Partners in UK offshore wind

MONA OFFSHORE WIND PROJECT

Response to Ørsted IPs ExQ1 Responses

Deadline: 4

Application Reference: EN010137

Document Reference: S_D4_47

Document Number: MOCNS-J3303-RPS-10398

4 November 2024

F01

Image of an offshore wind farm

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Document status

Version	Purpose of document	Authored by	Reviewed by	Approved by	Review date
F01	Submission at D4	RPS	Mona Offshore Wind Ltd	Mona Offshore Wind Ltd	4 Nov 2024

Prepared by:

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Prepared for:

Mona Offshore Wind Ltd.

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Glossary

Term	Meaning
Applicant	Mona Offshore Wind Limited.
Development Consent Order (DCO)	An order made under the Planning Act 2008 granting development consent for one or more Nationally Significant Infrastructure Project (NSIP).
Marine licence	The Marine and Coastal Access Act 2009 requires a marine licence to be obtained for licensable marine activities. Section 149A of the Planning Act 2008 allows an applicant for a DCO to apply for a 'deemed' marine licence as part of the DCO process. In addition, licensable activities within 12nm of the Welsh coast require a separate marine licence from Natural Resource Wales (NRW).
Mona Array Area	The area within which the wind turbines, foundations, inter-array cables, interconnector cables, offshore export cables and offshore substation platforms (OSPs) forming part of the Mona Offshore Wind Project will be located.
Mona Offshore Wind Project	The Mona Offshore Wind Project is comprised of both the generation assets, offshore and onshore transmission assets, and associated activities.
National Policy Statement (NPS)	The current national policy statements published by the Department for Energy Security & Net Zero in 2024.

Acronyms

Acronym	Description
DCO	Development Consent Order
dML	deemed Marine Licence
EIA	Environmental Impact Assessment
ERCoP	Emergency Response and Cooperation Plan
ExA	Examining Authority
MCA	Maritime and Coastguard Agency
MNEF	Marine Navigation Engagement Forum
MPCP	Marine Pollution Contingency Plans
NRA	Navigational Risk Assessment
NRW	Natural Resources Wales
NPS	National Policy Statement
NSIP	Nationally Significant Infrastructure Project
TCE	The Crown Estate

Units

Unit	Description
GW	Gigawatt

Unit	Description
km	Kilometres
km^2	Kilometres squared
kV	Kilovolt
MW	Megawatt
nm	Nautical miles

