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A decarbonisation working group by ZeroNorth

Vessel Reporting and Data Quality

White Paper

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A call to action for new standard for vessel reporting to improve data quality and decarbonisation efforts

Executive Summary

Shipping is facing a data challenge. The industry's optimisation goals – which go hand-in-hand with its decarbonisation objectives - are dependent on reliable and trustworthy output from digital platforms, which is hindered without high-quality, standardised, and interoperable data input.

The way in which shipping companies currently gather data from ships via noon reports, however, lacks the standardization and sophistication levels that are required to match the data needs of the industry to optimise its voyage, vessel, and bunker operations, as well as minimise its carbon emissions. In this situation, noon reports need to transform in line with how the rest of the industry's data landscape has matured. This includes improving their data quality standards, aligning with real world use cases, and overall evolving to a more standardised format as holistic "vessel reports".

As the industry becomes more data-centric and the need for useful and complete data to enable optimisations intensifies, this white paper explores the need for an industry standard for vessel reporting which will benefit the commercial performance of vessels, inform decision-making in line with sustainability goals, and generate better outcomes for the entire marine value chain.

The industry coalition behind this white paper, Impact Today, is a decarbonisation working group founded in March of 2021 by ZeroNorth which includes members from EuroNav, FedNav, Cargill, Q88, Maersk Tankers, Ultrabulk, Teekay Tankers and Siglar Carbon and a few others.

Introduction

Data quality is inherent to voyage and vessel optimisations. To ensure good outputs from digital platforms, it is critical that, to the extent it is currently possible, data input is high-quality, standardised, and interoperable.

Shipping faces a challenge in this area because of how it currently gathers data from ships. Although the use of real-time sensors and data flow meters is becoming increasingly common, there is no standard way of gathering data from vessels. The most commonly used method today is still noon reports submitted by crews.

Noon reports provide a vital snapshot of vessel performance and condition. On most vessels, it is generally the chief engineer that prepares the noon report each day. It is then sent by the master to shore management at a fixed time on a daily basis – historically noon.

The report provides the vessel's position and other relevant data that can be used to assess performance, including speed and weather condition. But noon reports can also include a huge range of other relevant data points, including average speed since the last noon report, propeller slip, engine RPM, sea condition, distance and estimates for fuel, oil and water remaining on board. This then

provides the basis for calculations on fuel and lubricant consumption, speed, distance, and the vessel's efficiency.

For the majority of vessels, noon reports provide a vital and regular indicator of vessel condition and performance. But because these reports are produced manually, often in accordance with individual company, charter party or ship management guidelines, the diversity of their input and how information is recorded can vary widely.

This poses a challenge for anyone looking to optimise voyages, vessels, fuel, bunker and emissions. Without a standardised input, extra time needs to be spent cleansing and aligning data, potentially lowering the impact and accuracy of recommendations given. However, improvement of quality data can be better obtained with the right data gathered for the right purpose thus reducing the heavy burden on and making it easier and more time efficient for owners, operators, and crew.

Optimisation is happening today and is bringing good results – but they can be even better. Transparency is allowing us to see the untapped potential and identify which data points are missing for which types of optimisations. The maturity of the current data landscape opens new opportunities to capture improved earnings and CO2 emission reductions.

Impact Today, during its meetings in 2021 when developing its first output - a standard for measuring fuel consumption accuracy - member organisations agreed on the importance of data quality, and that more action was needed to improve the quality of data from vessels. At the time, the working group decided to focus on developing its first industry standard and reserved the topic of data quality for its next focus.

The group met in December 2021 to begin the discussions with a number of interesting outcomes, but the main finding was that improvement of noon reports was not just about data quality, it was also about the noon reports themselves needing to be matured in line with the way that data is being utilised today. Key data which is currently missing in noon reports – including bunker and emissions data - needs to be captured to align these reports with real world use cases.

The realisation was that noon reports need an overhaul to boost data quality and support operational optimisations, as well as become less time consuming and complex to use for crews, in an effort to reach the industry's decarbonisation goals.

Evolving noon reports for a maturing marine data landscape

It was recognized during the December 2021 discussions that there is a need for quality data input from vessels and the particular use cases of improved noon reports that would strengthen the industry's decarbonisation journey.

With the current focus on decarbonisation within the sector, the working group agreed that noon reports as they are used today need to transform in line with how the rest of the industry's data landscape has matured. As optimisation has come into the forefront of a necessary action to reduce immediate CO2 emissions, it was agreed that the industry needed to address data the needs for the various use cases.

