.

MEMBER KELLY: Okay. I think we ought to make a practice of trying to target groups.

VICE CHAIR THOMAS: I do. I do too.

MEMBER MAUNE: I would add that Dr. Qassim Abdullah is a faculty professor, and he's going to join our Panel in Honolulu, and he just might be interested in this topic himself.

VICE CHAIR THOMAS: There we go, okay. Yes, all right. So yeah, no we -- I think we all like to encourage that participation, so we'll keep it in mind for every meeting. All right, last one. Hydrodynamic Modeling and Validation: The need for data inputs for modeling. Does this, and we say Hawaii. Does this actually fall more into the San Francisco AI one? Neeraj, do
you have a comment on this?

One of our last bullets is
Hydrodynamic Modeling and Validation: the need
for data inputs for the modeling as it pertains
to navigation within the near shore. Sal, maybe
you can show Neeraj. Do you have a copy of it
there?

MR. SARAF: We probably need to take
a closer look. But I have a feeling that's not -
- that directive, I think there's a comment
earlier that's another facet of AI, that you're
going to have many facets of AI that are going to
get folded in eventually. That could be one
later, but probably not at the outset.

VICE CHAIR THOMAS: Okay, all right.

MEMBER CHOPRA: I was going to say --
thanks. That's a requirement today because we
are deepening our channels, and we need that
hydodynamic modeling, because a ship is --
there's a relationship between the depth and the
width and the length of a vessel, and so how much
water it's taking out or pushing out of the
channel and what effect it has on the walls, on the jetties, the infrastructure floating and fixed.

So I think that's an important one to look at especially today, because we're going into a massive dredging program. A terrific dredging program has already been started in the space.

MR. SARAF: Thanks for that Anuj. I think that's actually very good feedback, that I think that we probably should consider accelerating that a bit.

VICE CHAIR THOMAS: Maybe San Francisco. They have more of a challenge coming into the Port of San Francisco. It might fit -- there's more, I think, hydrodynamic modeling going on in San Francisco than in Hawaii.

CHAIR SAADE: And they have a really great hydrodynamic model that might even be good for a tour.

VICE CHAIR THOMAS: I know, yeah. Oh yeah, at the Bay, at Sausalito, at the Army Corps
facilities.

MR. SARAF: So I think that's a --

VICE CHAIR THOMAS: Rick had something too.

MR. SARAF: The last point I would make is, you know, I think we're in the midst of a -- Coast Survey of a -- and with CO-OPS and a few others and NOS, on a five year modeling plan that we just approved. However, we do have opportunities to update. So if this indicates anything we should look at, we could probably do that. Thank you.

VICE CHAIR THOMAS: Okay, thanks.

Rick?

CAPT BRENnan: So as I remember this particular item, and anybody who has a longer memory than me on it please speak up, but I thought -- I mean when we were talking about hydrodynamic models, I think they were talking about like our operational forecast systems, and what the needs for those OFS were with regard to navigation as far as the products that we put
out, how they're getting used, what the
resolution of those products need to be and how
do they need to be portrayed.

So I think, I think that that's what
we were talking about with that one, so anyways.
Not that hydrodynamic modeling of ships wouldn't
be valuable too, but that's -- we don't do that.
So I think that may have been what that topic
was.

VICE CHAIR THOMAS: Okay. So this is
as it pertains to the OFS and is there a
resolution that can be met that would help any of
the navigation. Is that what you just said? How
about you send me a statement. No?

CAPT BRENNAN: Sure. I'd be happy to
do that. I mean I was just trying to jog
everyone's memory on that.

VICE CHAIR THOMAS: No, no, that's
true, because I don't have very much information
on this, which means that I didn't get a lot of
feedback. So okay. Oh, yeah. Lynne is just
wondering if Juliana or Rich have any input on
this that should be included also?

MR. EDWING: So I don't recall that discussion, so it's hard for me to weigh in. But I think what Rick said is probably accurate. I would agree with what Rick said.

VICE CHAIR THOMAS: Oh okay.

MEMBER McINTYRE: I would agree with that too, and I think it related to when we first started looking at the precision navigation subject and that's what it --

VICE CHAIR THOMAS: Okay. Rick, let me just work with you afterwards, and we'll come up with something there, just so I can get something more in the comments. Okay, yeah.