1 RESPONSE TO ØRSTED IPS EXQ1 RESPONSES

1.1 Introduction

1.1.1.1 The Applicant has responded to the Ørsted IPs ExQ1 responses below.

2 Response to Ørsted IPs ExQ1 Responses

Table 2.1: REP3-103 - Ørsted IPs

Planning Inspectorate Ref. No.	Question is addressed to	ExA Question	Ørsted IPs response	Applicant's response
REP3-103.1	Barrow Offshore Wind Limited Burbo Extension Limited Walney Extension Limited Morecambe Wind Limited Walney (UK) Offshore Windfarms Limited Ørsted Burbo (UK) Limited (collectively "the Ørsted IPs") Scottish Power Renewables (WODS) Ltd	Q1.19.3 Potential wake effects Do you agree that Table 10.10 of [APP-062] accurately reflects the approximate distances between the proposed Mona array area and the operational wind farms that you represent?	The distances recorded in table 10.10 are approximately accurate. For completeness, the Ørsted IPs note that there are some minor differences between the distances recorded by the Applicant and the Ørsted IPs' figures in respect of some developments.	The Applicant notes this response.
REP3-103.2	Barrow Offshore Wind Limited Burbo Extension Limited Walney Extension Limited Morecambe Wind Limited Walney (UK) Offshore Windfarms Limited Ørsted Burbo (UK) Limited (collectively "the Ørsted IPs") Scottish Power Renewables (WODS) Ltd	Q1.19.3 Noting that all of the operational wind farms that you represent are at least 30km away from the proposed Mona array area, how do you respond to the Applicant's statement that based on the findings of the 2023 Frazer-Nash study, wake effects become "vanishingly small" when there is a farm-to-farm separation of more than 20km?	The Ørsted IPs consider the Applicant has misrepresented the meaning of this sentence in the Frazer-Nash Consultancy "Offshore Wind Leasing Programme – Array Layout Yield Study" report dated 5th October 2023. The purpose of this study was to "…maximise the energy production from the portfolio of existing and future wind farms". The Crown Estate (TCE) is trying to optimise the UK seabed to find some balance between how the size of future offshore wind development zones and how far they should keep them apart (buffers). TCE is seeking to maximise the production from the entire portfolio and not only for new lease areas. The Frazer-Nash study takes some generic, theoretical offshore wind farm pairs and looks at the balance in total production based on different densities and separation buffers – asking whether the "portfolio" production increases when development zones are smaller and further away from each other (reducing the neighbour wake effect) versus larger wind farms which are closer to each other (the larger leases would allow lower turbine density inside the development zones reducing the internal wake effect). The "vanishing small" comment in full is as follows: "For separations much larger than 20km, farm-to-farm wake losses will become vanishingly small…". It is notable that the study uses the language "much larger" than 20km and not simply "more than". The study should be interpreted as saying that relative to the internal wake losses the neighbour wake losses are not as significant for separations much larger than 20km. Hence, in the context of the TCE's goal to maximise the portfolio production of total seabed of the UK, new developments should not be forced into very small array areas with very high turbine density as in this case the internal wakes will dominate relative to neighbour wakes. The study does not comment on whether wake losses extend beyond 20km, but it does advise against using long range wakes	The Applicant notes the comments regarding the 'Frazer-Nash Study'. This study is one of many studies on the subject of wakeloss, as highlighted by the Ørrsed IPs response at REP3-103.3, the content of which demonstrate that there is no accepted consensus on the way to model and quantify wakeloss, or what the real-world impacts of wakeloss are. The Applicant has set out in response to REP3-103.5 why it is not necessary, or straightforward, to 'model the real-world situation in the Irish Sea'.

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			as a basis for designing how to allocate the seabed. In fact, in section 2.2 of the report it mentions that "*Ørsted … have shown evidence from their own portfolio of offshore wind production data that the method reproduces long range wakes well up to 50km separation*". Additionally, the Ørsted IPs highlight that the study was based on a theoretical, unrealistic regular grid wind farm pair orientated directly North-South and not aligned with the principal wind direction. Therefore, it should not be relied on to predict the likelihood of actual wake losses in these circumstances. The Ørsted IPs consider it would be quite straightforward for the Applicant to model the real-world situation in the Irish Sea and reiterate their request that the Applicant does so.	
REP3-103.3	Barrow Offshore Wind Limited Burbo Extension Limited Walney Extension Limited Morecambe Wind Limited Walney (UK) Offshore Windfarms Limited Ørsted Burbo (UK) Limited (collectively "the Ørsted IPs") Scottish Power Renewables (WODS) Ltd	Q1.19.3 Do you wish to provide any evidence of material wake effects being discernible at farm-to-farm separation distances of 30km or greater?	The Ørsted IPs maintain (as explained in detail in response to question 1.19.4 below) that it is for the Applicant to undertake an assessment of the wake effects of the Project on other sea users. However, if the Applicant does not undertake this assessment, the Ørsted IPs will undertake this exercise. Notwithstanding the above, the Ørsted IPs record that there is ample evidence of material wake effects occurring at farm-to-farm separation distances greater than 30km, both in their own portfolios and in academic research. This evidence can be categorised as follows: • Satellite observations and aircrafts; • Scanning LiDAR; • Wake and other atmospheric models; and • Observations from existing turbines' SCADA data. These categories are explained further below, along with key excerpts of relevant evidence. The Ørsted IPs are able to provide further analysis, and copies of the papers referred to below, if that would assist the examining authority. **Satellite observations and aircrafts** Synthetic Aperture Radar or SAR installed on satellites can be used to directly observe wakes in the sea. The papers referred to below combine this approach with specially equipped research aircraft and laser measurements or models to measure the wake impact directly. The relevant findings of this research regarding wake loss beyond 20km is noted below: • Platis, A., Siedersleben, S., Bange, J. et al 'First in situ evidence of wakes in the far field behind offshore wind farms': *"…satellite imagery reveals wind-farm wakes to be several tens of kilometres in length under certain conditions (stable atmospheric stratification), which is also predicted by numerical models. The first direct in situ measurements of the existence and shape of large wind farm wakes by a specially equipped research aircraft in 2016 and 2017 confirm wake lengths of more than tens of kilometres under stable atmospheric conditions, with maximum wind speed deficits of 40%..."* • Platis, A et al 'Long-range modifications of the wind field by offshore wind parks – results of the project WIPAFF': *"The in situ measurements recorded on-board the research aircraft DO-128 and remote sensing by laser scanner and SAR*	The Applicant notes that the ExA have asked for the Ørsted IPs to submit full copies of articles concerning assessment of wake effects referred to in REP3- 103 at Deadline 4 (EV6-006). The Applicant will give consideration to the evidence provided once available.