Noon reports data had historically been helpful for a vessels performance optimisation, but for voyage optimisation the industry has had to make do with the current data being shared. As our industry moves further towards bunker and carbon emissions optimisation, noon reports are just lacking the necessary data. The current burden to vessels to deliver multiple noon reports to multiple stakeholders can also

be alleviated with data fit for purpose. Our goal is therefore to simplify noon reports for use cases and remove the redundant work for masters and crews.

It was agreed amongst the group of ship owners, data specialists, and optimisation organisations in the working group that the concept of noon reports needed to evolve to a more standardised format and to be redefined as holistic “vessel reports”.

By agreeing on an industry standard for how the vessel reports are created and completed, this will enable the entire value chain to have a better view of actual vessel performance in an age before real-time sensors are widespread, improving transparency and accountability. Crucially, as we have explored, it will also enable stronger recommendations from optimisation across voyage, vessel, bunkers, and CO2 emissions, ensuring that actions are being taken based on the reality of how a vessel is behaving at sea.

At the same time, the working group agreed that while standardising output was one half of the battle, the industry should also work to develop a standard to measure the quality of data inputs into vessel reports. These vessel reports would be standardised for critical data points needed for the different use cases, such as vessel, voyage, bunker, and carbon emissions optimisations, thus removing unnecessary data collection and improving quality of the data through new validation technologies. In effect, at the same time as completing these ‘vessel reports’, the sector could also measure how well it was gathering and sharing the types of data that it needs.

This white paper explores an industry standard for vessel reporting, which will generate better outcomes for the entire marine value chain, as well as enable us to take more decisive action on the environmental and commercial performance of vessels no matter their size or operating pattern.

Why do noon reports need to transform?

Like many areas of shipping today, it is new regulation and customer pressure that is driving a requirement for noon reports to transform. With mounting pressure on the industry to genuinely act on its environmental performance – and also to operate in a more holistically optimised way – it is vital that the sector uses every tool available to act for both profit and planet.

Optimisation is a critical part of this. There could be around 10% of latent performance improvements ready to be unlocked today through more optimal voyages, vessels and bunker utilisation. This is imperative for immediate reductions in CO2 emissions and a potential for improved earnings. This becomes even more critical once we factor in the transition to green fuels, which will see fuel bills multiply many times over in a decade.

Given this context, and as the industry becomes more data-centric in general, there is a requirement for good, useful and complete data to enable these optimisations to take place. In short, the industry has matured, and data needs to as well.

While there is currently a drive on newer vessels to implement advanced sensors that will gather and share data in real-time, we cannot wait for this to become normal practice and even data collected by these technologies will need to be validated. Moreover, it is currently unclear whether this method of data input will ever become a standard across the global fleet, rather than a preserve of some of the most advanced vessels. This, combined with the fact that it can be difficult to keep sensors fully functioning and calibrated over time, makes it harder to rely on sensor data.

It is therefore clear that noon reports will continue to be the 'master' data input for the majority of the global fleet for years to come. Noon reports also have an intrinsic role in negotiating time charters, settling bunkers and calibrating fuel models. We must, therefore, invest time and effort in improving them today.

Building a standard for vessel reporting

In accepting the need to evolve noon reports to vessel reports, it is critical that we create a comprehensive vessel reporting standard that is fit for purpose, genuinely increases data quality, and unlocks better optimisation outcomes thereby reducing carbon emissions and enabling shipping's decarbonisation journey. This call for action is to create a standard around these objectives:

- **Fit for purpose**
  A new data standard must cover all types of vessel reporting, including noon, bunker, port, cargo and more. It must consider all the types of data that a vessel in normal operation can report and make it clear and easy to do so. It must be broken down for critical data for each use case and flexible for owners or operators to choose the different data needs and avoid replication of input.

- **Increase data quality through validations**
  A new standard must also be accompanied by a way to check data at the point of entry, ensuring that it is correct in terms of content and format. This must persist across all data entered into vessel reports, to ensure this is a truly shared standard that upholds data quality.

- **Unlock better optimisation outcomes**
  We must not forget the reason for doing this today: more accurate data input means more robust recommendation outputs. Fuel models will get more accurate, parties across the supply chain will be able to increase trust and align incentives, and we will be able to unlock immediate actions that enable the industry to decarbonise. And the desired outcome of the right data to improvement optimisation of vessels performance, voyages, bunker, and CO2 emissions.

