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Moderator: Courtney Chambers
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Courtney Chambers: All right. Good afternoon, everyone. I'm Courtney Chambers and I work at the ERDC Environmental Laboratory, in technology transfer for Ecosystem Restoration and I would like to welcome you to our Web meeting today on the Joint Airborne LiDAR Bathymetry Technical Center of Expertise also known as JALBTCX and it's going to be presented by two speakers today; (Molly Reif) who works in the ERDC Environmental Laboratory and Lauren Dunkin who works in the ERDC Coastal Hydraulics Laboratory.

I'm sure we'll have some straggling participants joining us as we get going but we'll go ahead and start with our introduction and logistics and such.

As a reminder this series of Web meetings on Ecosystem Restoration topics by ERDC and the Ecosystem Restoration Planning Center of Expertise is designed to address a variety of topics including training, lessons learned, research and development and emerging issues.

The Web meetings are recorded and archive files are posted on the Environment gateway under the learning tab so please do refer to those in the future if you have additional questions or would like to spend more time on a specific topic.

The Learning Exchange Notification System sends an initial email notification to everyone who has signed up for Webinar announcements two weeks prior to a Webinar and that notification comes from the Ecosystem gateway email address.

In this email we encourage you to register for the Webinar, which enables you to add it to your Outlook calendar. Then those who register for the Webinar will be sent a reminder the day before the presentation.

Okay and just a few more notes before we begin today's session. We are going to have a time for questions and answers the last 15 minutes of the presentation so if you hear a term that's not familiar to you during the presentation or a question comes up as (Molly) and Lauren are presenting, you are welcome to enter your question in the chat feature so that it doesn't get forgotten.

However we will wait to address all of those questions till the end of the presentation. And then we'll cover as many questions as time allows and if we run out of time then we can certainly follow up with any of those remaining items.

If you are using a speakerphone I'd like to remind you to keep it on mute while you're listening throughout the presentation but then be sure to remove the mute feature whenever you're prepared to ask a question.

And then also please don't forget about us and put us on hold because the background music can be quite distracting from the presentation.

And then lastly in order to have a more comprehensive list of attendees. I ask that if you're calling in as a group that you take just a moment and write the names of your attendees in the chat box and send them to me as many of our participants have done already. Thank you.

All right, now I'll give you today's speakers. On the Joint Airborne LiDAR Bathymetry Technical Center of Expertise; we have co-presenters today. (Molly Reif) is a research geographer at ERDC's Environmental Laboratory located at JALBTCX in Kiln, Mississippi. She acts as a liaison between the Environmental Laboratory and JALBTCX, assisting in the expansion and use of airborne remote sensing data to address environmental challenges and needs within the Corp.

More specifically this includes analyzing hyper-spectral imagery and light detection and ranging also known as LiDAR elevation data to examine coastal land, cover dynamics, wetlands, submerged aquatic vegetation, invasive species and other coastal habitats.

Our second speaker, Lauren Dunkin, is a research civil engineer at ERDC's Coastal Hydraulics Laboratory also located outside of JALBTCX in Kiln, Mississippi. Similarly, her current work involves acting as a liaison between the Coastal Hydraulics Lab and JALBTCX where the goal is to expand the use of JALBTCX data products for coastal engineering applications through the development of tools and new products.

So, ladies, I'm going to make you the presenters now and you can share your desktop with us please.

(Molly Reif): Okay. So thank you, Courtney, and thank you, everyone else, for attending the Webinar today.

As Courtney mentioned, Lauren is with the Coastal and Hydraulics Lab and I'm at the Environmental Lab although we're located off site at the JALBTCX facility on the Mississippi Gulf Coast. And we're working...

((Crosstalk)

Man: Hi, how's it going?

Woman: It's going all right. I'm (unintelligible) your lunch.

Courtney Chambers: Excuse me, if you've got us on speakerphone we can hear your background noise. So if you wouldn't mind please putting us on mute. Thank you.

(Molly Reif): All right. Thank you, Courtney.

Courtney Chambers: You're welcome.

(Molly Reif): So Lauren and I are working on expanding data analysis and applications to address coastal engineering and environmental needs within the Corp so that's what we're going to be talking about today.

And then before we get into all that we're going to give an overview of the JALBTCX and describe the airborne survey system resources as well as the Corp's National Coastal Mapping Program and that will include information on previous and future surveying activities and data products that are available. And then we'll proceed to talk about some examples of environmental and coastal engineering applications and uses for the data.

So the facility itself is located at the Stennis International Airport in Kiln, Mississippi. That's about 30 minutes west of Biloxi or about 50 minutes east of New Orleans if you're familiar with this part of the world.

The center itself is a multiagency partnership between the Corp and the Navy and NOAA performing operations, research and development in airborne coastal mapping and charting. And the Corp executes the National Coastal Mapping Program through the JALBTCX and that involves measuring and monitoring physical, environmental and economic conditions along the U.S. coast.