Say "See Rick Brennan." That is it. I really appreciate it. I will try to update this and maybe get it even back out to you tomorrow, email it to you tomorrow, just to give a quick glance, a once over, make sure I captured everything. I will try to highlight in yellow any changes that I've added.

I just wanted to ask Juliana or Rich
or Liz, do you have -- are we missing anything
that is near and dear to your hearts, that you
feel like this committee or Panel should be
addressing?

MEMBER MAUNE: Julie, could you give
us a legend for what these colors stand for. I
forgot what the peach, yellow, green, blue stand
for.

VICE CHAIR THOMAS: You know, if you
look in the last column, it's merely separating
it by Hawaii, San Francisco, ongoing, track.
Don't worry about the colors right now. It's
really my way of organizing it, just so I know oh
this is like Hawaii. Okay, we got to look at
this for the next meeting.

MEMBER MAUNE: Okay.

VICE CHAIR THOMAS: Okay.

MEMBER MAUNE: All right, thank you.

VICE CHAIR THOMAS: And right now it's
a little bit jumbled, because as you know we are
modifying it. But by tomorrow, I'll send it out
again so it will be easier.
MEMBER DUFFY: So for my humor, I will tell you that I am handicapped and that I am color blind.

VICE CHAIR THOMAS: Because you're color blind.

MEMBER DUFFY: So I don't know what any of them mean. I can read. I can read very well.

VICE CHAIR THOMAS: The last column is really the most important for any type of logistics, because that says what we're going to do. That's like the status column, what we're going to do with it, okay?

CHAIR SAADE: Okay.

VICE CHAIR THOMAS: I think we're good on this.

CHAIR SAADE: Okay, great. So before we break for the audience, don't forget to do the sign-in sheets please if you're new coming in today, and if you are leaving to drop off your badges. Otherwise, we will be back at one o'clock. Thanks everyone.
MS. MERSFELDER-LEWIS: Ed, please take your valuables with you.

CHAIR SAADE: Oh yeah. Please take your valuables with you.

(Whereupon, the above-entitled matter went off the record at 11:56 a.m. and resumed at 1:05 p.m.)

CHAIR SAADE: Okay. We have a few short presentations on Technology Working Groups and some updates. Rick's going to start with an update first.

CAPT BRENNAN: Okay. So this is just to provide a brief update on NOAA's fleet recapitalization plan. So currently we've got -- we've got funding for two Class A's. Those are in the design process right now. I think it's out to three vendors and they'll be down sampling that. Those are not expected to be hydrographic vessels, which is what I believe that this body is interested in.

So the first approach of that would be for the NOAA Class B, which is you know -- whose
primary mission would be charting and surveying.

We have an independent planning team that's going
to be working on that, that we've got initial
requirements put together. We don't have
detailed requirements right now.

The thing that we have made
exceedingly clear to the Office of Marine and
Aviation Operations is that, you know, a 10 to 12
year timeframe to deliver a vessel to replace
these two 50 year old ships is not satisfying.
So what they are doing is they are investigating
a number of options to do that, of how they can
expedite that plan.

So one of the things that would do
that is to be able to take away a major element
of that design process, and one of those options
for that is to provide, as government-furnished
information or equipment, a hull design. So we
actually, we the government actually own a hull
design, and that is the hull form of the
fisheries survey vessels.

So what OMAO is currently going
through and looking at is can they repurpose that FSV hull form for use as a Class B. So we have just undergone some tank tests this summer, where they have taken the models. We've actually resurrected the model from the Navy and brought that to the Carderock Test Center just outside of D.C., and to put that in the tank. I've got some pictures that I'll show you of that.

But the original FSV when those were designed, they took I believe a 30 foot plug out of the center of that. So basically if you imagine taking a chain saw and cutting a 30 foot chunk out of the center and removing it and sliding the bow and the stern together and zipperng it back up, that's what they did, and that's the design that we have right now for our FSVs.

There were issues with -- there were issues with having the size vessel that we wanted. So this design, what they've done is they've undone the zipper, separated them, put the plug back in and they're working on that
length and full length version of that. So
that's ultimately what it looks like.

This was for a single prop design,
which I think we've passed along and they
understand is an unsatisfactory version of that
as well. They have another design for which they
did not build the model. They had the
mathematical and engineering design for it. They
had not built the model of that I mean, and there
is actually a physical model.

