Offshore Wind Industry Standards
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MAPPING OF OFFSHORE WIND INDUSTRY STANDARDS
PROJECT NO. 2016 - 080

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By Valdemar Ehlers - Technical Director

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EXECUTIVE SUMMARY

This project has been undertaken based on a demand for further investigations into the field of offshore wind industry standards, their application, scope of use and overall purpose. While considering the wide range of different standards used it becomes apparent that standards obviously serve one purpose, however, in doing so they cause challenges for the companies and people in the industry at design stage as well as during operations. The people involved being designers, consultants, builders, ship crews or operators face a range of complimentary standards during normal work. Even duplication of requirements and in some situations also conflicting demands and goals are encountered.

The project is shaped around a questionnaire with instructions sent to an international range of stakeholders. The feedback received has been assessed and analyzed, and we have attempted to ensure that the information presented is an accurate representation of standards applied in the offshore wind industry. As the industry still develops at a rapid pace, the standards mentioned may not be exhaustive although the information shared in this document is believed to be correct but not guaranteed, and users should consult with relevant organizations and bodies as applicable to retrieve further details.

Other reports have shown that there is a special need to harmonize or at least simplify the standards for ships in the offshore wind industry. While Administrations are working on common international regulations there appear to remain a broad range of standards in this industry, and these standards may constitute obstacles and limit market access if not harmonized while also increasing cost.

Cost and efficiencies for this industry have been addressed by others, e.g. the EU launched in November 2013 the FP7-OCEAN-2013 Logistic Efficiencies and Naval Architecture for Wind Installations with novel developments. Although this study is not yet completed, improvements to all the different steps of an offshore wind farm supply chain allow room for improvements.
Innovations will typically be assessed against market, environmental and socio-economic impacts. An overarching observation is that in particular the North Sea offshore wind actors are moving forward with regard to standards for construction, safety and other criteria. There are barriers that industry and government must work on collectively in order to ensure a level playing field and good market access.

A majority of the parties to the UNFCCC Convention have agreed to adhere to the long-term goal of maintaining the global average temperature increase within 2 degrees C. No doubt offshore wind as a sustainable energy source can contribute to this goal.

Consequently, and as a goal for this project this report includes recommendations on possible ways forward.

Shipbuilders and suppliers recommend the use of reliable international standards for the purpose of providing a level playing field. Different regional or national standards should by all means be avoided.

Shipowners’ associations have supported the political initiatives taken to unify requirements for ships as this will facilitate smoother operations. A level playing field will enable fair market access and benefit the well-prepared operators in the future development of offshore wind farms in the North Sea.

Designers recommend a strengthened focus on technology because that is the way a safer and more sustainable operation can be developed. Any contradictions in the regulations and standards should be avoided and the current practices and standards reviewed for the purpose of reducing unnecessary cost. This will benefit the business case for new investments and thereby contribute to an increased level of safety and emission reductions. No doubt offshore wind can contribute to the environmental performance. Research and engineering can give the necessary understanding to design and develop a modern risk based regulatory platform. It is time for the industry to act towards further collaboration and harmonization.

An overarching conclusion reveals that the general business case can be further improved through streamlining and harmonization of the framework of industry standards. Meanwhile the offshore wind industry is boldly moving ahead with regard to installation of new capacity.
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1. INTRODUCTION

Danish Maritime has been supported by The Danish Maritime Fund to prepare a mapping of the different industry standards typically applied to maritime operations in the North Sea offshore wind sectors. The demand for renewable energy in various forms keeps growing. The offshore wind sector has attracted investors and the sector has changed substantially over the last two decades. Design and arrangements of Wind Farm Support Vessels (WFSW) have changed to meet the demands of the sector i.e. generally larger vessels with improved sea keeping capabilities and greater deadweight. The installed power of the farms has gone up and down-time is unacceptable and not an option. The increase in size for farms, turbines and their support structure have called for specialized vessels to install, service and maintain the wind farm installations. Consequently, maintenance management has become very important and the operational profile of the vessels has changed. Logistics in connection with operations and maintenance are extremely important, and the most suitable and cost-effective transportation and an access strategy for the wind farm has to be determined.