And then on the operations side of the house they work to meet the mapping and charting requirements of both the Navy and the Corp.

So the airborne system needs to collect imagery and LiDAR elevation data is called CHARTS and that stands for Compact Hydrographic Airborne Rapid Total Survey. It is an integrated airborne center suite meaning that all these different centers are located on one common platform and are all tied to the same GPS.

And the system includes a Bathymetric LiDAR, which uses a green laser to measure water depths at two to three times the secchi depth, and typographic LiDAR, which uses a near infrared laser to measure high accuracy and high resolution land elevations, a CASI hyperspectral imager, which provides detailed spectral imagery at 1-meter spatial resolution and small and medium format digital cameras that provide high spatial resolution, true color photo mosaics and those range between about 15 to 30 centimeter spatial resolution.

The system itself is owned by the Navy and it is shared with the Corp and generally we have it during the summer months starting in late spring and going through the early fall.

Courtney Chambers: Hey, (Molly)?

(Molly Reif): Yes.

Courtney Chambers: We did have one request. If you could possibly speak up just a little bit please.

(Molly Reif): Oh, sure. Okay.

Courtney Chambers: All right, thank you.

(Molly Reif): No problem. Okay, so I don't know how familiar the audience is with LiDAR elevation data or hyperspectral imagery so I thought I'd provide a quick overview of these technologies.

For the LiDAR data the system that is used in the CHARTS system is called Shoals and depending on which mode it's in, it's either going to be in the topographic mode or the bathymetric mode because the different lasers operate independently of each other.

So depending on what mode you're in, it's either a green or a near infrared laser will be fired out of the bottom of the aircraft, aimed 20 degrees off meter and mirrors incorporated into the system direct the laser in an arced pattern across the sea floor or a terrestrial environment as the aircraft is moving forward in transit and this produces a wide swath of data that is consistent across all depth ranges. And the system on the plane receives the returned laser energy in which the return time is used to estimate the elevation or the depth.

So that's a brief overview of what's happening on the LiDAR side. For the hyperspectral imagery the sensor that's used is called a CASI 1500 and it's used alongside the Shoals system. It's a programmable push broom sensor featuring up to 288 spectral bands measuring reflective light in the range of 375 to 1050 nanometers across the electromagnetic spectrum. So that's covering roughly the visible portion all the way over to the near infrared portion of the spectrum.

And with this narrow contiguous band capturing that really high level of spectral details and it's due to that detail as well as the high spatial resolution that the imagery is especially useful for characterizing objects and materials on the earth's surface that can't be discerned with coarser bandwidth and spatial resolutions associated with multi-spectral imagery. So if you're familiar with landstat, that's what we're referring to.

So the JALBTCX executes the National Coastal Mapping Program, which is funded by headquarters and was started in 2004 to provide high resolution LiDAR elevation and imagery data along the sandy shorelines of the U.S. on a reoccurring basis. And primarily these data support regional sediment management but also construction, operations and regulatory functions in the coastal zone as well.

And the map I've got shown here basically shows how many times the areas have been surveyed up through the FY11 survey season and illustrates that much of the U.S. coastlines have been surveyed multiple times under the National Coastal Mapping Program.

This last survey season the JALBTCX fl3ew up in the Great Lakes area and they'll be that way again this next survey season. They'll be surveying areas along Lakes Erie, Huron and Michigan as well as the Niagara River. And these surveys will include both the National Coastal Mapping Program, which is shown in yellow, as well as those in support of FEMA's flood hazard mapping updates, which are shown in red.

So this slide actually shows the collection schema and the intent here is to capture the active portion of the beach profiles from the dune to the depth of closure or where the sand is moving to support the creation of regional sediment budgets.

So as I mentioned, the LiDAR systems operate independently of each other so surveys are specifically configured to collect either bathymetry or topography. And for the bathymetry surveys data coverage consists of 100% at a spot spacing of 5 meters with the extent starting at the waterline and moving offshore to 1000 meters or to laser extinction, whichever comes first, and then data acquired at federal projects will consist of 200% coverage.

Then for the topographic side data coverage consists of 200% at a spot spacing of 1 meter starting at the waterline and then moving onshore 500 meters.

And in general the JALBTCX tries to cover the shoreline with the bathymetric LiDAR at high tide and topographic LiDAR at low tide in order to minimize any gaps in coverage at the shoreline. And this is especially important for generating the digital terrain surface products that I'll talk about in just a second.

So all of that data that's collected from the CHARTS system is used to develop and generate a suite of data products and this slide shows the evolution of that product development since the beginning of the program. So the suite of Geographic Information Systems or GIS friendly products are provided to clients to support science and decision making in the coastal zone.