Nope, nope. These are all pretty but
don't tell you anything. There it is. So that
is the -- that's the physical three dimensional
model of that vessel, which they actually ran
through the tanks. It's about 12 feet long, so
it's not -- it's not something that you stick on
your mantle. And so they're doing testing on
that, and then I think the intention is that they
would build out a new model for the twin prop
version.

That would be Z drive and be fully DP3
capable right now so that you had, you know, had
that as an option. I think as we move forward with unmanned systems, I think you have to expect to have a vessel that's dynamically positioned. There's just no way you can, in my mind, that you can effectively do ROV operations without significant fear of cutting your umbilicals, without having some sort of DP positioning on that. So that is forthcoming.

So here's some other pictures of that, of them putting the plug back in. You can see that giant reddish-shaped area was the plug that they put back into it, and this is them finishing it just before testing on that. So they've run those, they've run those tank tests with this model, with a single prop version of that, lengthened from the current FSVs like the Dyson and the Bigelow ships that are currently in the fleet right now.

So there is value to that, and there's some thinking that this could shorten the design period significantly by up to three years. So then we give them this and then they just need to
put the propulsion systems in and the deck
structure in and all the mission equipment, and
so that would be a significantly reduced design
load on that and hence shorten the delivery time.

So that's certainly what we're looking
at. I believe the last time we reported out to
you that there had been some hopes of getting
vessels from the Department of Transportation
that had been repossessed. That has
unfortunately fallen through. So however, I
think there are still some negotiations, because
apparently DOT only sold the first -- well, it
was the most recent one that was launched, hence
the newest one, and that one did get auctioned to
the Navy.

And then they have I believe four more
out of the five that are sitting in the Reserve
fleet now down in Texas that they can't do
anything with. So I think we are pursuing
options for how to engage those vessels in some
useful way, because at this point they're just
-- DOT is not making use of them and they
apparently got no other bids during the most recent round of negotiation or sorry, the most recent auction.

So that's my very brief and impromptu update on fleet recapitalization. I'd certainly be happy to take any questions on that.

VICE CHAIR THOMAS: No, I think that's great.

CAPT BREN NAN: Great, thank you.

CHAIR SAADE: Thanks, Rick. Any questions or comments?

MR. ASLAKSEN: Did you want to do an update on aircraft?

CAPT BREN NAN: I'm not an aircraft guy, but we did just buy two aircraft, a KingAir and a Gulfstream 550. Did I talk pretty on that Mike?

(Pause.)

CAPT BREN NAN: I'll let Mike talk to this. July was a good month for us though. We did buy two planes, so that's -- that's positive.

MR. ASLAKSEN: Correct, so yeah. OMAO
awarded two contracts, one for a G550, which is a Gulfstream aircraft for hurricane reconnaissance, but also is used to support the GRAV-D program and then also a KingAir 350 ER, which is the exact make of the aircraft that we primarily use in NGS for the coastal mapping program. While it would be primarily to support Weather Service and there's no survey program, it will be outfitted for us to put our cameras and systems in as well as a backup.

CHAIR SAADE: Thanks for that update.

I'm going to go ahead and summarize a little bit on the Technology Working Group. We haven't met much since the last time we met. I'll blame it all on Lindsay because he's on boats all the time. Anyway, two things that we're definitely going to try and accomplish between now and going to Hawaii, which will be we've been promising a Seabed 2030 update for the masses, and we'll do that.

We can easily do that as a telephone call, a conference call with the associated
slides. And then we'll probably, once Lindsay gets back, we'll organize an artificial intelligence background update, the kind of things that are going on. Again, just to get everybody a little bit of background information on what we'd be planning ultimately for San Francisco. That's about all that's new and different, or that we should be pending. But we'll get back into the swing of things about doing these briefings every couple of months. Any questions? Any ideas? Okay, Ed. Do you want to do any Arctic update?

MEMBER PAGE: That's a cold call. Well, other than we have a position paper, I think there's nothing else. I mean you can't go a couple of days without having some meeting in D.C. or somewhere in Europe or whatever on Arctic issues and it's in the news. It's melting, it's still melting, melting faster than anticipated. All kinds of projections for us, how much more trade, how much more cargo going through there. But actually the most recent report
that came out of CMTS was fairly modest as far as increase of traffic. So when we talk about New Orleans and other places like that or LA or you name it, we're talking about maybe 500 deep draft ships going through the Bering Strait a year ten years from now or something like that, which is not a huge amount of traffic really.

