PMEL “Saildrones Explore the Bering Sea” transcript: https://www.youtube.com/watch?v=Nf5LdCL2tOg

MALE VOICEOVER 1 >> With PMEL we selected a core of about 20 different ocean sensors which means greater detailed drawings over a period of one year.

This year we're moving forward on the back of last year’s success in the Bering Sea. We're going back again with the same two vehicles, with the same science payload but including one key instrument, which is the science-grade fish finder.

MALE VOICEOVER 2 >> Saildrone work is going to be done during the time that we’re doing an acoustic trawl survey of Walleye pollock in the Bering Sea. This is a large fishery and we conduct semi-annual surveys to measure the number of fish now present in the area and that's used directly to set fishing quotas.

MALE VOICEOVER 3 >> If we could detect the presence of these endangered whales, it would get us information that's just brutally hard to get from ships and other traditional means.

MALE VOICEOVER 4 >> Having autonomous systems surveilling the sea is what we think is the future.

CHRIS SABINE >> All right, welcome to the Pacific Marine Environmental Laboratory, including all of you that joined us here physically today, as well as those of you that are joining us on YouTube.

What you just saw was a sneak peek at an exciting new project that we’re just starting in the waters off of Alaska this summer. And if this technology is successful, it can provide a new platform that scientists can use to remotely study the oceans and do research that was not possible before.

This mission is a collaborative effort between NOAA Research’s Pacific Marine Environmental Laboratory, NOAA Fisheries, Alaska Fisheries Science Center, the Saildrone Incorporated, Greeneridge Sciences, Kongsberg Maritime, the University of Washington Joint Institute for the Study of the Atmosphere and the Oceans, as well as the Marine Mammal Commission.

Last week, we launched two saildrones in an effort to study the eastern Bering Sea. These are autonomous sailing craft that you just saw in the preview clip that we just showed at the start of this broadcast. These saildrones are equipped with technologies that allow us to measure physical and chemical parameters as well as biological parameters that help us to better understand whales, seals, and fish in these remote areas of the Bering Sea that would otherwise be very costly and difficult to monitor from a research vessel.

With these platforms we’re able to gather data to help us better understand warming temperatures, sea ice changes, and ocean acidification in these highly productive waters. Last summer, the Pacific Marine Environmental Lab teamed up with makers of Saildrone to conduct a three-month survey that was very successful. We were just measuring the physical and chemical parameters at that time but the saildrones covered over 2,000 miles in that study and made over 40 million measurements as these platforms followed the sea ice retreat in the eastern Bering Sea.

Last week, as you saw in the video, Richard Jenkins, the developer of Saildrone, launched two more saildrones out of Dutch Harbor, Alaska. And for this year's mission, which is the first time we're linking the physical and chemical measurements together with these remote biological observations. So to talk about that I'd like to introduce Doug

DeMaster, he's the Director of the Alaska Fisheries Science Center and the team of scientists that are planning to conduct several important research projects as part of this saildrone mission. Doug?

DOUG DEMASTER >> Thank you, Chris, and thank you everyone for coming today and thanks for everybody on YouTube for watching this. The Alaska Fisheries Science Center is really thrilled to be partnering with PMEL and others in this project. Research in Alaska, as you know, is expensive. It's difficult to get to. It's dangerous and it's costly. We're very hopeful that this partnership will lead to kind of a new way to study the environment in the Bering Sea.

One of the things that the information will be using this year will be helpful in terms of managing the largest fishery in the US--the pollock fishery. And in addition, we're also hoping to collect information on protected species and of course, it's this information that we use for trying to promote the recovery of protected species that occur in Alaska. The outcome of the research, we hope, will provide for or ensuring a stable production of seafood for the US. We also hope that this information will allow us to protect jobs in terms of commercial fisheries and recreational fishing in Alaska. And we hope that it will help us preserve a way of life that has endured for thousands of years for many Alaska Native communities.

So the 2016 saildrone mission builds on last year's mission and the scientists will again be collecting oceanographic data as they did last year. But this year in 2016 we're also going to be collecting biological information and so that's something that's new.