And initially these products included things like LiDAR point cloud files, aerial photo mosaics and shoreline contours and then that gave way to seamless topographic and bathymetric digital elevation models and those are the terrain surfaces I just mentioned.

And then that also includes bare earth digital elevation models in which vegetation and infrastructure have been removed, which is beneficial for certain modeling applications. And more recent product development includes hyperspectral image mosaics, seafloor reflectance images and a basic land cover classification.

So some recent examples of the JALBTCX mapping product from this year's survey include the seamless bathymetric and topographic digital elevation model developed for the Marquette Harbor in Michigan.

And then for that same area we also have laser reflectance, which was taken from the bathymetric LiDAR and you can see on the seafloor here we've got a tonal and textural differences and those are useful for characterizing substrate materials along with the hyperspectral imagery.

And then lastly I've got an example of an aerial photo mosaic illustrating the high spatial resolution and details along a navigation structure in that same area.

Okay, so that covers most of the background material so moving into the environmental side of things I'm actually part of the Geospatial Data Analysis Facility in the Environmental Systems branch under Mark Graves and our group is well positioned to work with the JALBTCX because we specialize in using GSI and remote sensing to address environmental trends and conditions.

So the overall goal of the Environmental Lab and JALBTCX collaboration is to identify and expand environmental data products utilizing the imagery resources that I just described as well as the environmental expertise within the lab to address environmental and geospatial needs of the districts.

And so some of the environmental applications that we can address include things like site characterization, environmental monitoring, habitat identification, ecosystem restoration planning and emergency response and recovery although that's not an exhaustive list by any means.

And one of the ways that we're expanding environmental products and applications is through the fusion or a combination of hyperspectral imagery and LiDAR data. And this slide simplifies the concept behind that data fusion in a series of graphics so the left-most image shows the hyperspectral imagery in which you can see maritime forest, scrub, marsh, beach and water.

And the middle image is a hill shade relief taken from the LiDAR data and then the right-most image shows a combination of the two. It kind of gives you a sense of both the landscape structure and the type when you combine them.

And although that's a simplistic explanation, really by combining the spectral information from the hyperspectral with the structural information from the

LiDAR, you get some distinct advantages such as increased classification accuracy as well as feature extraction capabilities.

So those are the advantages that we're really trying to capitalize on and really we're doing that because we're doubling the information content. And currently the JALBTCX is already using such a fusion approach to create their basic land cover classification products so we're really just building on that.

So this is an example of some ongoing research that utilizes the basic land cover classification approach to assess land cover and elevation changes in response to a storm event.

In the case of Hurricane Katrina a section of the south shore of Lake Poncetrane, Louisiana, was assessed between 2005 and 2009 to characterize physical changes in the landscape in the recovery phase of the disaster management cycle meaning that we're looking longer-term and trying to say something about the changes that are happening both in the built environment and the natural environment at that neighborhood level for planning purposes.

And typically we see land cover change shown as a percent cover in terms of area change, which is the graph on the bottom left while elevation change is characterized as overall erosion and accretion, which is the table in the middle right.

And in this study we combined those two types of change to estimate volume change by land cover type, which can shed some detailed insight into physical changes than if you just looked at one of those two alone. And so the bottom right graph attempts to show what's happening by looking at that volume change associated with land cover type.

And typically remote sensing really isn't used much in the recovery phase of the disaster management cycle so we're trying to encourage that but this type of technology also has utility for estimating debris volume in the response phase or the immediate phase after a disaster, which is critical for estimating damages and clean-up operations.

So here's an example from that same study along the 17th Street Canal, which if you look at the top left image, this was right after the storm and is in the area where a breach occurred. And then as you move through 2006, '07 and '09 you can see how those purple and gray colors sort of give way to recovery.

And the results of this project were summarized in a Journal on Coastal Research paper and I've got the citation listed there in case you're interested in learning more about it and we hope to continue this work.

So one of our goals is to expand the basic land cover classification for coastal studies and modeling and we're doing this through a pilot project with a FEMA contractor, AECOM. And they're working on updating storm surge values in coastal North Carolina in support of updated flood insurance rate maps.

And specifically they wanted to see if it was possible to develop a coastally focused land cover classification that would work with their model so that's what we set out to demonstrate in this particular part of North Carolina.

And to do this really what we did was expand it on a current land cover classification system that combines the hyperspectral imagery and the topographic LiDAR and in that bottom right hand corner you can see I've got both of those datasets shown there with the hyperspectral imagery on top and the LiDAR data on the bottom.

And so again we just expanded the current classification system to include coastal classes such as beach and marsh. And coastal land cover data is needed for the modeling because as waves move inland they are impacted by changes in topography and land use so it really all comes down to friction.

