Description of CAD Model of UMaine VoltrunUS-S Reference Platform

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This short document presents a CAD model of the UMaine VoltrunUS-S reference platform and shows the basic internal structure of the model.

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1 Introduction

The National Renewable Energy Laboratory (NREL) as a part of the IEA Wind TCP Task 37 produced models for a 15 MW wind turbine and a semi submersible floating platform (in conjunction with the University of Maine) with these reference materials forming an important part of research into floating offshore wind energy [1, 2]. With the 15MW turbine being the largest model available via public access and the floater being specially designed for use with the turbine, these models will help with current engineering goals to increase the size of wind turbine in commercial use in line with goals to deploy 15MW turbines in the early 2030s [3].

Currently, full CAD models of the turbines blades, tower and nacelle however a full CAD model of the semi submersible platform has not been produced and no internal structure has been outlined. This means there are some limitations in the simulation software that can be used for modelling the floating platform. With this in mind a CAD model with a simple internal structure using the external dimensions and mass properties presented in the NREL report. This short document presents the model made and considers the design decisions that were made.

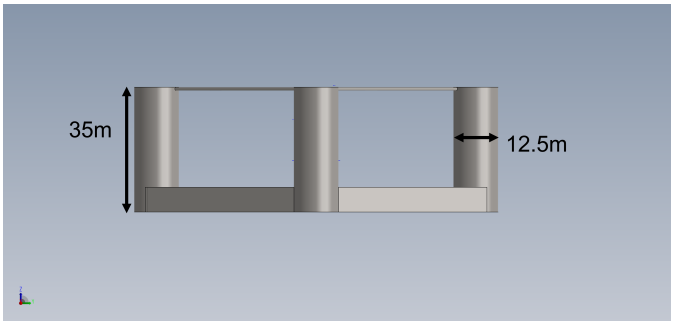
2 CAD model

The external dimensions and the mass of steel in the structure are clearly stated and these formed the basis for the dimensions of the model. An internal structure had to be made such that the mass of steel in the structure was approximately equal to 3914 tonnes. It was decided that a simple internal structure would be used where the hull thickness of the pontoons and internal diameter of the buoyant columns. The external parts of the model can be seen in figure 1.

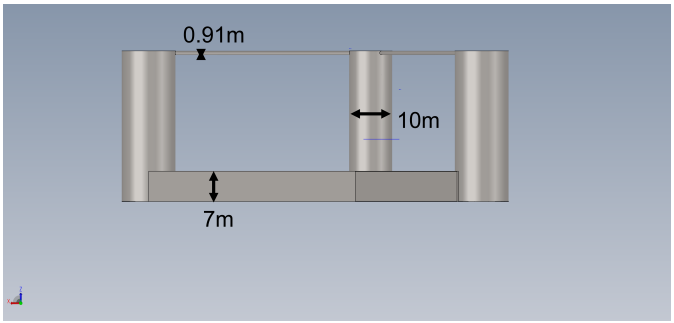
The central tower was given a thickness of 55.34mm, which is consistent with the thickness of the tower at the end which attaches to the floater. The buoyant columns were given a thickness of 34.5mm where this value was chosen in conjunction with the pontoon hull thickness of 30mm or 40mm and the three cylindrical struts were not given an internal thickness. Figure 2 shows cross sections of the floater and highlights the different thicknesses. The total mass of the model was found to be 3917 tonnes giving a percentage difference of 0.07% compared to the original which is deemed to be an acceptable difference in masses. The centre of mass of the model was set as the centre point for the model.

3 Usage

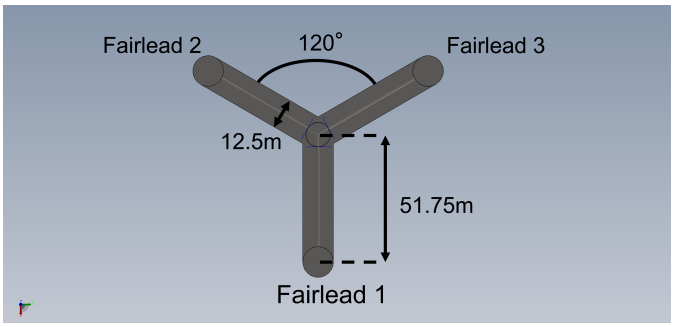
This model was created for use in the Offshore Simulator Centre (OSC) Marine Simulator at the National Decommissioning Centre (NDC), where the appropriate ballast can be added to the model. Work is ongoing regarding the calibration of the model, specifically looking at the RAOs in surge, heave and pitch.