We have four projects that will be conducted using the saildrone as a platform this summer and we are combining oceanographic information, biological studies, to generate a more complete picture of the relationship between marine mammals, fisheries, and the environment in the Bering Sea. So we have representatives from the four scientific research teams with us here today. I'm going to invite each one to share a little more about their specific research projects. And after each one has had a chance to provide a quick overview, then we'll open up for questions and answers.

So first I'd like to invite Phyllis Stabeno from the Pacific Marine Environmental Lab to speak about her planned oceanographic work. Phyllis' work is helping to build a baseline of environmental conditions that will help us determine how future changes, due to climate change and other factors, are affecting the Bering Sea in Alaska. Phyllis?

PHYLLIS STABENO >> [Audio cut off] …is a large, semi-enclosed sea. To give an idea of how large it is, the eastern half is a shallow shelf which is much larger than the state of California and the southern boundary is longer than the east coast of the US. This vast area supports one of the most productive marine ecosystems in the world with vast numbers of marine birds, marine mammals, and fish. In fact almost half of the US catch of fish and shellfish come out of the Bering Sea. And this supports a multi-billion dollar fishery industry. In addition to commercial fishery, this marine ecosystem also provides about three-fourths of the subsistence harvest of the indigenous communities, that are scattered along the coastline, use each year. The Bering Sea is a high latitude sea--that means that in December ice begins to form in the north. It's advected southward, usually covering much of the Bering Sea. This means that in the north, the ice, it's ice-covered for about six to seven months a year, and in the south from one to three months. This makes it a very difficult place to study year-around. So the Bering Sea [coughs], excuse me.

Like most high latitude seas, the Bering Sea is very sensitive to climate change. Um…So how the Bering Sea ecosystem would respond to a reduction in the ice and warmer conditions is an important question that we're now investigating.

We have noticed marked changes in the Bering Sea in recent years. For instance from 2001-2005 there's virtually no ice on the southern shelf and there are very warm conditions. Connected with this was a very low recruitment of pollock for those years. The mechanisms, well, the low recruitment, in turn, caused a lowering of this quota for fisheries for the fishing catch, by almost half. The mechanisms were not clear, are still unclear, on what's caused it. But we have another opportunity. After eight years of cold conditions, in 2014, the Bering Sea shifted again to warm. And that has continued in 15 and 16. So this year we have an opportunity to explore the mechanisms that are affecting the ecosystems such as the lowering of the stock. To do that, we need to have a large number of measurements. But as I said before, the Bering Sea size, the harsh conditions, and its remoteness, makes collection of data difficult. Data is typically collected using research vessels during the ice-free period and with more instruments throughout the rest of the year.

In recent years there has been rapid advances in the development of new high-tech platforms and instruments to sample the ocean and atmosphere. By augmenting the traditional sampling via ships and moorings, with its new technologies, such as the saildrone which is what we're going to discuss today, we can expand the spatial and temporal scales of what we're measuring which is critical to answering the questions of "Why" is the ecosystem responding to these multiple years of warmth. And we can also monitor these changes as they occur. Thank you.

DOUG DEMASTER >> Thanks, Phyllis.

Now I'd like to introduce Jessica Crance from the Alaska Fisheries Science Center. Jessica is going to talk about eastern North Pacific right whales. This is an extremely endangered population and this novel research we're hoping will lead us to helping locate some of the very few remaining animals of the species in the eastern Barents Sea. Jessica?

[No audio, muted mike]

JESSICA CRANCE >> Sorry, take two.

So our project involves passive acoustic monitoring of marine mammals with a focus on the North Pacific right whale. There are only an estimated 30 individuals left and very little information is known about their full distribution range or migration patterns in the Bering Sea. We know that they are consistently detected in one portion of the southeastern Bering Sea each summer but conducting the full-scale marine mammal surveys needed to monitor their entire historical distribution range is prohibitively expensive. But by integrating with the saildrone we can cover a large spatial area, especially to the west of the 70 meter isobath that we have not been able to cover in over a decade. So this will hopefully help fill in some of the current gaps in knowledge regarding the spatial distribution of right whales in the Bering Sea.

