

Developing the Vessel Encounter Module: Comparing Ship Domains



More information

[Visit our webpage](#)

How you can help:

We are looking for feedback on these calculated ship domains from all stakeholders, especially those with expertise and interest in:

- Salish Sea vessel operations
- Navigational considerations of large vessels
- Operation and navigation of towing vessels

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Introduction

This focus sheet describes ship domains that we may use as part of our oil spill risk model. A ship domain is an area around a ship that should be free of other vessels.

We are using ship domains to identify situations where two simulated vessels are close enough to represent the possibility of a collision. If two ship domains overlap, then the model counts that event as an encounter.

We're seeking your input on the size and shape of these domains, as well as our approach to creating domains for towing vessels. Illustrations of different domains are included on page 2.

You can provide feedback via [email](#) or at one of our virtual events. We are hosting a [technical discussion on the topic of ship domains on March 17th 2021](#), where you can provide additional feedback.

To learn more about the model, and how ship domains relate to the rest of the project, please review our [Modeling Approach focus sheet](#).

Identifying Vessel Encounters

The encounter module in our model will identify situations where collisions could occur, by determining when two vessels are in proximity to each other. Evaluating whether a collision occurs in the model will be accomplished by the vessel accident module.

We are considering two different ship domain-based encounter models, the Quaternion Ship Domain (QSD) Model and the Pentagonal Model. Each produces a two dimensional zone around a simulated vessel. Examples of the two domains are included in the side bar on page 2.

The Quaternion Ship Domain (QSD) Model was proposed by Wang (2010). The domain is an ellipse that is based on four directional radii:

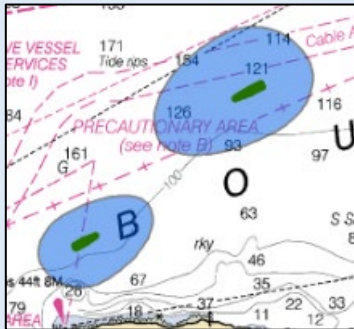


Figure 1: Example of QSD Domain

The Pentagonal Model (Bakdi et al, 2019) is based on the same formulas, but has a pentagonal shape, instead of the ellipse shape of the QSD:

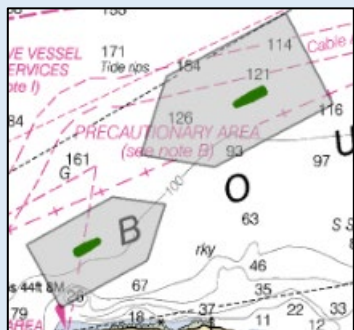


Figure 2: Example of Pentagonal Domain

References:

Bakdi, A., I. K. Glad, E. Vanem, and Ø. Engelhardt. (2019). AIS-Based Multiple Vessel Collision and Grounding Risk Identification based on Adaptive Safety Domain. *Journal of Marine Science and Engineering* 8:5.

Wang, N. (2010). An Intelligent Spatial Collision Risk Based on the Quaternion Ship Domain. *Journal of Navigation* 63:733-749.

Requested Feedback

We are looking for feedback on

- the shape of the domains produced by the two different models
- the relative size of the domains based on vessel size and speed
- ship domains for towing vessels
- ship domains for anchored vessels

Additional information on each of these topics is included below. We welcome your feedback at our upcoming technical discussion and via email.

Shape of the Ship Domains

The QSD Model and the Pentagonal Model are based on the same formulas, but they produce slightly different shapes. In the linked document, by comparing [Encounter Candidates 1 and 2](#), you can see that under some circumstances, this can make the difference in a situation being counted as an encounter or not.

Ship Domain Size Based on Vessel Size and Speed

The ship domain models use vessel size and speed to calculate the size and shape of the ship domain. In the linked document, by comparing [Encounter Candidates 3-6](#), you can review the different ways that ship length and speed affect the size and shape of the ship domains.

Ship Domains for Towing Vessels

For deep draft vessels, the size of the ship domain is based on ship length. For a tug towing a barge, this may underrepresent the true area of interest around the vessel. An alternative is to calculate the domain based on the combined length of the vessel, tow, and barge, resulting in a much larger domain size. In the linked document, these approaches are contrasted in [Encounter Candidates 7 and 8](#).

Ship Domains for Anchored Vessels

Vessels not underway, including anchored vessels, also have ship domains. This allows the model to identify encounters when other vessels pass in proximity to an anchored vessel. Representations of ship domains of anchored vessels can be viewed on the "[Vessels at Anchor](#)" page in the linked document.

How to Provide Input?

We welcome feedback and input on these topic at our upcoming technical discussion session as well as in writing.

[Register for our March 17th, 2021 Discussion Session](#)
[Provide written feedback via email](#)