And currently the model that they're using for this is a simple 1-D model but it's also very tedious and the graphic on the left is meant to give you an idea of all the manual editing that goes into it. There's transects that are manually drawn and then polygons that are manually drawn that are associated with all the various land use and so my hope is that we could incorporate a coastal land cover dataset into this process to help speed up the modeling.

And we're currently exploring methods for expanding that classification with emphasis on coastal environments and post-storm analysis and hydrologic modeling. Currently there is no land cover product that captures both the topographic and schematic content, which is really important for a wide range of applications ranging from sea level rise studies to these types of flood insurance rate map updates.

And the slide shows an image classification result that we developed for the North Carolina pilot project - that's that middle graphic that goes across the slide - with the coastal classes listed on the right there.

And the slide also shows the variety of information that can be extracted from a fusion dataset like this and that includes things like a geomorphic feature extraction, which Lauren will get more into. You can also look at elevation distribution for a particular land cover class so for example if you want to see how your wetlands are responding to changes in sea level rise; you can also look at canopy and beach profiles and extract (unintelligible) and values. So it's a rich dataset.

Now another research area that we're working on concerns identification of invasive species in support of management and monitoring. One example of this type of work is shown here from the survey that was done in the Buffalo district near the Buffalo Harbor at Times Beach which is a confined disposal facility.

Invasive phragmites is a problematic species in many coastal marshes and dredge disposal facilities and so we wanted to use a classification approach that would target or identify an emergent marsh such as in this area that's dominated by phragmites.

So you can see in the light green color in the bottom right and edge, that's where the emergent marsh is that's dominated by phragmites and that top left picture was actually taken at that site.

And this demonstration involved combining these kinds of mapping techniques with ERDC's chemical control team to help prioritize areas for future treatment and also help determine what types of control measures are best suited for an area as well as examining areas that may be vulnerable to invasion.

Now other critical habitats that can be identified using a fusion approach include wetlands and in this case too we can also emphasize the use of the LiDAR to characterize marsh topography, which is typically done using intensive field methods. And we can also characterize wetland condition looking at things like biomass and other factors.

In the map I've got shown here is just primarily coastal marsh with some scrub and forest and highlights the influence of elevation on habitat type distribution. So it really just shows how elevation may be useful for characterizing marsh and other habitats in the coastal zone.

Now I'm going to end with a couple of collaborative projects, the first of which is the collaboration between the JALBTCX, the Environmental Lab and Michigan Tech Research Institute and the PI for this work is (Bruce) in the Environmental Lab in case you're interested in learning more. But the study itself involves identifying submerged stamp sand off the coast of Lake Superior along the Cuban (Op) Peninsula in Michigan.

And this area has a copper mining history and much of those sands have eroded offshore. And if you look at that top right graphic you can see sort of a hazy brown area that hugs the coast.

Those are those stamp sands that have eroded offshore and they contain toxic metals that are detrimental to the aquatic life. Now this project actually started back in 2008 and involves using the hyperspectral imagery and the bathymetric LiDAR data that was collected with the chart systems to map the stamp sand in their migration down the coast as well as other characteristics like in that middle image looking at factors like depth.

And then in the bottom left image, we're looking at features of interest including an offshore reef that's used for fish spawning. And the project also illustrates some of the final results that came out of this, illustrates how hyperspectral can be used to distinguish the stamp sand from the native sands.

And I think all of this work is being presented in a journal article that's due out soon and I can get that information if you're interested. But our hope is that a lot of this data will be useful in the environmental restoration and remediation activities that are planned for this area.

So another collaborative project is between the environment lab, the JALBTCX and the New England district and it's a DOER funded effort to map submerged aquatic vegetation.

It started during a mission planning meeting for the National Coastal Mapping program. And the district expressed a need for updated SAV mapping in preparation for their dredging maintenance. However, things are a bit more complex in this are because they actually have multiple species of SAV.

So the goal of this project was to see if the chart data, including the bathymetric LiDAR and the hyperspectral imagery could be used to improve the SAV mapping capabilities, specifically addressing this issue of whether or not we could discriminate species of SAV because that's really not possible with traditional mapping methods.

And there's pretty much one primary reason why discriminating species is important and SAV are protected under the Clean Water Act and impact from activities such as dredging must be minimized or avoided. And therefore, distinguishing (seed rash) from other species, such as marine (macrology) which are not mandated for protection is important for dredging operations planning as well as mitigating ecological damage monitoring and other restoration efforts.

So for the image processing, we're taking advantage of some of the new sensor technology and software developments that are going on at JALBTCX which (Lauren)'s going to talk about at the end, but the primary goal here is to remove the effects of the water columns so that we can obtain the reflectants from the sea floor.

And if we can do this well, we can actually see the vegetation patches more clearly and potentially tell subtle differences between the different types. The technique in the software actually has evolved over the years through initiatives between the JALBTCX and their partner, (Optex).