To that end, with funding from the Marine Mammal Commission, we have integrated a passive acoustic recorder, the Acousonde, designed by Bill Burgess of Greeneridge Sciences, into the keel of each saildrone. This instrument will record marine mammal sounds continuously throughout the entire mission.

We will identify right whales by two of their call types: the gunshot call and the up-call.

[Audio plays of gunshot call and up-call]

If we're successful, the data obtained from this project will help us better understand the distribution of this critically endangered species in the Bering Sea and will help guide conservation and research efforts in the future. Thanks.

DOUG DEMASTER >> Thanks, Jessica.

Next Alex De Robertis from the Alaska Fisheries Science Center is going to talk about pollock. As many of you know pollock is the largest fishery in the US. It's a multi-billion dollar fishery. We're hoping that this partnership will allow us to look at new technology that may be, that may allow us to expand our surveys both in spatially and temporally and get a better idea of how climate change might affect this stock over the next few decades. Alex?

ALEX DE ROBERTIS >> [Garbled] making acoustic measurements, we wanted some distribution of Walleye pollock which is a key species of fish in the Bering Sea ecosystem. These fish are really [garbled]. They're an important source of food for fish, sea birds, and marine mammals. They also, as has been mentioned earlier, support the largest commercial fishery in the United States. To help manage this fishery, NOAA has conducted acoustic trawl surveys of pollock since the late 1970s using research vessels and acoustic technology. We are now attempting to make similar measurements with unmanned vehicles.

There's a backstory of those work. NOAA fisheries have been working with Simrad Fisheries, which is a division of Kongsberg Maritime, to help develop miniaturize low-power scientific echo sounders in which we are trying to measure the abundance of pollock for moorings mounted on the seafloor. These devices, like all echo sounders, work by emitting sound pulses into the water and then measuring the faint echoes that return from objects such as fish and plankton in the water. The more the way they work, essentially, is the more fish in the water, the stronger the echo.

We deployed prototype instruments for the first time last spring on the seafloor. Just about at the same time, Saildrone and the Pacific Marine Environmental Laboratory had conducted a successful saildrone mission in the Bering Sea which you'd heard about earlier. It was clear to us early on that these two technologies strongly complement each other. For example, the saildrone is mobile and it generates enough excess solar power to allow us to operate the echo sounder 24 hours a day. And the echo sounder allows us to image the entire water column using the saildrone so it really expands our field of view.

We've all worked together over the last year or so to integrate and test these two technologies and it's been very productive and enjoyable. The bottom line here is that shiptime is costly and we're trying to explore how echo sounder-equipped saildrones might be used to expand our ability to observe fish populations in both time and space.

The work really has two main goals. The first is really to characterize the suitability of echo sounders on saildrones. The way we're going to do this is make measurements over a wide range of weather conditions because environmental conditions can affect the instruments themselves. We will also compare observations from saildrones to those from the NOAA Ship Oscar Dyson which will be conducting a pollock acoustic survey. This vessel was purposely built to make high-quality acoustic measurements. The second goal is to conduct a study of prey availability, the satellite-tracked northern fur seals. And you'll be hearing about this from the next speaker.

In short what we're trying to understand here is the advantages and limitations of unmanned vehicles as platforms for acoustic measurement of the abundance of fish and plankton. We're optimistic there is a lot to be learned from combining these two complementary technologies to make observations of times and places that otherwise wouldn't be possible. Thanks.

DOUG DEMASTER >> Thanks, Alex.

And finally I'd like to introduce Alaska Fisheries Science Center marine mammal biologist Carey Kuhn. She's going to be talking about the relationship between Alaska pollock and northern fur seals. Northern fur seals are dependent on pollock as a prey item. They're also a depleted species. It's a species that's been in decline for over 30 years, a decline that we don't really understand. And we're hoping that this work will help us better manage this stock to recover.