Most of those ships will just be going to Russia, you know, to haul out LNG or mining zinc and other products, or condensed, gas condensate and I'm still not sure. There's a lot of hesitation, you know, reading the news of shipping companies like MSC. I'm sure you followed this, Anuj, have said we're not going to take the chance of transiting the Arctic waters with all the environmental issues, uncertainties and lack of infrastructure, et cetera, et cetera.

So that sounds kind of like the big part is not going to happen as anticipated. On the flip side is it's a zero tolerance issue. So I still think there's going to be more shipping, a different type of shipping. There's still a
need. It's the Wild West, I use that term a lot, but it is truly the Wild West as far as infrastructure capabilities.

So and Congress is very interested and the Coast Guard's interested in icebreakers, et cetera. So there's going to be some more activity up there, and so I think it still warrants what NOAA has been doing all along. And so our position paper really just talks about the challenges and what the needs are.

So the challenge is obviously remote area, limited infrastructure in the past, no aids to navigation to speak of, and I mentioned the other day how the Coast Guard hasn't put much in over the years. Basically said we don't have enough money to deal with the Arctic, so we'll let people figure out on their own how to get around up there.

That's starting to change. The Coast Guard and NOAA are going to have more of a role in that, and so I think today, and the paper just kind of speaks to that. I mean we're not -- I
think everyone recognizes, those other agencies recognize it's going to be a new mission up there, other things to do. We're just validating there, providing HSRP's position that that's a new mission, new opportunity.

But this is nothing new. NOAA's already, you know. Rick and his crew have been prioritizing where they're going to survey and have been spending a lot of time up there surveying waters, especially in light of the fact that some tankers are going up there and lidaring and other activity.

And it's going to be new, what they call Arctic PARS if you will, that's going to be routing measures off the Beaufort Sea. Right now there are routing measures to the Bering Strait. The next step is move that all the way across the Arctic, across the Beaufort Sea. That also kind of drives what my understanding NOS would do, is make sure that any corridors outlined basically are safe to transit, there's no surprises, not going to come across something in those
corridors.

So that's one of the things the Coast Guard does, has asked in the past. Can you validate that I'm not sending people into harm's way? I know last time you tried it, it was the 1800's. I know you were a little uncomfortable with that datum and perhaps we can upgrade that. So a lot of the activity has been done already on that, and there's still a lot of gaps and holes so that's my story and I'm sticking to it.

CHAIR SAADE: So you know, obviously you hear a lot about a tremendous amount of melting and green linen and the heat waves that you guys have gone through this summer. Is there any awareness where you sit relative to Russia's Arctic? I mean do you just assume it's retreating dramatically?

MEMBER PAGE: They have kind of -- they have less heavy ice than we do, but they also have a very -- there's a real business, there's a real economy coming out of the Arctic for them.
So everybody invests in these super-duper icebreakers that are huge and nuclear powered and way bigger than us to make sure ships get in and out and they charge heavily for that capability to get in and out, and they consider all those waters their territorial seas, even though somewhat challenged that they've gone a little bit too far on that.

But you know, who's going to fight them off on that? It's not worth fighting over I don't think, so I mean they have the same issue. I mean it's less of a challenge getting ships in and out. The season's extending further and further.

Ice is leaving, you know. It's a much longer transit season. Where it's just a couple of months beforehand now it's almost six months where you see vessels going to the Bering Strait in December and these aren't icebreakers. These are tankers going through December, which is almost unheard of in the past.

So you know, the next time you go up
there, you know, if you just wear your New Orleans clothes you'll be fine. Not quite there yet. And but so -- and my theory is that I don't think we're ever going to have -- my colleague here, my chocolate colleague here might think otherwise, but I don't think we're going to have a big growth in shipping activity on our side of the Arctic, until such time there are ice retreats beyond the Northwest Passage.

So you can do a straight shot to Iceland, because the Northwest Passage is just like a big plug. It's shallow, it's a lot of channels, navigational challenges. There's ice that only gets stuck in certain, blocks it off and you can't get there, and they don't have the infrastructure like Russia, where they have these huge icebreakers willing to facilitate trade, nor are we.