And the approach is actually called spectral optimization. In short, the algorithm is a physics based approach in which the hypo spectral imagery is inverted and the water column components as well as the sea floor are (reflectant) for all models.

So key to this processing is the inclusion of the LiDAR depths because the optical properties of the water column actually vary with depth and in this case we can add that as a constraint in our equation but then the models will hopefully make things more accurate.

Other attempts to use models like this for mapping generally don't have concurrent bathymetric LiDAR so they actually have to model depth as well as the water column components in the inversion processing.

So the results from the spectral optimization include a (suite) of the water column components and (unintelligible) images. And I've got that shown here in the bottom graphic.

And then once we get that sea floor reflectance we can actually use that as we would any traditional (reflectant) image and apply classification techniques to it.

So in the example I've got here, we're looking at things like water leaving (reflectance), water column attenuation, (sparm) absorption, chlorophyll concentration and then the sea floor (reflectant) images.

So real quick, in looking at some of the results of that study, in the top left image this is one of our project sites in Massachusetts and we were able to differentiate sea grass patches, which if you can see that, they're shown in green, and then brown and red macro algae which are shown in a darker brown.

That may actually be kind of hard to see but it's towards the southern end of the study site. And then we've got our ground truth site shown on top of that. And this is compared with a more traditional air photo interpretation technique that was developed by a local expert and that's the bottom right image in which the yellow areas show estimated sea grass only.

As I mentioned, you can't really use traditional photo interpretation techniques to look at different species so that's just sea grass. But both of these techniques are useful for judging operations planning and offer different levels of information about the SAV types and characteristics.

And this project is currently being finalized and we've got a tech note that's due out any day now if you're interested in finding out more about it. In addition, we're going to have a journal paper out later this year of the classification results.

But in short, we found it was possible to distinguish sea grass around other SAV with a high degree of confidence. So this wraps up my portion of the presentation covering the environmental applications, so now I'm going to pass things over to (Lauren). If you have any questions we ask that you please hold them until the end so that we can get through all of our material.

(Lauren): Thanks (Molly). So I'm going to be talking about the coastal engineering applications of the NCMP data products. But first I want to give a brief background on the coastal hydraulics lab where it has two primary focus areas, the first being hydraulics which involves water related projects and the second is coastal engineering work which focuses on waves, currents, winds and other coastal environmental forces.

Within the coastal hydraulics lab there are several branches that better define the two primary efforts and I'm actually part of the coastal engineering branch where the goal is to plan and execute coastal engineering studies and evaluate the functional performance of coastal projects in addition to developing improved design methods.

We have expertise in project planning and design, performance monitoring and evaluation, geologic and geomorphic analysis and dredge and dredge material disposal issues.

So with that, the coastal engineering branch is ideally positioned to work with the JALBTCX to simply provide support to solve coastal engineering problems and are therefore able to assist with expanding the market for and maximizing the benefits of the LiDAR derived data products.

The specific identified needs are listed below and I'm actually going to start discussing those in the following slides. Coastal regions are vulnerable to extreme surges that can cause erosion or over wash for the area from impact of waves (in surge).

So before storms arrive, the NCMP data products can be very useful to identify areas of vulnerability such as narrowed beach width or low dunes which are valuable for providing protection to upland infrastructure.

There are a series of semi automated feature extractions. The cells of the beach profile as seen on the graph on the left can be extracted. The graph on the right shows the elevation of the seaward most dune peaks in the blue line and the distance from a shore contour to the seaward most peak in the green line.

This information can be used to show areas of vulnerability which may be seen in that circled area where you actually see that there is more of a narrow beach and also a low dune line.

After storms have impacted a region, it’s invaluable to have multiple surveys which provide a unique opportunity to compare pre and post storm surveys to quantify damages and recovery efforts.

The Florida Panhandle is impacted by several hurricanes the 2004 and 2005 season. After each of these storms, this area was surveyed and the data is available to assist with change and recovery assessment.

The plot on the left actually shows a cell by cell comparison of the minimum elevation for all the surveys to the present survey. So basically this is showing locations that are greater than the minimum elevation where you have the greens and yellows where you see that at the bottom for the pre Ivan and near the top for the 2006 timeframe which was actually after a beach nourishment project.

So this is expected since the increase of sediment is the result of sediment being added to systems with the 2006 beach nourishment project or at that kind of equilibrium state with the 2004 pre-Ivan.

Similarly, areas that are close to the minimum based elevation are shown in the dark blue and these signify that these areas may be more vulnerable to erosion during storm events or have been eroded during these storm events.

The goal of showing data in this manner is to provide insight into areas that may be more vulnerable to erosion during extreme storm events such as areas that have - maybe are near a beach where sediment volume is at a minimum.

In addition looking at all the surveys for an area using this method could be used to identify most logical trends. This analysis was done from a (minimum of four) line contour to the dune but it can also be seen that the near shore region is also highly dynamic as seen in the seaward migration of the near shore in that top right corner graphic.