- **Standardise and create a definition of terms**
  Building on reporting requirements for upcoming regulations, the standard should meet existing reporting requirements, especially IMO DSC and EU MRV and also CII, EEXI and learnings from Sea Cargo Charter and Poseidon Principles. Solving challenges today due to the differences in the definitions between these reporting regimes and across the noon reports. This call to action should look at what defines a voyage leg, what defines the start and end of a voyage leg, what distances are to be reported, how time at anchorage is considered, drifting, and more. We believe that the proposed standard must ensure that the required data points for these reporting regimes are all collected, and preferably also adds clarity to the users (owners) and reducing their current work load which mean across the industry there is an agreement in what field is called and what data should be there and then across the industry those standards are implemented.

By aligning the way these reports are constructed around end goals like voyage, vessel performance, bunker, and carbon emissions optimisation, we will be able to ensure better data input. Now, this report will explore the types of data needed for complete vessel reports – and how this standard will set out to maximise accurate inputs.

Laying foundations: data for voyage, vessel performance, bunker, and CO2 emissions optimisation

Vessel reporting data can be used in a multitude of ways. This white paper has set out to explore some of these uses, focusing on how data can underpin the optimisation decisions that the sector needs to make for profit and planet.

The below table comprises the types of data, and their formats, that we believe are critical to achieving the objectives laid out above. Much of this is data is already being gathered by masters and crews, but some critical data points are still missing. The below provides a clear indication of what data is needed for the different use cases and which data can be used to unlock better optimisation outcomes.

Data which is needed to be gathered on a daily basis (from noon reports):

Data field	**Where gathered**	**Importance**	**Additional comments and what can it be used for**
Reporting period (start/date)	From crew	High	All calculations that needs to be derived from a time period.
Type of the report	From crew	High	To distinguish sea and port conditions. This is needed for voyage and vessel performance purposes.
Voyage details	From crew	High	Departure port and arrival ports of a specific voyage leg. If in port, then the port that the vessel is in. This is needed for operational and CO2 emissions purposes.
Draught aft/fore	From crew or sensors	High	Voyage optimisation, vessel performance and operational purposes
Loading condition	From crew	Medium	Voyage optimisation and vessel performance
Ballast water	From crew	Medium	Amount of ballast water. For vessel performance and voyage optimisation.
Position	From crew or GPS	High	Cross-referencing data points from the report with other sources
Distance over ground	From GPS	High	For speed over ground calculations which is used for voyage optimisation, vessel performance and carbon emissions reporting.
Distance through water	From speed log	High	For speed through water calculations which is used for voyage optimisation, vessel performance and carbon emissions reporting.
Weather details	From crew or sensors	Medium to High	Data points include: Course over ground, air temperature, ambient pressure, (true) wind speed, (true) wind direction, (true) wave height, (true) wave direction, swell height/direction/period, sea water salinity, average water depth, water temperature, water density.

			All the above is used for operation purposes, carbon emissions reporting, vessel performance and voyage optimisation.
Engine and power: Main Engine(s)	From chief engineer	High	Running hours, RPM, average power, average loading percentage wrt. MCR and propeller pitch (if variable pitch). Average power needs to come from at least one source, preferably two - either from the main engine indicator and from a torsion meter. If from torsion meter, then it should be indicated where the torsion meter is placed.
Engine and power: Auxiliary Engines	From chief engineer	High	Running hours, electrical energy produced and average loading percentage wrt. MCR.
Engine and power: Boilers	From chief engineer	Medium	Type of boiler. Running hours of each boiler. If electrical boiler, the amount of electrical energy consumed. For boiler performance purposes; Steam pressure, feed water temperature and delta pressure across boiler. If exhaust boiler, then the temperature of the exhaust is given at the inlet and outlet.
Engine and power: Other consumers	From chief engineer	Medium	Type of consumer (mechanical, fuel, hydraulics, electrical etc.) Running hours and if electrical consumer or producer, then the electrical energy consumed/produced. This can be used for engine performance purposes and carbon emissions reporting.
Consumption: Bunker grades	From chief engineer and bunker delivery notes	High	Per grade, the lower calorific value, the sulphur content and the density at a fixed temperature for the fuel.
Consumption: Direct fuel consumers	From chief engineer and/or flow meters	High	Consumption per grade for direct fuel consumers like: main engines, auxiliary engines, boilers, fuel consuming power packs, fuel consuming inert gas systems and other fuel consuming equipment.
Consumption: Cylinder oil	From chief engineer	Low	Base number, density at a fixed temperature, average temperature and consumption of oil in kilograms. For operational purposes and cylinder oil optimisation.
Consumption: Lube oil	From chief engineer	Low	Lube oil consumption in kilograms. For operational purposes

Remaining on board	From chief engineer	High	Per bunker grade, the total remaining on board in metric tonnes.