CAREY KUHN >> As a part of the saildrone mission, our research group will integrate studies of northern fur seal behavior with the fish abundance data collected by the echo sounder which Alex just described. This will allow us to gain a better understanding of the relationships between northern fur seals and their primary prey Walleye pollock.

During the summer months, the largest proportion of the world's population of northern fur seals can be found on the Pribilof Islands in the southeastern Bering Sea. This population has been experiencing an unexplained decline since the mid-1970s and this is where we're going to conduct the research. Between July and October, fur seals from Pribilof Islands feed on Walleye pollock and other schooling fish and often travel over 150 miles from the colonies to find food. Due to this large foraging range and lengthy breeding season, spatially and temporally, linking fur seal behavior with prey availability has been a long-standing obstacle. This summer we'll track the foraging behavior of 30 northern fur seals using satellite-linked behavior recorders that will allow us to measure their diet and movement pattern from our office here in Seattle.

By concurrently measuring fur seal behavior and prey availability via the saildrones, we'll finally be able to spatially and temporally link these data sets and fill a critical information gap. This project is a significant step forward in our understanding of how the distribution and abundance of prey influence fur seal behavior, feeding success, and population trends. And these data integrated into our larger northern fur seal program will be used to make informed management and conservation decisions which are critical as this population continues to decline.

DOUG DEMASTER >> Thanks, Carey.

So you heard about the four research projects we have going on this summer--the oceanography work, got work on eastern North Pacific right whales. We've got work on pollock and work on the interaction between northern fur seals and pollock distribution. At this point we hope you enjoyed and appreciated the short snippets that we didn't have time for a lot of detail. At this point we want to open it up for questions and answers either here in the room or through the YouTube chatline.

So should we open up to the room first? Okay, do we have any questions for any of our researchers who you heard from or questions about the overall mission? Please don't be shy.

[Inaudible question]

DOUG DEMASTER >> So the question is, is the path of the drone known or can it be changed dynamically? It's been preset but it can be changed dynamically through a web connection. You can direct the saildrone to change a course or heading. So for example if we find an interesting spot where the fur seals are we can direct the drone over that area. Is Richard on the line?

WOMAN >> No. He is not.

DOUG DEMASTER >> Noah! Noah is on the line. Noah with an "H", not the big NOAA, but our Noah. Microphone behind you here. And re-state the question.

NOAH >> All right, so the question was about how, if we can actually change the tracks of the saildrone and kind of send it to different places in real-time and how that happens and what the web interface is for that. So Richard, Saildrone Incorporated is the company that makes the saildrone, so as part of the saildrone operating system they have a web-based interface. So basically I can sit in a coffee shop or anywhere with a web connection on my iPhone, on a laptop, on a, you know, an iPad, anywhere like that, and you can in real-time basically send the saildrone to different positions. And the way you do that is you say, you change, it sets to a series of waypoints. So you can say, oh, ok, I want to send you over to these waypoints, and the saildrone then makes the corrections on-board on how it actually sails to those waypoints. So, you know, we're not controlling-we're not basically saying you know tack, tack, tack. We basically say just go to this position in the ocean and the saildrone figures out how to do that in real-time.

[Inaudible question]

NOAH >> Yes, it uses GPS and it has satellite telemetry. Basically we're talking to it pretty much every, you know, three minutes. We're talking back and forth.

DOUG DEMASTER >> Thank you. Other questions? Yes? But wait for the mike.

WOMAN IN AUDIENCE >> Was there anything in last year's data that stood out or had any particular importance and do you expect anything to stand out this year in the findings?

DOUG DEMASTER >> For Phyllis or Chris?

PHYLLIS STABENO >> Could you repeat that? It's very hard to hear.

WOMAN IN AUDIENCE >> Oh, yes, was there anything in last year's data that stood out or was a surprise or of anything of particular significance? Do you expect anything this year to stand out for that matter?

DOUG DEMASTER >> Phyllis, let me repeat the question. It's easier for me with a mike up here. It's not your fault, it's the room.