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			prove that wakes of more than 50 kilometers exist under certain atmospheric conditions." • Hasager, C.B.; Vincent, P.; Badger, J.; Badger, M.; Di Bella, A.; Peña, A.; Husson, R.; Volker, P.J.H, 'Using Satellite SAR to Characterize the Wind Flow around Offshore Wind Farms': *"The approximate extent of the individual wind farm wakes is outlined in the image. The longest is at Belwind around 55 km long while at Thornton Bank it is 45 km…"* **Scanning LiDAR** Scanning LiDARs are wind measurement devices that use the doppler shift of laser beams to accurately measure wind speed. The majority of modern offshore wind farms have their energy yield analysis based on measurements from LiDAR technology. The papers referred to below contain relevant findings based on this data source: • J. Schneemann et al. 'Cluster wakes impact on a far-distant offshore wind farm's power': *"Our results showed clear wind speed deficits that can be related to the wakes of wind farm clusters up to 55 km upstream in stable and weakly unstable stratified boundary layers resulting in a clear reduction in power production…"* • B. Cañadillas et al. 'Offshore wind farm cluster wakes as observed by long-range-scanning wind lidar measurements and mesoscale modelling': *"Both the observations (Fig. 8a) and model (Fig. 9) show a wake extending at least 40 km downstream of the N-3 wind farm cluster…"* **Wake and other atmospheric models** Mathematical models can also be used to predict the extent of offshore wakes by modelling the behaviour of the atmosphere when interacting with offshore wind farms. In all cases these models have been validated on operational data from offshore wind farms and hence can be relied on as good predictors of the behaviour of offshore wakes. The papers referred to below contain relevant findings based on these models: • D. Rosencrans et al 'Seasonal variability of wake impacts on offshore wind plant power production': *"The strongest wakes, propagating 55 km, occur in summertime stable stratification…"* • Akhtar, N., Geyer, B., Rockel, B. et al. 'Accelerating deployment of offshore wind energy alter wind climate and reduce future power generation potentials': *"The mean deficit, which decreases with distance, can extend 35–40 km downwind during prevailing southwesterly winds."* • R. Borgers et al 'Mesoscale modelling of North Sea wind resources with COSMO-CLM': *"In weakly stable conditions, absolute capacity factor reductions are much higher, as these exceed 13 % over large zones within and outside the wind farm clusters and 5 % more than 20 km from wind farm clusters and larger wind farms"* • Sara C. Pryor, Rebecca J. Barthelmie, Tristan J. Shepherd 'Wind power production from very large offshore wind farms':	

