Vessel Movement Module Webinar

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The following summary notes are not intended to be a transcript but rather a review of the question and answer session that took place at the end of the webinar. Participant questions and comments are shown in bold text followed by Ecology responses.

Canada is currently reviewing the pilotage waiver system and the outcome of this effort could affect traffic patterns of certain US flagged vessels. Pacific Pilotage Authority is leading the review but Transport Canada will likely be the lead regulator. This will be important to consider when looking at rules that might affect vessel movements. (Robert Lewis-Manning)

JD Leahy: I appreciate that information. The fact that there will be changes over time is certainly one of the challenges that we are facing. This is not a static environment, so we will see changes in vessel regulations and vessel patterns over time. That is one of the reasons that we need to build in the flexibility and complexity that we have presented today. We don't want to just be limited to patterns that we see in historical data – we need the ability to make adjustments based on changes that are planned for the future.

This is a comment on the vessel taxonomy informing route generation. I suggest looking at some individual vessels and at a finer level. Some vessels can make up a huge part of the data or have unique behaviors. You can extend that concept deeper to suggest the 50 most important vessels with unique behaviors. I'm thinking of some of the analyses we did of tugs where there was some overlap in your coverage area up to BC. We looked at a single tug that spent a lot of time in our study area and had unique behaviors. I think ferries and individual cruise ships would be similar. (Bretwood Higman)

JD Leahy: Definitely thinking of looking at some vessel types at a finer level, and ferries is a good example. The Washington State Ferries are grouped ferries into classes, which is an existing typology that we could lean on without having to go down to the individual level.

Is there the possibility of including rules in the vessel movement module about the Area To Be Avoided (ATBA)? You'll see larger vessels hanging outside that area. My other question might be beyond the scope of your project. Can you encourage the US delegation to the IMO to take a look at vessel type coding. The current coding really needs to be changed and we've been looking for improvements on this for a number of years. (George Galasso)

JD Leahy: In regards to the possibility of including rules in the vessel movement module about the ATBA, that's an interesting question. This I think would be an example of a type of rule that will be incorporated just by inclusion of vessel traffic patterns. Most vessels follow the rule but not all do. We want to make sure we are accounting for those vessels that may not follow the rule. For your other question, regarding possible changes that could be made to AIS typology, I do think it's outside the scope of the project but we'd love to be in touch with you on those topics.

I want to stress the importance of validating your AIS data. I work with it a lot and we find lots of user errors. There was a bulk carrier that transited a lot through the San Juan Islands, but once we looked into the MMSI we found it was actually a yacht. We found that it is important to pull the MMSIs into the data, and look at other sources in addition to the AIS when determining vessel type. (Tim Robertson)

JD Leahy: Definitely, in order to get more detail beyond the AIS type, we'll need to be linking the MMSI to other databases so we should catch situations like this.

Do you plan to differentiate between different types of fishing vessels, i.e., commercial, recreational, tribal? (Tom Ehrlichman)

JD Leahy: Yes, we need to differentiate between these different types of fishing vessels, but how we draw these lines is yet to be decided. We look forward to having that discussion. We need to select types that are meaningful in terms of the routes that vessels take. The other piece is that we need to have a machine readable ability to differentiate between these different types—the vessel types need to be distinguishable based on what is in the AIS data, Coast Guard database or Lloyds Database. We understand "fishing vessel" is probably not a discrete enough category, but look forward to discussing this in the future.

In the spirit of risk-based modeling is any consideration given to looking at metrics of Jones Act versus Foreign Flag vessels? (Rick LaBlond)

JD Leahy: In terms of looking at differentiating between vessels in terms of what tracks they might select in visits to this waterway, I think what you bring up is an interesting example. We talked about potential factors like visibility. We might see in the data that visibility impacts vessel speed or track selection. But there could be less obvious factors like the flag of a vessel. If people think those factors might influence track selection in the

waterway, we are definitely interested in hearing that, and exploring that statically in our analysis of track and route selection.

I just want to confirm, you referenced not being able to see the traffic between March Point and the anchorage areas, but I'm assuming the analysis will show the traffic in between these areas. Is that correct? And will you be accounting for the vessels going to and from anchorage areas multiple times? (Lovel Pratt)

JD Leahy: Yes, those will be included. That image was not zoomed in enough but if it was a closer image, we would have been able to see those tracks. In addition, the algorithm will distinguish those tracks based on those movements and create breaks in time that allow them to be identified.

At what point will we be getting information about if this model will be addressing the consequences of oil spills, and how will this be done? (Lovel Pratt)

JD Leahy: We dug into that a little at the last webinar. The output of this model will be the size, type, location, of oil spilled on a given day at a given time. That's the consequence output that will be produced. Those outputs could be used for deeper analysis as appropriate. [Additional information on this topic can be found in this 4 minute clip from our July presentation on modeling approach.]