The question had to do with 2015 when you did the pilot study on oceanography. Was there anything that surprised you? Was there anything that stood out in the 2015 oceanography work that we might anticipate, either see or not see in 2016.

PHYLLIS STABENO >> [Garbled audio] …some of the things that really interested me. First of all 2015 in the Bering Sea was extremely warm. It's the warmest year that we've seen. And the frontal structure around some of the islands was very sharp which has certain implications for what happens around the islands. I'm hoping with this year, when we go out and look at the fur seals and that type of thing, we'll be able to see that structure or see what kind of structure is around the eddies and such that are along the coast. Last year was more limited in what we could measure. We just did mainly physical and some chemical measurements. This year I'm hoping to be able to integrate what we see in the physics and the chemistry with the broader biological. Why do the fur seals go to certain places to feed? Why are there higher, hopefully we see higher, concentrations of pollock in certain places. Is that associated in any way with the surface temperature and salinity and that type of thing.

DOUG DEMASTER >> Thanks, Phyllis.

Ok.

Questions?

Yes?

MAN IN AUDIENCE >> Hi, I had a question about the acoustic readings that you're planning to do. I imagine the saildrone itself generates a certain amount of noise, you know, splash, maybe the motors or whatever it uses, I'm not sure. I was wondering if you could sort of comment on how you separate out, you know, the sort of functioning noise from the readings that you're trying to take.

DOUG DEMASTER >> Thank you.

Let me…I'll repeat the question and probably, Alex and Jessica, if you can help us out with this that'd be great.

The question has to do with the saildrone itself probably produces noise and when you have the saildrone producing noise and you're collecting either a reflected signal for the active acoustics or when you're recording underwater vocalizations from whales through passive acoustics, how do you tease out or distinguish the sounds you're interested in from the mechanical sounds or electrical sounds that are made by the saildrone?

So Alex, why don't you start, and then Jessica.

ALEX DE ROBERTIS >> Sure. From the point of view of an active acoustics that we're doing, it's really high frequency, 70 kilohertz, so essentially the cylinder on itself, the platform, doesn't produce any sound at that frequency. What you really worry about there is electrical noise but that's not really an issue on this platform. As well we don't have a lot of crosstalk so things look pretty good. The main limitation that we have is that the transducer is about two meters deep so it's not very deep so when you get lots of wind mixing and bubbles under the surface, they get under the transducer and block the pulse that you send out and create quite a bit of interference. So really it's going to be a weather window. And one of the things we're trying to do here is sort out, you know, what the operational limits are.

JESSICA CRANCE >> And from a passive acoustic standpoint, there will be sounds of water slapping the hull we will hear. We're hoping that these won't be so loud that they mask the sounds from the whales themselves but that's one of those unknown feasibility variables we hope to test. The saildrone will be sailing towards some of our long-term moored passive acoustic recorders and so we will be able to do some ground truthing from what we're hearing on the saildrone's Acousondes with what we're hearing on our long-term recorders and so hopefully that'll help us ground truth those data. But the biological signals should be different sounds, frequency modulated, and look very different from the sounds of water slapping the hull

DOUG DEMASTER >> Thanks, Jessica.

There still questions here in the room?

Yes? In the back there?

MAN IN AUDIENCE >> Yeah, can we follow along with the status of the saildrone or any of the data in real-time since it's got a web interface and a feed, as general consumers of information?

DOUG DEMASTER >> Chris, you want to address that or…I don't think Richard is on.

But the question was can the general public actually follow the trackline and the progress of the saildrone?

Or Noah?

NOAH >> Yeah, so, the short answer is, you know, this mission and last year's mission, we're still engineering missions so these are very feasibility studies. So this is one of the things that we are working on--is how do we best present this data to the public. So I guess the short answer for this year is, not in real-time, but we do have a website that will probably be brought up on the link. From there you can actually follow some of the data and some of the plots that are generated but those will probably be, you know, a day or two behind.

In the future, you know, I think it certainly is possible to do something like moorings where you can kind of go to this site, like the Weather Service, and look at what the weather's like out at where the saildrones are.