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			"Under some flow conditions whole wind-farm wakes can extend up to 90 km downwind of the largest lease areas…" • P. Baas et al 'Energy production of multi-gigawatt offshore wind farms': *"In this case, a clear wake is visible, which is still present as the flow reaches the southern edge of the domain. Clearly, for studying wake lengths behind windfarms of this size, much larger domains are required than the present 80 km."* • Sanchez Gomez M. et al 'Can mesoscale models capture the effect from cluster wakes offshore?': *"Long wakes from offshore wind turbine clusters can extend tens of kilometers downstream, affecting the wind resource of a large area"* • Stoelinga M. et al 'Estimating Long-Range External Wake Losses in Energy Yield and Operational Performance Assessments Using the WRF Wind Farm Parameterization': *"The simulations produced dramatic hub-height project-scale wake swaths that extended over 50 km downwind, with a specific example showing a waked wind speed deficit of 7% extending 100 km downwind from the array of turbines that produced it."* **Observations from existing turbines SCADA data** Another way to evidence the impact of wake effects at distances of greater than 30km is to use observations of the power produced by existing wind turbines both before and after a neighbour wind farm has been installed. These "natural experiments" occur with increasing frequency as the number of offshore wind farms that are installed globally increases. As the owner of the world's largest offshore wind portfolio, Ørsted A/S (the parent company of the Ørsted IPs) is uniquely placed to use its own operational data to observe the wake impacts of neighbouring wind farms. In a presentation13 delivered at the Wind Europe Technology Workshop 2023, Ørsted's Nicolai Nygaard shared some of this evidence. The presentation is referenced in the Fraser-Nash Consulting Study referred to by the Applicant. The paper uses operational data from 37 offshore wind farm pairs located in Northern Europe to demonstrate the neighbouring wake effect through the reduction of power generated by front row turbines. The paper demonstrates that when a wind farm is in the wake of a neighbour at a distance of 30 km you can expect a power reduction of just under 10%, whereas at 50km the reduction is still about 5% of the available power. It should be noted that the paper provides these impacts for a wind speed of 8m/s. The power also shows how the wake impact varies depending on the wind speed, the stability of the atmosphere at the time of the observation and also the size, distance, shape and density of the neighbour wind farm. As the Mona development is anticipated to be 1.5 GW, and is in the predominant wind direction of many of the Ørsted IPs' developments, the Ørsted IPs expect the wake impact to be material on the wind available to the Ørsted IPs developments.	
REP3-103.4	Barrow Offshore Wind Limited	Q1.19.3 Based on the internal modelling referred to in para 1.18 of [REP1-072], do the Ørsted IPs have concerns about all of the operational projects that they	As mentioned above, the wake impact between neighbours depends on the distance between the wind farms, the size and number of turbines, and the frequency with which the wind	As the Applicant set out in ISH4 (summarised in S_D4_04) it does not consider that an assessment of the likely significant effects on wake loss effects to be necessary in this case. NPS EN-3, para