The choice of access strategy is site specific depending on distance from shore, number of turbines, sea state and wind climate. All is balanced against the best possible return on investment. High accessibility will increase the number of hours available for industrial personnel to undertake work.

A balance exists between accessibility and vessel costs.
Operations have to be safe and cost effective while occupational health matters are of ever increasing importance. Working patterns have changed because of growth in wind farm sizes. Numerous visits offshore under different weather conditions are made, and vessels have to be fast but at the same time able to accommodate industrial personnel from other installations while stand by waiting to pick-up others.

Obviously, wind farms are situated in areas selected because of their strong prevailing winds. Together with a preference for generally more remote locations, a different and higher set of demands in terms of safety, powering, maneuvering, seakeeping, comfort, fire protection and other aspects related to the vessel design arrangements and operational envelope is placed.

While passenger ship requirements are applied to a number of designs, the nature of the operations are very different from traditional passenger vessels. This makes it necessary to assess risks and to base compliance on fulfilment of functional requirements rather than prescriptive requirements.

To evaluate the application of standards is essential, and for this purpose stakeholders were approached using a questionnaire with instructions and during interviews. This report discusses key issues and concerns raised by stakeholders and reflects on possible changes to improve a level playing field.

1.1 Purpose
The purpose of this report is to review the standards most frequently applied by the offshore wind industry. Vessel owners, ships, their masters and crews have to apply these standards when undertaking work in the various installation areas and EEZ’s in the North Sea. The standards constitute an important element and cornerstone of the offshore wind industry and have over the years developed substantially and continue to evolve. Based on a detailed mapping of the current industry standards the purpose is to investigate possibilities of market access for the maritime industry. Consequences of the current conditions will be described and suggestions for improvements made.

1.1.1 Goal 1.
To map and evaluate the consequence of the different offshore wind standards in relation to market access and competitiveness.

1.1.2 Goal 2.
In dialogue with relevant industry stakeholders to evaluate and propose improvements to the industry guidelines and standards.

1.1.3 Goal 3.
To prepare a report which describes proposals for the envisaged changes.

1.2 Background
In December 2015, the Danish Maritime Authority tasked DNV-GL to undertake a review of the national and international regulations applicable to the crafts and vessels serving the offshore wind industry. The report showed a rather comprehensive and complex picture of the requirements for this relatively new industry. New ship types and craft have been developed to service this industry, e.g. as a consequence of the growing size of turbines sophisticated installation vessels have been developed capable of undertaking heavy moves with high accuracy in a challenging and sometimes rough environment.

Danish Maritime represents the maritime industry including shipbuilders, designers, equipment manufacturers and suppliers. These important stakeholders face from time to time challenges which are cumbersome not only because of the technical nature and engineering challenges of the
task. Standards developed over time and in different countries make access to some markets and parts of the business demanding and costly. Our members wish to have unified requirements in order to ensure a level playing field and open access to markets.

1.3 **Scope**

The scope of this project is restricted to current standards in use in Germany, the United Kingdom, the Netherlands and Denmark. The analysis is based on replies to questionnaires sent to industry stakeholders.

The standards have for analytical purposes been categorized as follows.

1.3.1 **Vessel / craft design and construction**

For the purpose of this report the maritime standards included are those addressing:

- Design and arrangements
- Structure and equipment
- Propulsion
- Electrical systems including automation and control systems
- Subdivision and stability
- Structural fire protection
- Life-saving appliances
- Fire safety
- Navigation and communication equipment
- Occupational health matters

1.3.2 **Vessel operations**

For the purpose of this report the maritime standards included are those addressing:

- Standard operational procedures related to offshore wind construction and maintenance activities
- Navigational safety and environmental protection related to offshore wind farms
- Marine communication, coordination and emergency preparedness related to offshore wind farms

The operations are typically identified as:

a) Transit to/from wind farm
b) Docking / undocking at the wind turbine
c) 24-hour operation / overnight accommodation
d) Transfer of personnel and equipment to / from the wind turbine or larger vessels floatels / SPS certified ship or other Installation and Construction Vessels
e) Heavy Lift Installation and Construction Vessels, their design, construction and engineering operations

1.3.3 **Personnel competency and training**

For the purpose of this report the maritime standards included are those addressing:

Competency and training requirements for those who are involved in operations of the above vessels.
## 2. OFFSHORE WIND STANDARDS - MAPPING

### 2.1 Vessel / craft design and construction

<table>
<thead>
<tr>
<th>Organisation Owner of Standard:</th>
<th>Title/Application / Scope:</th>
<th>Area of application:</th>
<th>Specific requirements:</th>
</tr>
</thead>
<tbody>
<tr>
<td>ISO</td>
<td>ISO 29409</td>
<td>Special offshore structures and support vessels</td>
<td>CTV &amp; Bumper via boat landing</td>
</tr>
<tr>
<td></td>
<td>ISO 29406</td>
<td>Offshore wind energy - Personnel transfer systems</td>
<td>Vessel &amp; gangway via boat landing</td>
</tr>
<tr>
<td></td>
<td>ISO 19902</td>
<td>Fixed steel offshore structures - Substations</td>
<td>Vessel &amp; her deck crane</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Vessel &amp; WTG external crane</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Helicopter &amp; harness via hoisting zone</td>
</tr>
<tr>
<td>G+</td>
<td>Good practice guideline working at height in the offshore wind industry</td>
<td>Designers’ obligations</td>
<td>Undertake HAZID Access equipment requirements</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Decision criteria for hatches/gates</td>
</tr>
<tr>
<td>Bundesamt für See-schifffahrt und Hydrographie (BSH)</td>
<td>Konstruktive Ausführung von Offshore Windenergieanlagen</td>
<td>German EEZ</td>
<td>Site conditions</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Support structure</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Rotor assembly</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Classification into danger, protection and safety zones</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Hull-retaining support structure for offshore wind turbines and offshore stations</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Individual Technical Approval</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Application notes etc.</td>
</tr>
<tr>
<td>DNV-GL</td>
<td>Report of HAZID and risk reducing measures workshop</td>
<td>DMA Safety analysis for high-speed offshore vessels carrying up to 60 persons</td>
<td>Identification of structural measures to mitigate the envisaged hazards. Proposed risk-reducing measures for all high or medium risk hazards.</td>
</tr>
<tr>
<td>IMCA</td>
<td>Guidelines for vessels and units with DP systems (MSC.1/Circ.1580)</td>
<td>International standard for DP systems e.i.f. 09.06.2017</td>
<td>Equipment classes, functional requirements, operational requirements, surveys, testing &amp; DP verification acceptance document</td>
</tr>
<tr>
<td>IMCA</td>
<td>Terms and conditions for ROV support services</td>
<td>ROV work</td>
<td>Scoping, IP rights, inspection, warranty, indemnities etc.</td>
</tr>
<tr>
<td>IMCA</td>
<td>Example specification for a DP FMEA for a new DP vessel</td>
<td>Summary of objectives for the FMEA</td>
<td>Depth of the FMEA, FMEA team, deliverables, additional requirements</td>
</tr>
<tr>
<td>IMCA</td>
<td>Marine inspections for small workboats</td>
<td>Vessels GT&lt;500 or L&lt;24m</td>
<td>Water tight integrity, machinery, electrical, stability, freeboard, escape, fire, comms., navigation equipment etc.</td>
</tr>
<tr>
<td>IMCA</td>
<td>Guidance on satellite based positioning systems for offshore applications</td>
<td>Selection of a satellite positioning system</td>
<td>Pre-installation &amp; installation phases, operating GNSS, installation checklist</td>
</tr>
</tbody>
</table>
### 2.2 Vessel operations