Our icebreakers are not going to be opening the sea lanes. They're there to provide a presence and they're deliberately not designed like they are in the Great Lakes to open sea
lanes. They're just there to be there, and
search and rescue, environmental protection and
some research, et cetera.

So nevertheless, I mean vessels will
be going across our waters, but not to any great
extent. You won't see container lines or
tankers, whatever, bulkers going to any large
numbers until they can actually clear the
Northwest Passage and go above it, and then I
think they get a clear shot over to Europe and
that will be a different ball game. When's that
going to happen? 20 years, I don't know.

MEMBER CHOPRA: I'd love to add
something valuable. I was going to say two
things happening. On our side, there's not much
happening. But because of the way the rates are
at the moment, shipping rates are now -- so last
time shipping rates were high was 2006-2007, and
then it's being continuously in recession.
There's been the longest recession in shipping as
such.

Now the rates are coming up to some
extent, although there's something with this trade war going on that the bulk is going down. But they're still at multi-year highs. That makes it viable for them to run that short route between Europe and Asia. So Asia is the consumer engine. Europe is the one coming in from there.

That engine, that's what we're talking about, 80,000 to 170,000 dollars per transit what they're charging on those, the Russian side of it and their requirements. But that's what's happening. The other bigger problem with melting is multi-year ice is coming into ship channels. So it's actually a bigger problem in shipping than this melting, than otherwise.

So first, that multi-year ice which slides into shipping channels will have to melt and go away or get grounded somewhere before it opens up for shipping, because multi-year ice is stronger than steel. So that's our challenge at the moment.

CHAIR SAADE: Any other comments on Alaska or on technology or --
(No response.)

CHAIR SAADE: Okay. Julie, you want to pick up where you left off or the next conference? Thanks.

VICE CHAIR THOMAS: Sure, okay. One comment is I have just updated the matrix, the priorities matrix. I want to just get together with Rick for that last sentence. But I'm going to mail it out to Lynne and Virginia and they'll send it to you, and maybe we can just look at it. Not tonight, because we're going to be busy, but maybe some time over breakfast or some time.

I'd love to just have consensus because we included this in the letter to the Administrator last, after the last meeting. So it would be nice to have it pretty well done by the time we leave here. And then I think we're going to break into breakouts for the working group. There were a lot of people to go with Gary.

I think that maybe since we have most of them that are going to be in Emergency
Management you just stay here, and you could consolidate a bit. Arctic? Was it Anne?

(Off mic comment.)

VICE CHAIR THOMAS: I know. I'm going to have to pay somebody 100 to sit on mine. Dave and I are the only ones. Is there anybody else on Sea Level?

(Off mic comment.)

VICE CHAIR THOMAS: Oh, I wanted to mention that. We have fabulous offers from our partners here in this room, and we definitely can benefit from subject matter experts also. So I note for Audra has volunteered. Mike, I think you've been tapped for a couple. Maybe you can kind of go between the two groups, and Neeraj, Galen I mean any --

You know, if anybody in this -- you are welcome to join these groups in other words. Officially, I believe that we can receive advice, that we have to craft the wording and really do it ourselves. But we are more than welcome.

There's a lot of expertise that's out there,
Susan, anybody. Anybody that wants to join us is welcome.

So I think that Dave, why don't you and I go next door to where we had breakfast, right, or lunch that's open, and maybe Ed too. I think that we take our two groups into the lunch room and do it there, okay? Great.

MS. MERSFELDER-LEWIS: It's only for how long Julie?

VICE CHAIR THOMAS: Oh, for how long? When are we leaving? You tell me Lynne. What is the time?

MS. MERSFELDER-LEWIS: Are you going to want to recap?

MEMBER McINTYRE: Let's do the recap in the morning.

VICE CHAIR THOMAS: No. Well yeah. Let's do the recap, you know. I mean we'll see how far we get. But I'm assuming we're going to use up our time.

MS. MERSFELDER-LEWIS: Do you want to come back in here as a group at 2:15?
VICE CHAIR THOMAS: Oh sorry. 2:15, and then we have to leave at?

MS. MERSFELDER-LEWIS: You're going to break at 2:15. You're going to have to talk about whatever you want in 15 minutes, about what you just discussed, and then you'll leave at 2:30 and we'll leave.