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	Burbo Extension Limited Walney Extension Limited Morecambe Wind Limited Walney (UK) Offshore Windfarms Limited Ørsted Burbo (UK) Limited (collectively "the Ørsted IPs") Scottish Power Renewables (WODS) Ltd	represent, or do they contend that the effects would be more pronounced for particular operational projects?	direction will place one wind farm down stream of another. As all of these considerations vary for the Ørsted IPs assets in the Irish Sea it can be expected that the operational projects will see varying impacts as a result of the Mona development. the Ørsted IPs' internal modelling shows that each asset will be impacted.	2.8.198, states an assessment should be undertaken for all stages of the lifespan of the wind farm in accordance with the appropriate policy and guidance for offshore wind farm areas. The Applicant notes that there is no appropriate policy or guidance for offshore wind farm areas on which to undertake a wake loss effects assessment. An assessment of this nature is not something that has previously been undertaken for any consent application or assessment to date, and there is no guidance in existence which would allow a transparent and informed assessment to be undertaken of a new wind farm on the yield of existing operational wind farms. As the Applicant also set out, modelling of wake loss effects is dependent on accurate information of the wind farm that is being proposed as well as the existing operational wind farm (for instance their current yield, downtime, curtailment, internal wakes etc.), information which is confidential and not available in the public domain. In order to model the real-world situation in the Irish Sea, as the Ørsted IPs contend is possible and should be undertaken, that detailed, and commercially sensitive information, would be needed not only for the Applicant's proposed development and the Ørsted IPs developments, but also for other projects in the Irish Sea that are owned and operated by other parties and none of whom are suggesting that such an assessment should be undertaken.. The Applicant reiterates that there is no current accepted industry standard model or methodology, and no recognised guidance that would allow a robust analysis to be undertaken. Whilst undertaking such an assessment would therefore be complex, it is not the Applicant's position that it is not undertaking an assessment due to that complexity. The Applicant maintains that in relation to NPS EN3 para 2.8.197, it is not sufficiently close to the Ørsted IP projects to necessitate undertaking an assessment and, even it was sufficiently close, it does not have the potential to affect activities for which a licence has been issued.
REP3-103.5	The Ørsted IPs The Applicant	Q1.19.4 **Potential wake effects – DCO Requirement** In the event that no wake assessment was undertaken during the Examination, the Ørsted IPs refer to Requirement 25 of The Awel y Mor Offshore Wind Farm Order 2023 which is focussed on the interaction with Rhyl Flats Wind Farm in light of its geographical proximity. The ExA is clear that any such Requirement would need to meet the relevant legal and policy tests and would introduce an additional pre-construction approval responsibility upon the Secretary of State. As such it should only be considered as a last resort and if supported by substantive evidence. To the Ørsted IPs: • On what basis do you consider that such a Requirement would be justified in this case? To the Applicant: Noting your position [REP2-078] that such a Requirement would be unnecessary, do you wish to make any further submissions on this matter?	The NPS EN-3 requires that, where a potential offshore wind farm is proposed close to existing operational offshore infrastructure or has the potential to affect activities for which a licence has been issued by government, the applicant should undertake an assessment of the potential effects of the proposed development on such existing or permitted infrastructure or activities. The Applicant has, in the Ørsted IPs' view, erroneously scoped out wake loss effects on the Ørsted IPs' developments from assessment. It is not appropriate to 'scope out' wake loss, as it is a direct effect on another sea user not simply an effect to be considered through the EIA process. Independent literature (see references in response to Q1.19.3) as well as internal modelling undertaken by the Ørsted IPs indicate that the Project will have an impact on energy yield at their developments. This is a matter which must be properly assessed by the Applicant. As noted above, it is required to be assessed under the NPS EN3 as an effect on other sea users. Additionally, it is relevant to any evaluation of the environmental benefits and disbenefits of the Project. Finally, it is a matter of good design. There may be alternative layouts/design solutions which result in a less significant effect on the energy yield at the Ørsted IPs' developments, which should be considered. Finally, we note that the necessary data and modelling tools are available to allow the Applicant to undertake this assessment. Therefore, there are no practical reasons that would prevent the Applicant from fulfilling a condition that requires such an assessment. In summary, we consider that, in order to comply with the relevant legislative and policy requirements outlined above, the Applicant must undertake an assessment of the impacts of the Project on energy yield at the Ørsted IPs developments. At the current stage of the development of the Project, the Applicant is best placed to understand the realistic scenarios for the Project, which can then be tested against the known positions of the existing assets.	
REP3-103.6	The Ørsted IPs	Q1.15.7 Coordination with the Ørsted IPs Further to your submissions that additional engagement beyond the MNEF is required going forward [REP2-	As noted below, and in the Ørsted IPs' written representation (REP1-072), the Ørsted IPs seek engagement in relation to impacts (positive or negative) on their developments from future	Within the Applicant's response to REP1-072.7 (REP2-104), it was noted that the Navigational Risk Assessment (NRA) was comprehensive and included significant engagement with