<table>
<thead>
<tr>
<th>Organisation Owner of Standard:</th>
<th>Title/Application / Scope:</th>
<th>Area of application:</th>
<th>Specific requirements:</th>
</tr>
</thead>
<tbody>
<tr>
<td>IMCA</td>
<td>Logbooks and competence records</td>
<td>Offshore mariners, workboat crew, crane operators, DP, offshore engineers</td>
<td>Record keeping</td>
</tr>
<tr>
<td>IMCA</td>
<td>Safety promotion material</td>
<td>Working at height, preventing slips, toolbox talks, manual handling, permit to work, watch your hands, lifting operations, lifting equipment, confined spaces</td>
<td>See safety pocket cards, posters</td>
</tr>
<tr>
<td>IMCA</td>
<td>SEL 001</td>
<td>Guidelines for change management</td>
<td>What changes may occur, responsibilities, process &amp; request form, register, evaluation scenarios</td>
</tr>
<tr>
<td>IMCA</td>
<td>SEL 003</td>
<td>Guidance for the initial and refresher familiarization of vessel crews</td>
<td>Types of familiarization, induction for joining a vessel, induction checklist, further reading</td>
</tr>
<tr>
<td>IMCA</td>
<td>S&amp;L 004</td>
<td>Environmental management standards – ISM</td>
<td>See standards &amp; code</td>
</tr>
<tr>
<td>IMCA</td>
<td>SEL 007</td>
<td>Basic safety training and vessel induction for non-marine personnel working offshore</td>
<td>IMO requirements, IMCA guidance, geographical requirements, personnel categories, security awareness, basic safety training, drills and exercises, vessel induction</td>
</tr>
<tr>
<td>IMCA</td>
<td>SEL 021</td>
<td>Risk assessment</td>
<td>Process controlling hazards</td>
</tr>
<tr>
<td>IMCA</td>
<td>SEL 025</td>
<td>Guidance on the transfer of personnel to and from offshore vessels and structures</td>
<td>Glossary of terms, types of personnel transfer, further information</td>
</tr>
<tr>
<td>IMCA</td>
<td>SEL 026 – 041</td>
<td>Misc. guidances</td>
<td>Gangway, mooring, lifting, high-voltage, shipyard safety, occupational health, work in confined spaces, safety committee rep., fire, emergency response, drug &amp; alcohol</td>
</tr>
</tbody>
</table>
## 2.3 Personnel competence and training

<table>
<thead>
<tr>
<th>Organisation Owner of Standard</th>
<th>Title/Application / Scope</th>
<th>Area of application:</th>
<th>Specific requirements:</th>
</tr>
</thead>
<tbody>
<tr>
<td>G+</td>
<td>Good practice guideline, the safe management of small service vessels used in the offshore wind industry Good practice guideline working at height in the offshore wind industry</td>
<td>Offshore wind industry</td>
<td>Site management, marine coordination</td>
</tr>
<tr>
<td>HSC</td>
<td>Statutory – not addressed</td>
<td>Site management, marine coordination</td>
<td></td>
</tr>
<tr>
<td>DNV-GL</td>
<td>Report of HAZID and risk-reducing measures workshop</td>
<td>DMA Safety analysis for high-speed offshore vessels carrying up to 60 persons</td>
<td>Identification of operational measures to mitigate the envisaged hazards. Proposed risk-reducing measures for all high or medium risk hazards.</td>
</tr>
<tr>
<td>IMCA</td>
<td>M202 Guidance on transfer of personnel to and from offshore vessels and structures. C016 Guidance on verifier training</td>
<td>Competence assurance</td>
<td>Formal verifier and assessor standards and qualifications</td>
</tr>
<tr>
<td>IMCA</td>
<td>C004 Guidance on competence assurance and assessment</td>
<td>Offshore survey division and marine survey division</td>
<td>Competence assurance, competence assessment, assessors and verifiers</td>
</tr>
<tr>
<td>IMCA</td>
<td>C015 Competence assurance</td>
<td>Operational practices</td>
<td>Job specific proficiency criteria, ongoing competence assurance, ensure safe and effective operations</td>
</tr>
<tr>
<td>IMCA</td>
<td>C017 Guidance on competence assurance and assessment</td>
<td>Marine roles for small workboats</td>
<td>Competence tables – small workboats, assurance and assessment</td>
</tr>
<tr>
<td>------------</td>
<td>-----------------------------------------------------</td>
<td>----------------------------------</td>
<td>----------------------------------------------------------------</td>
</tr>
<tr>
<td>IMCA</td>
<td>C010 High voltage training</td>
<td>A syllabus for training offshore workers involved with high voltage equipment</td>
<td>Training syllabus incl. graphical representation</td>
</tr>
<tr>
<td>IJUBOA</td>
<td>Occupational Standards</td>
<td>Official industry standards of competence and knowledge</td>
<td>Barge master qualifications covering preparation of jack-up for offshore operations, transit, position and refloat, maintenance of stability and effectiveness of jack-up barge at operational site.</td>
</tr>
</tbody>
</table>
### 3. INDUSTRY QUESTIONNAIRES FEEDBACK