The near shore bars for that increased protection when they're in elevation results in breaking waves and therefore energy is dissipated and maybe reduced and may reduce the erosion of the beach.

The bar (crests) are actually extracted from the one meter digital elevation models from the NCMP data product using an automated method to identify the near shore bar peak. And this is similar analysis as looking at the dune peak that I talked about in a previous slide.

The two surveys, pre and post Ivan, are used to quantify net movement which, for this area, is an average of 50 meters of migration in a seaward direction.

I’m going to be changing gears a bit from the vulnerability and storm damage assessment.

I’m going to move into discussing how the NCMP data parts can be used for monitoring projects in coastal environments. So shore protection projects continue to increase and the need for recurring monitoring is very important.

Airborne monitoring has greatly improved the efficiency and accuracy of monitoring morphological changes as compared to traditional surveys. In order to fully utilize these LiDAR products, new analysis methods have started to be employed to identify parameters from the digital elevation models that capture the geomorphic changes in the along shore.

So with the recurring LiDAR surveys, these geomorphic changes can be used to identify erosional and accretional trends for use with monitoring and subsequent design efforts.

This is an example from the Florida Panhandle that shows the volume change for an area comparing the 2005 survey with the 2006 post-nourishment survey. And you can see that the average volume change is accretional which is expected since nourishment was added to the system.

As with the vulnerability and storm damage assessment analysis, geomorphic features such as the dune and offshore bar extracted using automated methods. This is the same area from the previous slide where multiple surveys are used to find shoreline change rates to monitor field placement and migration post nourishment using and automated process that is helpful for reducing the manual delineation.

This example shows that there's a (westward) erosion pattern and it extends from the inlet and due to the presence of the beach (cuff), the negative one to one meter per year change is actually considered to be relatively stable for this area.

So as expected, the top line - the red line on the figure is the pre and post Ivan comparison. And this generates the most change in shoreline position when compared to the other comparisons with the pre Ivan and 2010 survey which is the bottom line where the average shoreline change rate is actually negative 2 meters per year.

And this rate is very similar to the rate that's calculated from the 2006 post nourishment and 2010 survey. And that's the middle one.

So moving into the navigation projects, the airborne and bathymetric LiDAR technology and the (ommitted) post processing routines that have been discussed previously can be used to extract navigation channel conditions from the bathymetric data.

And being able to quickly assess the condition of the navigation channels vital to maintaining safe transportation especially when you have storms that impact the region, it's important to know where you actually have a buildup of sediment immediately after the storm.

Also Web based tools that compare the survey channel depths to design depths can quantify potential requirements for maintenance dredging and commerce data such as the gross imports in tonnage and dollars and commodity movements that are available through CPT can be used in conjunction with channel condition information that can help to prioritize and potentially help plan high impact dredging projects which would ultimately make the most out of the dredging dollars available.

So now moving seaward from the inlet, we're going to talk about the ebb shoal features that need to be identified. So these features include the bypassing bar and (chemically) the attachment bar. And different techniques for mapping the system include using aerial photography or LiDAR bathymetric data which is typically manually digitized which is - results in a laborious and kind of suggestive endeavor.

So preliminary efforts of extracting the ebb shoal features have been performed using hydrological processes by taking the in (bar) acceleration of the ebb shoal and then using that to identify the sinks where if you flipped it over at the peaks actually would be for the ebb shoal feature.

The last figure shows the ebb shoal bounds for the East Coast Florida area using contours to extract out the bounds of the ebb shoal. And this shows the five years ranging from 2004 pre Ivan to the most recent 2010 survey. And you can see - it's a little bit difficult to see but 2010 ebb shoal bounds actually have moved farther offshore when compared to the other surveys.

Some of the budgets are important for quantifying the amount of sediment entering or leaving the system and therefore must be calculated. And first we start by identifying sediment pathways across the ebb shoal delta and then the distinct most logical features which make the ebb shoal which I discussed in the previous slide.

Once the delineation of these features can be done in a retained or automated manner, then the volumes or volume change can be more efficiently calculated along with the migration of the features or changes within the feature and can be used to compute the path wave.

All this information ultimately leads to input into the sediment budget. Another utility of using the NCMP data products are to provide input into numerical models which (Molly) talked about previously and (unintelligible) values for overland and the (bottom) classification to use within the CMS, which is the Coastal Modeling System, or can be used with FT waves as well as the shoreline contour which can be extracted from the LiDAR elevation data for input into (Gincates).

And that's a model that's used to predict long term shoreline change. And again, this is just a few examples of the models that can be used and I'm sure there are many, many others that would benefit from this sort of input.