Data which is needed to be gathered on a less frequent basis (event driven):

Data field	Where gathered	Importance	Additional comments and what can it be used for
Bunkering data (Fuel Oil)	From crew	High	Bunker delivery note details (bunker type, amount, LCV, sulphur content, viscosity, density etc.) Timestamp of bunker delivery and port/position of delivery. For operational purposes and carbon emissions reporting.
Bunkering data (Lube oil, cylinder oil)	From crew	Low	Timestamp of delivery and port/position. Amount of lube/cylinder oil. For operational purposes.
Tank soundings (Fuel Oil)	From crew	High	Bunker amounts for each tank or in total per grade while in port condition. For operational purposes, bunker optimisation, and carbon emissions reporting.
Cargo loading and discharging data	From crew	Medium	Amount of cargo loaded or discharged with timestamps. With corresponding data fields that apply to the ship type.
Propeller polishing, hull cleaning and dry dock	From crew	High	Timestamps and additional details of the operation. Used for vessel performance, voyage optimisation, carbon emissions reporting and operational purposes.
Engine test report (Main engine and Auxiliary Engine)	From chief engineer	Medium	Timestamps of the test. Test details for each engine. Used for vessel performance.

A proposed model: a new standard for vessel reports

Data validation and maintaining accuracy

We have already explored why it is critical to ensure validation of data quality at the input phase, before it is used to underpin optimisation decisions. Over time, this will improve data quality, as crews get iterative guidance on the best ways to input data.

The framework builds on both standardising data, ensuring collection of all the data that is needed, and ensuring that the entered data is validated - preferably at input source. The validation process builds

on first and second layer validations; the first layer being validations directly on the input fields (like min / max limits of the fields), whilst the second layer validation is used for cross referencing values across the report with each other.

Examples of the first layer validations include ensuring that the reporting power measurements are within the limits of the specific engines MCR. Furthermore, it should also be ensured that all running hours correspond to normal usage and the reporting period. Other examples include validating the draught against the scantling draught of the vessel.

Examples of second layer validations include validating the absolute fuel consumption per consumer against the expected SFOC of the engine(s). Other validations would include ensuring that the vessel would have had at least one aux engine running during the period. Furthermore, it could include cross-referencing and ensuring that the amount of electrical energy produced is not less than the amount of electrical energy consumed. Another validation type would be to cross reference data across reports; an example here would be to cross reference the previous reports position, with the current report and ensuring that the distance travelled corresponds to the expected distance between the two reported positions.

Another example is to validate the reported weather measurements against each other, or to validate the significant wave height against the beaufort number. Another example of a second layer validation is the verification that the reported cargo and ballast water weight aligns with the reported draught.

As currently designed by the working group, the new standard has over hundreds of data validations to help improve data quality. This provides a high-level of granularity and the ability to 'course correct' if data is consistently low quality when gathered in certain ways, at certain times or for certain functions. The number of validations also depends on the amount of data fields that the vessel is able to report.

The new standard will also make it easier for aggregators utilizing data from multiple customers to provide analysis, and it will set the industry up for a future when data sharing will be open across the industry to increase positive joint environmental impact.

Conclusion and next steps

In summary, this report has presented a vision for how the industry can evolve noon reporting into holistic ***vessel reports*** - which have data fit for purpose, increase data quality through validations, and unlock better optimisation outcomes - and the reason for why there is tremendous benefit to do so. The urgency of the green transition requires all of us to act, and by improving structural frameworks and current ways of working, we will be able to make a positive and tangible impact on maritime decarbonisation.

Indeed, we cannot afford not to find new ways to optimise operations. Setting aside the regulatory and consumer pressure for the industry to clean up its act, on a pure cost basis alone, the coming years will be challenging given the need to transition to clean fuels.

As the industry becomes more used to optimising its operations, it is vital that we take the right steps now to create a strong foundation for those optimisations to take place. A new standard for ***vessel reporting***, once adopted at scale, will generate better data inputs for all players in the marine value chain.

To foster adoption, the working group will now collaborate with interested owners, operators and managers to implement the standard within their current processes. This will be accompanied by a

period of familiarising crews with how to input and validate data. From there, results on the trial will be shared publicly to encourage further uptake, as we will be able to more clearly calculate the upsides associated with consistent, accurate and interoperable data.

We must start driving impact today, and there are few better places to unlock immediate action than by improving how vessel reports are created, shared, and used.