**Questionnaire feedback:**

<table>
<thead>
<tr>
<th>Company/organisation</th>
<th>Regulations applied by industry</th>
<th>Cost elements or implications</th>
<th>Recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td>DONG Energy</td>
<td>Applicable conventions, codes, class rules</td>
<td>Significant efforts spent on inspection &amp; verification. Cost associated with administration of a complex regulatory regime</td>
<td>Standard vessel requirements in tenders. Industry to agree common standards and priority is given to this task</td>
</tr>
<tr>
<td>Netherlands Maritime Technology</td>
<td>Different statutory requirements</td>
<td>Differences from one flag to another</td>
<td>Need for alignment of regulations in the North Sea or even internationally. International regulation is the goal.</td>
</tr>
<tr>
<td>Verein Schiffs und Meerestechnik (VSM)</td>
<td>Relevant IMO &amp; ISO instruments class rules. Industry standards are beyond the scope of VSM</td>
<td>Inconsistency, incompatible. Additional cost for design, certification</td>
<td>Ships carrying valid certificates questioned about equivalency to national standards.</td>
</tr>
<tr>
<td>UK</td>
<td>Health &amp; Safety Executive, subordinate regulations e.g. EU directives</td>
<td>Duty-holder to implement risk reduction measures. Enforcement actions are proportionate to the HSE risks</td>
<td>Promote broad ownership across industry and engage further with G+, Renewable UK, IMCA, Global Wind organisation.</td>
</tr>
<tr>
<td>OSK-ShipTech</td>
<td>All applicable regulations &amp; standards</td>
<td>CTV rules not harmonized. Additional requirements e.g. related to fire insulation, fire pumps, sub-division and other areas meet varying requirements</td>
<td>Current regulations &amp; rules have very different origin. A common set of rules will be advantageous although difficult because definitions, standards, etc. already exist and new definitions may thus add to the already prevailing confusion of various rule sets</td>
</tr>
<tr>
<td>A2SEA</td>
<td>All statutory int. &amp; nat. National rules for construction sites e.g. UK CMD, BS etc. DNVGL IMCA IUUBOA OCIMF NI OPITO GWO G+</td>
<td>Third party certification with e.g. marine rules, Nobel Denton. Many &amp; different interests e.g. GWO versus STCW; Danish vs. UK rules for lifts; different perception of competencies. Local content can bring safety down, as know-how not always up to required standards</td>
<td>Collaboration with national &amp; int. industry, formal networks, government workgroups. Wish to collaborate more towards common standards with the IMO, DMA and other Danish authorities</td>
</tr>
</tbody>
</table>
Industry quotes in relation to the question: “Do the requirements cause a challenge for you in terms of:


Re 1: Answers: Differences between national regulations cause administrative challenges and confusion, leading to lower levels of safety due to different mindset on e.g. safety and management.

Ex.1: Ships certified by certain flag states may not be allowed to work in other coastal states.

Ex.2: DNV-GL standard for offshore lifting operations is only applied in the oil & gas sector. No unified standard for offshore lifting operations in wind farms.

Ex.3: As a consequence of the rules for CTV, which are currently not harmonized and to some extent not developed for the purpose, compliance with rules of more than one flag state / class is a challenge; the rule sets are often contradictory and focus on widely different areas. E.g. DMA Notice F for craft below 15m and addendum for vessels 15m < L< 24m versus UK MCA Marine Guidance Note 280 + Code Books.

Bureau Veritas NR 490 “Crew Boats” (obsolete, but still used for lack of better for small craft) vs DNV Rules for Crew Boats.

Nordisk Båtstandard for Yrkesbåtar 1990, originally developed by the maritime authorities of the Scandinavian countries but no longer accepted by the DMA. In the smallest range of craft for crew transfer these rules are still used by Norwegian suppliers of commercial craft competing with boats built to other flag states.

Re 2: Answers: Difference in regulation is the cause for us to spend significant efforts in verification / inspection + harmonization / development of industry standards.

Ex.1: In case several rule sets are to be complied with, the result is the combination of the most severe requirements of all of the rules, and the result will be heavy and impractical.