So regional sediment management is an iterative process that involves developing sediment budgets, identify the needs and sources to optimize that budget, modeling changes that occur due to dredging of channels or shoal for (cell) placement, placing sediment in areas to beneficially use it as a resource and then monitoring the placement of material to ensure that the sediment is being used at - optimally.

The data collected is part of the National Coastal Mapping Program needs to refine the sediment budget by providing the high resolution data needed for these input models and then monitoring efforts for functional performance assessment as was discussed previously in the shore protection and the navigation project slides.

So in summary, we have discussed the environmental and coastal engineering applications and current research and development efforts of using the high resolution LiDAR elevations and imagery products which are acquired through the National Coastal Mapping Programs and which is executed from the joint airborne LiDAR bathymetry technical center of expertise.

But before we end, we'd like to introduce you all to a new sensor development effort by the (army corps) with the coastal (lens) mapping and imaging LiDAR or seasonal.

So basically this includes everything in terms of hardware advancements and algorithm developments. But there are a few key differences between charts and seasonal which include first the way surveys are conducted, charts, topographic LiDAR surveys are conducted separate from the chart's bathymetric surveys.

However, with the seasonal both bathymetry and topography can be surveyed simultaneously to provide a seamless cross environment survey. So this will ultimately have the number of (flights) required to achieve the coverage area.

Second, the laser on seasonal is more powerful then that appropriated in the charts so therefore we should be able to measure greater depth then we achieve with charts.

Also we expect better performance in shallow (turbid) waters where charts have had some challenges. And lastly, the integrated center of seasonal, the LiDAR imagery and the hyperspectral combined with these sophisticated software developed in advance of the seasonal (hardwell) provides unique opportunities for data fusion and facilitates the generation of environmental data products to include water column properties that (Molly) discussed at the end of her presentation.

So the JALBTCX Web site listed to the right provides a map to the available charts, bathymetric and topographic data. Down by the data the viewer will actually direct you to no residual coast site where you can select the area that you would like to receive the data from.

So that concludes our presentation and we really appreciate your time in participating in this Webinar. And now we'd like to give the control back to (Courtney) and I guess at this time we'd be happy to answer any questions pertaining to either mine or (Molly)'s presentation.

(Courtney): All right, thank you all very much. Those were great presentations. We do have one question already entered in the chat feature. The Pittsburgh district was wondering if they were - if there were any inland uses for this technology.

(Molly): There definitely are. It falls outside the National Coastal Mapping Program's footprint but that doesn't mean that with additional funding that, you know, inland surveys can't be conducted. And, in fact, we have some product examples in which we've done rivering surveys and hope to do more especially with having both charts and seasonal around to do more survey work, so definitely.

(Courtney): Are there any other questions today?

(Greg Williams): I had a question. This is (Greg Williams) in the Norfolk district. With regards to, you know pre and post imagery on storm events, what type of - or what is the process as far as coordination and what is the flow for obtaining that imagery? Is there any sort of, you know, hierarchy as far as if you know a storm is going to hit, do you try to fly that area ahead of time?

It seems like there's fairly good coverage afterwards but getting imagery and data ahead of a storm, we seem to be kind of lacking in that area. We're trying to sort that out.

(Lauren): Right, so it's not - I guess if we're mobilized in the area, we can actually survey before, you know, we know a storm is actually going to arrive which I think was done recently with the North Eastern region.

And also, USGS, you know, could also be surveying in that same area. So there is collaboration between different organizations so that we're not duplicating efforts. So regardless of a pre or a post storm, we try to coordinate to make sure that really only one organization is surveying so that data (unintelligible).

(Greg Williams): I guess as a follow up, do you know who - where that coordination is taking place? Who's handling that?

(Molly): Yes, that's basically the - a little over our level but definitely the director, (Jennifer Rozencraft), because we are a multi agency partnership and actually we're - we've got - we're working on getting USGS as a partner as well.

But, so really that happens at a higher level but because of their partnering, they're already partners - it's fairly easy and we can do that in-house with, you know, upper level management and discussing those coordinated surveys. I can get you more information if, you know, if you're interested in that.

(Greg Williams): I appreciate that.

(Courtney): All right, (Molly) and (Lauren), there's another one asked by (Tom Lynch), asking about will Alaska, Hawaii, Guam, (CNMI) and American Samoa ever be included in these surveys?

(Molly): I'm not sure about Alaska. I know there's been interest in Alaska but there are some technical issues with GPS and things like that in that part of the world. But we do have survey data for Hawaii and I believe we're - the JALBTCX is going to be heading back out in that direction again in FY'13.

And then for Guam and other parts of the Pacific, actually the navy provides those overseas survey efforts. So some of that data is restricted and some of it's publicly available. So you know, it really just depends on a particular area.

So if there's a specific area of interest, it's best just to email somebody here at the center and find out what kind of coverage exists or even look at the JALBTCX's Web site.