(a) Front view

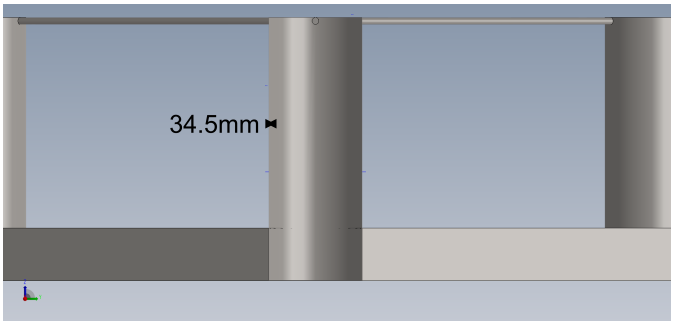


(b) Side view

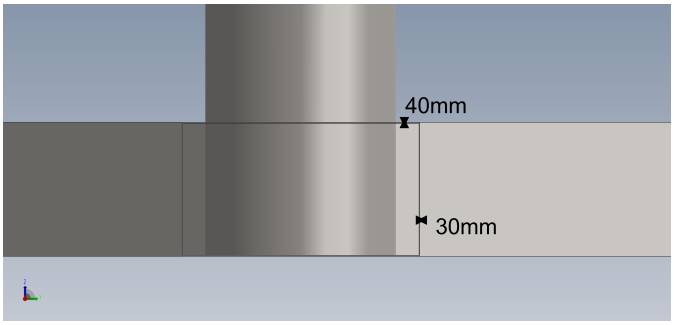


(c) Top view

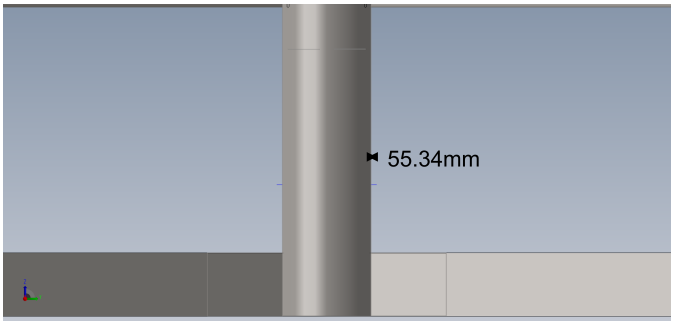
Figure 1: CAD model of UMaine VolturnUS-S Reference Platform. Dimensions taken from [2]



(a) Cross section of buoyant column



(b) Cross section of pontoon



(c) Cross section of central tower

Figure 2: Cross sections of the model showing thicknesses where relevant.

Acknowledgements

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References

[1] Gaertner E, Rinker J, Sethuraman L, Zahle F, Anderson B, Barter G, et al. Definition of the IEA 15-Megawatt Offshore Reference Wind; 2020. NREL/TP-5000-75698. Available from: https://www.nrel.gov/docs/fy20osti/75698.pdf.

[2] Allen C, Viselli A, Dagher H, Goupee A, Gaertner E, Abbas N, et al. Definition of the UMaine VolturnUS-S Reference Platform Developed for the IEA Wind 15-Megawatt Offshore Reference Wind Turbine; 2020. NREL/TP-5000-76773. Available from: https://www.nrel.gov/docs/fy20osti/76773.pdf.

[3] Eatough L. Floating offshore wind technology and operations review. ORE Catapult; 2021. Available from: https://f.hubspotusercontent20.net/hubfs/4351574/7523%20Catapult%20Report%20%E2%80%93%20FOW%20Technology%20and%20Operations%20Review%20%E2%80%93%2027.10.21.pdf?__hstc=&__hssc=&hsCtaTracking=17ada39c-b9e9-4278-98c7-440c74781190%7C9706834e-54fb-4332-802d-54dca6be0131.