You'll also notice that specific types of vessels only go to specific terminals. ie. an oil tanker will only go to certain terminals. Or a ferry will only go to ferry docks, etc. This could be useful for building routes. (Paul Devries)

JD Leahy: The way we are approaching this is by adding that definition to the vessel type component of the analysis. This is how we can figure out that certain vessels are operating only on certain routes.

Alex Suchar: We are still in the early stages of defining a route. We don't want to have 10,000 routes but also don't want to have 10. We want to separate the data into meaningful numbers. If we use a broad definition for destination, we'll have to use the information to know exactly where those vessels are. It's a balancing act for now until we have the AIS data and try different strategies.

What is the method of knowing if the vessel is laden or in ballast? (Michael Anthony)

JD: In terms of the laden or in ballast question, there's not an easy answer to that, but we have access to Advanced Notice of Transfer info which is one source we'll look at to shed light on laden status. We'll also need to create algorithmic rules to assign that status to different vessels. We'll look to people on this call and those with experience in this area to help narrow down those rules to be as accurate as possible.

Is the model going to concern the extra escort traffic needed in the new rule? (Michael Anthony)

Yes, absolutely. Escort traffic is another part of what we are calling "dependent vessels" – these are vessels whose movement appear within the system based on the presence of other vessels. That being the case, we don't necessarily need historical data in order to be able to represent these.

Why are small non-AIS vessels being concerned? (Michael Anthony)

First off, some of these vessels aren't small, and regardless, they are part of the maritime transportation system and our charge is to assess oil spill risk within the Puget Sound and Washington waters and those vessels are certainly part of that equation – and that is why we are looking at including them. It's a lift and there will be additional uncertainty added to the model as a result of whatever way we ultimately include this vessels.

Alex Suchar: This is exactly the type of question that we will hope to have your assistance with. From a technical point of view a collision is a collision, whether it is between big or small vessels, and each collision carries a risk of oil spill. If the vessels are small, the risk of oil spill might be smaller also, but it is still something that we have to capture.

Will the model be adaptable to other waters? For example, the Columbia River. If so, are there longer term intentions to apply the model elsewhere? (Sean Kelly)

JD Leahy: Our charge is to build a model that's capable of assessing oil spill risk in all Washington waters, which would include parts of the Columbia River. That said, the two analyses that we have coming up, are both linked to the Puget Sound. As a result, we are limiting the area we are looking at right now to waterways that are connected to the Salish Sea. We want to be efficient and be able to get these two analyses done. However, we are building a foundational structure of a model that can be applied in different areas and capable of looking at different Washington waters. There's a lot of difference between the Columbia and Snake River waterways, and the Salish Sea in terms of vessel operations. There would need to be a lot of updates or additions that we would need to consider before using this model to look at the Columbia River, but we need to keep it broad enough that that's a possibility. We don't currently have direction from the Washington legislature to conduct an analysis on the Columbia River, but we need to be capable of looking at all Washington waters.

Could you speak to your thinking on the range of years you will use for AIS data? What might be the last year of data you use? (**Tom Ehrlichman**)

JD Leahy: We have not yet decided on a specific range of years that we will use to build our tracks and routes from AIS.

Adam Byrd: We're trying to build our system with a really robust data set and build a model with longevity. This will be updated constantly, so there will be no "last year." Looking at maybe 5 years ending in 2019. Still a lot of questions to answer down the road in terms of implications for analysis. There isn't ever going to be a cut off point for that data.

Alex Suchar: We'll use the info that's necessary to create the code and methods for the model so we can create our simulation. In the model, we'll use AIS data just in the development process without really considering if this is the last year. When we get to the analysis phase, that is when we will need to decide which AIS dataset will be used as a baseline.

Also, can you please indicate how you are now addressing the issue of laden versus unladen tankers, barges and ATBs? (Tom Ehrlichman)

JD Leahy: That will be a key and challenging component of this. It's an important piece of this puzzle, and one we look forward to thinking on and then discussing with you all. We're currently focused on components related to track selection and vessel typing. As we get to questions of laden vs unladen status we look forward to discussing those.

Are the Vendovi and Jack Island/Samish Bay anchorages "destinations" with green diamonds? (Tom Ehrlichman)

Adam Byrd: The diamonds were referring to actual terminal locations in that particular map. Anchorages are defined by areas as polygons.

JD Leahy: There are destinations in the context of the list of destinations that we are working with. They may not have been represented on as diamonds on the specific diagrams presented today.