(Courtney): Okay. (Tom), if that didn't answer your question, please just feel free to follow up on that. And then from (Mark), we have the question, what is the average cost for LiDAR (unintelligible) acquisition? And then the average cost to combine or model the data?

(Molly): That's a great question and unfortunately we don't have like a one size fits all answer. Basically if you're interested in a specific project site, again, it's best to email one of us and get a quote because really the cost can be all over the place depending on how big an area is and where it's located.

You know, that impacts mobilization costs. In some cases if it's already following within the footprint of the National Coastal Mapping Program, there's - the cost might actually be a lot lower because we can leverage those survey efforts.

So really it just kind of depends. I'm sorry I can't give you a better answer then that.

(Courtney): All right, are there any other questions today? Remember, if you're going to speak make sure you remove the mute feature so we can hear you.

(Larry Robinson): This is (Larry Robinson) with the USGS. Do you guys - or can you talk more about the problems you had with sedimentation, say at the (map) of a river into the coastal area?

Woman: What specifically - I mean, do you just need (turbidity) and water or?

(Larry Robinson): Yes, you said you had problems with that but you didn't really go into any details. Just curious how much sedimentation causes problems. Is there quick attenuation? You get, you know, wrong readings or what happens?

(Molly): Well, basically we just get so much scattering from the, you know, the particulates in the water column itself. We just don't penetrate through the water column to get to the bottom.

(Larry Robinson): And what does two to three (sec) usually give you on the (coast)? Is it ten feet, 20 feet, deeper?

Molly: Yes, in some places we can get, you know, 20, 30 meters if it's clear enough. But generally, you know, we're looking at about a 10 meter range. You know, but again it really depends on the area.

Lauren: Right. Like the Gulf coast area's around 10 meters and then East Coast, depending on where you actually are located, you know, can either be 5 to 10 meters and the West Coast, you know, maybe a little bit less.

(Larry Robinson): Okay, one final question - do you think the stronger sensor will allow you to penetrate some of that sedimentation a little bit better?

Molly: That's what we're hoping for with a more powerful laser. That's really what spawned the motivation for developing a new sensor, is to get that better performance in the shallow turbid water environment because that's what everybody wants.

(Larry Robinson): Thanks.

(Courtney): All right. Any other questions?

(Jeff): Yes, this is (Jeff) in Omaha. Do you process strictly with the DEMs or with the LC TINs?

(Jeff): Do we use TIN files - as (read) TIN files?

Molly: Oh, the triangulated irregular networks, is that...?

(Jeff Brenny): Yes.

Molly: Yes, actually we have a processing stream in which I believe we actually start with TIN and then go to a DEM product. So depending on, you know, what a particular client is interested in, you know, there are different numbers of ways that we can process or even provide the raw data if someone's actually interested in providing or developing their own terrain surfaces.

(Jeff): Do you do a statistical comparison of the derived surface using actual, like, spot point?

Molly: I believe with the initial processing they use, they have some control points that are collected when they're actually out surveying so you have some ground (truthing) available.

(Jeff): Okay.

Molly: Yes, and in fact, we have some clients that - I think we have a university client that's interesting in looking at that and they're sort of working on some statistical analyses and looking at, you know, different impacts of gridding and, you know, comparing different gridded products from different agencies and how that impacts your results. So there's a lot of thought that could go into that but we don't - on the operations side we really don't get into that too much.

(Jeff): Which software are you using to develop the surfaces in? Is it all in (ESRI)?

Molly: No it's not. We use QT Modeler and what's the other one that we use?

Lauren: Micro Station also is used in the process. (Terascan), (Leader Mouse?) is used to go over and check the points - the point clouds to get rid of the high flyers or low flyers.

Molly: Yes, these are the primary three - (Leader Mouse?), QT Modeler, (Terascan) and Micro Station and Arc.

Lauren: Yes right.

(Jeff): What was that first one you said?

Woman: QT Modeler, (Terascan), (Leader Mouse) and Arch GIS. And that's for the LiDAR side of things. Then for the hyperspectral side we use (ESRI) software.

(Jeff Brenny): Thank you.

(Courtney): Other questions? All right, well if there're no other questions we will - we'll finish up the meeting here today. I do want to thank (Molly) and (Lauren) very much for your time and the effort to present. We certainly learned very much from it.

If any of our participants do have more questions, please do feel free to email (Molly) or (Lauren) with - at their addresses there on the screen. And then also you're welcome to refer back to this presentation. The recorded meeting will be posted on the environmental gateway under the learning tab.

And thank you all for the - for sharing your time and participating today. And I hope you can join us for future Web meetings and those will be announced, again, through the ecosystem restoration learning exchange and - so please stay tuned for those upcoming meetings. And have a great afternoon.

Woman: Thank you (Courtney).

(Courtney): You're welcome. Thank you all.

END