VICE CHAIR THOMAS: Okay. So let's take -- let's come back at 2:15 and regroup, and we can just get -- if we're not done, we're not done. If we're done, you know, at least we can kind of update on the status. So that gives us 45 minutes. So that should be enough to make quite a bit of progress. Does that sound good?

Any questions?

MEMBER THOMPSON: And Emergency Services stays --

VICE CHAIR THOMAS: Emergency, you are right here Gary.

(Whereupon, the above-entitled matter went off the record at 1:27 p.m. and resumed at 2:17 p.m.)
CHAIR SAADE: Okay everyone. Could you take your seats please? We're going to reconvene and do a wrap-up for 15 minutes. So Kim, being that you're in that corner, you get to start, if that's okay.

MEMBER HALL: Well, I'll just give a quick readout from what happened. Does that work too, or we don't hear this right now.

CHAIR SAADE: Wrap-up for the day.

MEMBER HALL: I'm going to save my comments for the morning. Thank you.

CHAIR SAADE: Okay, that's fair.

VICE CHAIR THOMAS: I thought we -- we're not giving a wrap-up on the breakout groups?

CHAIR SAADE: What are we giving a wrap-up on?

VICE CHAIR THOMAS: On the breakout groups.

CHAIR SAADE: Oh sorry, my fault.

MEMBER HALL: I can start. That works.
CHAIR SAADE: It's not in my script so

I'm --

MEMBER HALL: You're lost. I understand. So we haven't been doing this and I apologize. I'm Kim Hall and I was with Gary Thompson talking about the issue paper related to AI and automation related to emergency response and disaster response.

So where we got to with our small group is we have an outline of how we move forward. I will rewrite the paper within the next week or so, share that with the smaller subsection of folks. Then once we're happy we have something, we will share that with the rest of the committee and the subject matter experts that very thankfully added some flavor to our discussion today, and then we will move forward with a plan that I guess in Hawaii it will likely be finalized if everybody agrees.

But it is going to be completely rewritten, so we have nothing to offer for this meeting.
VICE CHAIR THOMAS: We got to line 6.
CHAIR SAADE: Not Sentence 6, line 6.
VICE CHAIR THOMAS: Line 6 of the paper literally. We just had a really good discussion, because once again talking about sea level, it's like how broad do we make that within NOAA? It's hard to exclusively talk about these three divisions, just exactly what we do without tying it into the bigger picture.

So but we've kind of come up with something we think is pretty good, and Anuj and Dave are reworking that first sentence, and then we are going to still be -- we still need more time. If we had any time, like an hour tomorrow.

(Off mic comment.)

VICE CHAIR THOMAS: Yeah. So I'm hoping that tomorrow we can, with a -- Anuj is going to update that text and then email it back out, and then we can having some time tomorrow to look at it again. I think the context -- it was really that first sentence, getting the idea of how broad are we going to make this and what are
we really addressing for the three.

I think the examples and everything
will fall into line after that. Okay, thank you.
Yeah, thank you all for being in that group. It
was a really good discussion.

MEMBER McINTYRE: Yeah. So we looked
through the Arctic paper and -- yeah, because
he's not here. Oh sorry. We reviewed what Ed
had put together, and this is essentially kind of
an update paper for the paper that had been done
in 2015. And at this point what we discussed,
that it should be reorganized a bit and focused
more on the areas where NOAA has the input to
effect. Is the speaker working?

CHAIR SAADE: Yeah, we're hearing you.

MEMBER McINTYRE: Okay, so it's not
feeding back right, and then the other. Closer?
Okay. So we're going to reorganize it a bit. We
didn't feel, because the other one is out there,
that that's a big push and get this paper out at
this meeting, and then the other thing that we
discussed was related to some of the issues that
Dave Maune had put forth from his observations up in Juneau with the small coastal communities, is that perhaps we could add a sentence and a bullet point within the Arctic paper, addressing the concerns that David brought to the attention of the Panel today.

CHAIR SAADE: Anyone have any other topics that they'd like to discuss today?

(No response.)

CHAIR SAADE: That's it. Let's go. We're going to call it for the day.

(Whereupon, the above-entitled matter went off the record at 2:22 p.m.)
CERTIFICATE

This is to certify that the foregoing transcript

In the matter of: Hydrographic Services Review Panel

Before: NOAA

Date: 08-28-19

Place: New Orleans, LA

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