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		104], what do seek in terms of commitment from the Applicant on stakeholder engagement and coordination to address your concerns in respect of vessel traffic at construction and operational stages?	case agreements and ask that any consultation feedback from vessel operators is shared directly, including highlighting any changes in risk to their developments. Additionally, in order to be able to properly assess and understand the risks at their developments, the Ørsted IPs seek that the Applicant share details of their emergency response plans and consider it would be appropriate to be engaged with and provided copies of in respect to Marine Pollution Contingency Plan and ERCoP. The Ørsted IPs also consider that a post-consent Navigational Safety Plan should be developed, detailing routeing to/from the site for Project vessels.	operators. Therefore, the anticipated impacts on passages of vessel operators, and any resulting navigational risks, are well described within the Application and available to the Ørsted IPs (Volume 6, Annex 7.1: Navigational Risk Assessment (APP-098)). Ongoing engagement with vessel operators relating to residual concerns do not relate to navigational safety and therefore would not result in any changes in risk to the Ørsted IPs' developments. The Applicant would welcome ongoing operational dialogue with Ørsted IPs post-consent, particularly as relates to emergency or pollution response. This includes any interface necessary between Mona Offshore Wind Project's ERCoP and Marine Pollution Contingency Plans (MPCP) with the Ørsted IPs own ERCoP and MPCP and the Applicant anticipates this being facilitated through the MNEF. Once approved by the licencing authority in consultation with the MCA and Trinity House, the Applicant would distribute copies of the ERCoP and MPCP to the Ørsted IPs. The deemed Marine Licence (dML) within the draft DCO (C1 F05) secures the development and approval by the licencing authority in consultation with the MCA and Trinity House of a Vessel Traffic Management Plan (in accordance with the Outline Vessel Traffic Management Plan updated at Deadline 3 (REP3-018)) to ensure navigational safety and minimise impact on other marine users during the construction and operations and maintenance phases of the Mona Offshore Wind Project. The Vessel Traffic Management Plan is analogous to a Navigational Safety Plan and will contain the same information. As per the outline document updated at Deadline 3 (REP3-018), the Vessel Traffic Management Plan will include: • Overview of the Mona Offshore Wind Project • Details and locations of construction/operations and maintenance ports • Roles and responsibilities for managing or coordinating vessels • Numbers, types and specifications of vessels • Passage plans and transit routes • Anchoring areas • Environmental or operational limits • How and what information will be promulgated to stakeholders.
REP3-103.7	The Ørsted IPs	Q1.15.7 Do you wish to comment on the Applicant's response to your Written Representation [REP2-078], ref REP1-072.7-8?	The Ørsted IPs respond to the Applicant's response to their written representation on shipping and navigation matters below. The Ørsted IPs recognise that the Project is over 10nm from their developments. However, the Ørsted IPs wish to comment on the cumulative effects of the Project from a shipping and navigation perspective. It is noted that the Navigational Risk Assessment (APP-098) included a Cumulative Navigation Risk Assessment. The Project cumulatively influences the routeing in the wider Irish Sea area and traffic movements around the Ørsted IPs existing developments. The effects of the Project must be considered both individually and in-combination with other existing and proposed developments. As such, acceptance that the Project alone provides acceptable levels of risk for shipping and navigation does not demonstrate acceptance that the cumulative risks presented as part of the application are acceptable.	Within the Applicant's response to REP1-072.7 (REP2-104), it was noted that the NRA included a comprehensive cumulative risk assessment which included an assessment of the risks of allision to, and collision with, assets of the Ørsted IPs. With the exception of a passage between two adjacent Tier 1/Tier 2 cumulative projects, consensus was reached with stakeholders at the hazard workshops held on the 28-29 September 2023 at which Ørsted was present that such risks were As Low As Reasonably Practicable (as detailed in Appendix B of Appendix E of Volume 6, Annex 7.1: Navigational Risk Assessment (APP-098)), and these conclusions are agreed through Statements of Common Ground with the MCA, Trinity House and UK Chamber of Shipping as updated at Deadline 3 (REP3-026, REP3-027 and REP3-028). As noted in the Applicant's comment on the Ørsted IPs response to Q1.15.7, the anticipated impacts on the routes of vessel operators in the Irish Sea are described within Volume 6, Annex

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			The Ørsted IPs therefore take this opportunity to note that whilst they do not have comments on the Project-alone assessment for shipping and navigation effects, they do maintain their concerns in relation to cumulative vessel increases in the area including those associated with the Project. The Ørsted IPs maintain there is a need for some form of coordination between projects in the wider Irish Sea area including existing operational projects. Notwithstanding the existence of the Marine Navigation Engagement Forum, the Ørsted IPs maintain that: • specific engagement is required in relation to impacts (positive or negative) on their developments as a result of future case agreements; and • consultation feedback from operators should be shared directly with the Ørsted IPs, in particular highlighting any changes in risk to their developments.	7.1: Navigational Risk Assessment (APP-098) and any ongoing engagement with operators is not anticipated to have a material impact upon the Ørsted IPs. Therefore, the Applicant believes that ongoing engagement post-consent through the MNEF remains the most effective means to coordinate on shipping and navigation matters.