DOUG DEMASTER >> Thanks, Noah.

Yes?

WOMAN IN AUDIENCE >> So as a follow on to that question…Does any of this instrumentation, is it transmitting the data and in real-time or are you waiting for the saildrone to return so that you can collect all of that information?

DOUG DEMASTER >> So the question is, and Noah, this is probably going to be for you again--- Does the saildrone transmit the information in real-time or is it being collected and stored and will be retreated on return to Dutch Harbor?

NOAH >> That will depend on partly on what instruments we're talking about here. On this cruise, things like the passive acoustics, listening for whales, they generate enormous sound files which is a lot of data and we're kind of bandwidth-limited. We can only send so much data over satellite links. So for this cruise we will not be getting the passive acoustics in real-time and the same thing goes for the active acoustics, you know, you're not going to be able to send, I mean, they generate, you know, hundreds and hundreds of gigabytes of data, you know, pretty much continuously, so we're storing those on board.

ALEX DE ROBERTIS >> Noah.

NOAH >> Yeah?

Um, wait one second, Alex.

[Laughter]

NOAH >> But for things like meteorological data and some of the easier data--wind speeds, temperatures, things like that--that all comes back every five minutes, we get that. And that is one of the big benefits of these platforms and in along with those user interfaces is that we can actually look at the data in real-time and we can say "okay, this looks really interesting" and we can go and explore these certain phenomenon as they happen.

DOUG DEMASTER >> Ok, Alex?

ALEX DE ROBERTIS >> Yeah, I just wanted to mention that at least for, we're sort of, have a small implementation for the active acoustics, which we get some heartbeat data. Basically it tells us that it's working. The instrument is happy and it's working. It sends out a bunch of acknowledgement sort of signals that were part of the debug messages that we've actually piped through and are sending back. So I just can check them on my phone, you know, and make sure everything's still happy. My kids tell me to stop checking the robots…

[Laughter]

DOUG DEMASTER >> Any other questions?

Question over here?

MAN IN AUDIENCE >> I have a question about the Acousonders. You mention that it will send out the low power acoustics. I assume that they will not have an impact on the mammal communications. But please comment on that.

Another question is, by which mechanism you can differentiate different species. In other words, how do you know what you are seeing or what you are listening is from the pollock, for example.

DOUG DEMASTER >> Ok, so the question has to do with what's the, for the active acoustics piece when it's transmitting, is there concern about it interfering with marine mammals in the vicinity. And the second question, I think both for Alex and for Jessica, is for the active signal how do you discriminate different species once you get the signal back and for passive acoustics, how do you determine what species of large whale or marine mammal it might be, that's vocalizing.

So Alex first and then Jessica.

ALEX DE ROBERTIS >> Ok, so it was a little bit difficult to hear but I think the first question was related to impact on marine mammals. And I guess what I'll say about that is that this device is very low power. It's small, and designed to work for long periods of time, so it's about an order of magnitude less power output than the types of devices that you have on fishing vessels or on our research vessels. It's also quite high frequency so isn't really a major concern in terms of marine mammal impacts.

And I can't remember what the second question was. Could you remind me, Doug?

DOUG DEMASTER >> The second one, I think, is in terms of identifying species. So is it a pollock, is it cod? What's going on?

ALEX DE ROBERTIS >> Oh, yeah. You hit the nail right on the head, that's a really tough one. And in some ways, species identification with acoustics is really a major problem and it's a challenge. You get clues from doing analysis of the data but the reason we call what we do acoustic trawls or races because we essentially rely on trawls to do a lot of species identification, especially size. And we can't do that from a saildrone. The sort of thing that we have going for us there is that in the Bering Sea, the mid-water fish community is really dominated by one species, Walleye pollock, once you get out on the outer shelf deeper than about 70 or 80 meters depth. So in this particular area, when you see backscatter, you pretty much know it's from Walleye pollock and we know that from doing 40 plus years of acoustic surveys. So it's a good question but we sort of get around it by working someplace that simple and that's part of the reason we're doing this in the Bering Sea.