Will anchorages be treated as fixed obstacles when occupied, for purposes of analyzing risk of collisions/allisions, or will the anchored ship not be accounted for as the other vessel passes through that area? (Tom Ehrlichman)

JD Leahy: We're not currently planning to treat the entire anchorages as fixed obstacles when they are occupied. Anchorage areas are a lot larger than an actual ship, so we want to represent something closer to the size of the ship. We will account for anchored vessels as potential factors in vessel encounters.

Since this is a Washington endeavor, why does the analysis area include areas solely in Canadian waters? Will you take into account transits solely in Canadian waters that never enter US waters? (Jim Peschel)

JD Leahy: Yes, we need to model the traffic in the system that's relevant to oil spill risk in Washington waters. That's why we've chosen a broader box for data collection. The Canadian waterways are certainly relevant to vessel movements and oil spill risk on the Washington side. When we complete various analyses using the model, we may choose to look at a smaller zone.

Will hull type and bunker type be part of spill risk modeling? There may be a higher risk of spills from vessels like tugboats and escort tugs than from double hull vessels. (Sol Kohlhaas)

JD Leahy: As we move through the modules, we'll get to the oil outflow module which is a strategy for determining that if there is an accident of some kind, then based on the characteristics of that accident, how much oil comes out, where does it come out, what type of oil is it, etc. In order to do that we'll need to include all the factors involved in that calculation, which will definitely include such as type of fuel and hull type. Getting at that data can be complex, and there is certainly different levels of complexity that we could include in the oil outflow module, but all those pieces will come into play there. We are aware of the importance of those factors and will be looking at ways to include them.

This process always come down to the need for some kind of calibration. Given this verified documentation from AIS that we're lucky to have, you will be able to estimate a certain proximity of all these vessels, but the

age old questions here is, once you have all these vessels moving in your simulation, you need to come up with a probability that something is going to go bump in the dark. Do you have some kind of novel way to address that? (Fred Felleman)

JD Leahy: There's a lot of challenges here that have been tackled by lots of people, and we've been doing a lot of reading on different strategies. We'll combine those to be as cutting edge as possible, but that doesn't mean we'll eliminate uncertainty. We are going to put these pieces together in a way that brings new information to the table and is a useful tool for folks.

All models are wrong, some are useful (as the saying goes). The mess in the past has been: how far do you go back in the accident record? And do you draw from the international database? Have you identified some path forward on approximating this? (Fred Felleman)

Alex Suchar: We don't have a satisfactory answer right now, we have debated this internally and discussed it extensively, in particular at the beginning of the model development process. We decided we'll address this issue when we get to the accident module. We need to start with simulating vessel movement, and then vessel encounters, and then we will start work on the accident component. We have some half-baked ideas, but we will tackle this when the time comes. It makes sense to go about it this way because even if we come up with the perfect accident model, but if we can't simulate the vessel movement, that model is useless.

Adam Byrd: One of things we have discussed is not actually baking in an accident probability into the model. One approach we're still considering is that the system we're building now is not a defined accident rate that can't be modified later.

I suggest that this a place to get the broader community to understand what assumptions you're making and working to get their buy in. The approximation part is worthy of extensive outreach and communication. There is no perfect answer, but it's something that everyone should have some sense of agreement on. I'm just suggesting that accident probability is where community input will be most valuable. (Fred Felleman)

JD Leahy: One of the things we are trying to do is communicate that we value community input and involvement in this process, and start to build trust with these conversations. Maybe we can start with some of the topics that are less reminiscent of challenging conversations that have been had in the past. It might feel like we should just start with the hardest question of them all, but all of these pieces, including the ones we have discussed today, are important so we need to address these too. Hopefully by doing that we are better prepared to have the tougher conversations down the road.

How will the module address routes that may have been in the use in the past, but no longer used due to changes in the industry or economy? For instance, Alcoa terminal etc. (Nate Menefee)

JD Leahy: This is exactly why we need to have this creation of routes. We don't want to figure out where all vessels have moved in the past and then simulate those same movements in the future. We want to be responsive to changes in terminals and movements, and we want to calibrate the number of movements on a given route with the levels that we are trying to simulate. If we have a number of historical visits to a terminal

but that is no longer in play, the creation of routes as discrete components of the module allows us to surgically remove that route from the simulation.

Alex Suchar: The advantage of having all AIS messages classified by route, vessel type, time of year, time of day, and external conditions is that we have flexibility to simulate different conditions.

A smaller non-AIS vessel might not impact the Vessel Movement Module, but this non-AIS small vessel will definitely impact the collision avoidance of larger AIS vessels with an oil release potential. (Ken Lawrenson)

Once this vessel movement model (and the rest of the modules) are completed, do you foresee it/them being usable for modelling other risks, beyond oil spills? Such as maybe collisions? Or perhaps areas of potential future traffic congestion? (Paul Devries)

JD Leahy: The charge from legislature is to be able to assess oil spill risk. Vessel collisions are a component of that. We need to be able to model collisions as a way to get to oil spill risk. Certain other things need to be modeled on our way to the quantification of oil spill risk. With that in mind, the model will be able to look at component aspects of oil spill risk, but there is no current plan to extend the model to look at things that extend beyond oil spill risk.

Vessel routes/tracks are often predicated on whether they are operating under pilotage. Will the taxonomy factor in this element? (Rick LaBlond)

JD Leahy: Pilotage could be incorporated into vessel taxonomy or as a factor in track selection. Pilotage requirements could impact track selection or routes, so that's a great suggestion that we didn't have on our list. Suggestions like these are very helpful in terms of making sure we're covering everything.

Is there a way that you can just modify the weights of an anchored vessel/anchorage point for oil spill potential/interaction? This way they can be included but not influence or skew the model too much in one direction. (Salma Abdel-Raheem)

JD Leahy: That will come into play in the vessel encounter module. We will want to select a strategy for our encounter module that differentiates between an encounter with a stationary/anchored vessel and a moving vessel.

Alex Suchar: Another aspect that will come into play here relates to the oil outflow module because the force of impact is related to if the vessel spills oil and how much. So the fact that the vessel is at anchor would play a role in determining that force of impact.

Just a reminder that there was a collision between vessels at anchor in Plumper Sound in March, so I'd assume you would look at the potential for two vessels at anchor to collide with one another. (Lovel Pratt)

JD Leahy: Good point. We'll need to look at situations like that in the vessel encounter module. There's some complexity at how best to do that. Weather would be an important factor to look at in terms of dragging anchor. That's an interesting point.

Will you be able to model the risk of spills from bunkering operations from ships at anchor? (Lovel Pratt)

JD Leahy: Our plan is to include transfer spills of various types as a component of oil spill risk.

Its Darwin and Casey from Tsawout First Nation. Our traditional territory covers a critical area for ship routing. Are we able to access the routing information or tools you are developing? One key area we would use this for is responding to the multiple development referrals we have to deal with that are looking at impacts of increased traffic and possible spills. (Casey Dick-Wyatt)

JD Leahy: As part of this work, we are committed to transparency and making sure tools and resources that we develop available as we able. We're interested in sharing things like that, but it will be down the road. Our primary focus right now is to meet our deliverables, and then look at ways of sharing our work product after that is taken care of.

In follow up to Fred's question regarding accident data or lack thereof, how will you account for risk mitigators and actions like during a propulsion loss using the momentum to position the vessel better for anchoring or to gain time for a tug response? (Mike Moore)

JD Leahy: Those are all important pieces of the puzzle. Just like we are hoping to have in depth discussions on how to model vessels that don't carry AIS, and how to figure out how to organize vessels into a taxonomy, we will be looking to have in depth discussions on how loss of propulsion incidents play out. We will tackle this once we start work on our accident module. We'll be looking at previous work on the topic and to our community, and then we'll piece that together in a way that's transparent and allows us to grow and learn as a community, and that is going to be one of the values that we get out of this process. We might not get perfect representation of oil spill risk, but we'll be learning along the way, sharing knowledge, and we'll be making incremental progress.

All of the things that you mentioned are going to be key components in our analysis of the Emergency Response Towing Vessels, so they will definitely need to be incorporated into our model.

Can tracking data for vessels who do not ascribe to AIS ie. Navy be captured and overlaid into the modeling regions? (Rick LaBlond)

JD Leahy: The Navy is not required to transmit via AIS, but they have made some policy changes in recent years, and as a result are broadcasting an AIS signal more often. So we will see changes over time in Navy ship movements depending on which years of AIS data we are looking at. Folks currently on the water will have insight into this as well.

I think it's important to separate transfer spills from the escort conversation. Should be able to separate out from underway data, because it's a completely separate problem. (Blair Bouma)

JD Leahy: We are including transfer spills in the model because they are part of the oil spill risk picture, so we want to make sure that's included. But your comment is well noted, and there will be discrete outputs, that will be able to be looked at separately.

I've wrestled with the same problems you're dealing with in AIS cleaning and track breaking, and I would be happy to do a brief presentation on how I've handled those issues to whoever is in the technical weeds there. (Bretwood Higman)

Norma Serra Sogas at University of Victoria is doing work on tracking non-AIS carrying vessels. She's currently doing some work with Transport Canada. I would be happy to put you in touch. (Louise Murgatroyd)