DOUG DEMASTER >> Thanks, Alex.

Jessica, can you give us a sense of species ID with passive acoustics?

JESSICA CRANCE >> Yeah, that's actually one of the problems that passive acoustics faces is we have no idea what's swimming out there past our recorders. There also is the problem that several species make similar sounding calls but there are several call types that are unique to species. For example, that the gunshot call is unique to the North Pacific right whale so we can use contextual clues what species have been in the area. We can use species-specific call types to differentiate between, say, a Humpback whale and a North Pacific right whale.

DOUG DEMASTER >> Thanks very much!

We have two questions online. Do we read those out?

WOMAN >> Yup.

DOUG DEMASTER >> Ok, the first one has to do with is there any concern about the saildrones being damaged by some of the large marine mammals and would they look tasty to Orcas?

[Laughter]

DOUG DEMASTER >> I could answer the one on would they look tasty to Orcas. I'm going to boldly say no but Jessica, you could disagree.

[Laughter]

And then I don't know about breaching whales landing on a saildrone, that would be incredibly bad luck and I'm an optimist. But Jessica you may want to comment on that as well.

JESSICA CRANCE >> Yeah, I can't say as to whether a whale would want to breach on top of a saildrone or not but their hearing sensitivity is very very high so they will be able to hear sounds of the water hitting the hull. So they'll know that the saildrone is coming. So that combined with the fact that the saildrone is cruising at about two knots average, that gives the whale plenty of time to move out of the way. So a collision between a saildrone and a whale is very unlikely.

DOUG DEMASTER >> And then we have another question. Will the drones stop in a coastal community and is there any collaboration with subsistence users?

That's a good question. At this point we do not envision the saildrone motoring up to a community and somehow signifying its presence and then leaving. At this point it's going to stay out at sea and we'll pick it back up in Dutch Harbor in September. But that's certainly something we could consider in the future and we would want to make sure our communication protocols are in place.

Is there another question?

Can school students track these drones on a regular basis on the web and can we keep tabs on what the drone sees? Alex, you may be able to help with this one and Noah's addressed it a little bit. We won't be having real-time tracking of the saildrone but we do have a website that will show where the drone is in relatively current time. And I think as Noah said and Alex said, there is some information that's being downloaded in real-time to the principal investigators and some of that may be made available on the web as well. Temperature, salinity, wind speed, it actually has four little cameras on it and I don't know if those pictures can be downloaded. Noah's saying they can. So we can actually get something of what the saildrone is seeing, like a breaching Humpback or something. Hopefully its camera is on all the time so we wouldn't miss that if it happened. Hopefully we will able to see some interesting pictures from the small cameras. But Alex, is there anything else that you want to add in terms of information that will be transmitted?

ALEX DE ROBERTIS >> No, I think you have it pretty well covered. I'm not sure exactly what's going to go on the website but maybe Noah can speak to that or Heather.

CAREY KUHN >> Doug, can I also jump in?

DOUG DEMASTER >> Sure, absolutely.

CAREY KUHN >> We're going to have a weblog on the Alaska Fishery Science Center webpage. Then I'll show some of the recent saildrone tracks along with the northern fur seal tracks. So if people are interested they can take a look at to see where the fur seals are. Not in real-time but in recent time in relation to where the saildrones are and see how the two are working together to collect data.

DOUG DEMASTER >> Great, Carey, thank you.

Ok, any other questions online?

That sounds good, any other questions in the room?

Is Chris still here?

Well, we want to thank everybody for both coming here in the room as well as those of you participated on the YouTube chat. This is a first for us. I hope you found it interesting. I want to thank all the scientists for being available and kind of answering questions in real-time and without knowing what the questions are. That's always a challenge. I hope you found it interesting.

This is a technology that we intend to work closely with our partners, NOAA, as well as the industry and academia. And it's just a real exciting time. So when we pick the drone up in September, hopefully we'll have all the information that we expect - no big surprises, or no unpleasant surprises. And we'll do this again. So thank you all very much for coming and thank you again those on YouTube chat. Have a good day!

[Applause]