<table>
<thead>
<tr>
<th>World Marine Offshore</th>
<th>BG Verkehr non-conv. Ships G+ DNVGL BV</th>
<th>Substantial cost associated with operations of CTV to passenger ship requirements</th>
<th>Industrial Personnel requirements to be agreed. STCW to obtain recognition by GWO and OPITO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seahealth</td>
<td>Collaboration in: IMCA renewable G+ Cross-Wind Network</td>
<td>Duplication – see recommendations</td>
<td>Health &amp; Safety should not be an area in which companies compete. Alignment of requirements important. Energy majors appear to do everything their own way to attract investors, and HSE becomes a “battlefield”. Supply chain to be involved.</td>
</tr>
</tbody>
</table>
Ex.2: Engine room openings: a) DMA Notice F requires closing appliances according to the Load Line Convention. b) BV NR 490 requires 2300mm sill height but do not permit watertight closing appliances. c) DVV-GL HSLC Chapter 5, Small service craft (<24m) or Chapter 4, Crew Boats, requirement depends on service restriction but do not mention watertight closing appliances & d) MCA MGN 280 very pragmatically states: “Sufficient to prevent the admission of water when the vessel is heeled”.

Re 3: Answers: Some specific regulations, which in theory are to raise the safety level, cause confusion and actually a lower level of safety in practice.

Ex.1. Cargo vessels must carry immersion suits for all POB, passenger vessels only for crew. But a>12Pax CTV is not providing equivalent means of rescue equipment as for large passenger ships.

Ex. 2: UK Work Boat Code is being stretched beyond its scope of application as windfarms move further offshore / into other countries thus affecting crew training, fire-fighting capacity, power supply, structure etc.

Ex.3: No equivalence is yet established between marine crew training (STCW) and offshore personnel (GWO). Neither GWO nor OPITO recognize STCW.

Ex.4: In some cases, even double systems may be required to satisfy all involved parties. In all cases, excess weight is undesirable since the craft are expected to be high speed.

Ex.5: Fire insulation: The rule sets listed above have widely different approaches to structural fire insulation. As the use of a class notation is always on condition of acceptance by the flag state, the requirements of class will have to be combined with requirements of the flag state. Differences are typically experienced around engine compartments. a) DMA Notice F V-7: “vessels normally carrying up to 12 passengers shall be built of steel”. V-7.1 states that relaxations may be given, but no definite conditions which cause uncertainty for the designers / builders. b) DMA Notice F requires engine room sides and deck to be insulated to A-30 standard to 300mm below the water line vs BV NR 490 requiring engine room to be separated from other compartments to A-60 standard.

c) MCA MGN 280 requires B-15 engine room insulation for vessels in category 0 (largest) or above 750 kW or carrying >16 persons. This requirement is equal to the requirement of DMA Notice F for craft below 15m length!

d) UK MCA MGN specifies fire test procedures for materials which do not refer to IMO test procedures, which makes it almost impossible to find insulation acceptable to UK-flag and other flag simultaneously.

e) In the mentioned rule sets, requirements for fire pumps and emergency sources of power differ greatly. Some accept hand operated fire pumps, while others have a different interpretation of what is sufficient for fire-fighting.

f) Most rule sets require steel or equivalent piping material for bilge pipes. Unfortunately, nothing but steel is considered equivalent to steel!

A common set of rules is a way forward. For historic reasons the existing set of rules and standards have very different origins.

- Those based on SOLAS / HSC code have a high starting point when considering craft below 24m, as many of the requirements are the same as for ocean going vessels.
- DMA Notice F is based on fishing vessels not suitable for high speed craft, too heavy and lacking relevant areas.
4. **INDUSTRIAL PERSONNEL**

At the 97th session of the Maritime Safety Committee the IMO adopted Resolution MSC.418(97) containing the ‘Interim recommendations on the safe carriage of more than 12 Industrial Personnel on board vessels engaged on international voyages.’

These interim recommendations are applicable to ships' safe carriage of more than 12 Industrial Personnel (IP). IP means all persons who are transported or accommodated on board for the purpose of undertaking offshore industrial activities (construction or maintenance) on board other vessels and/or other offshore facilities and meet the criteria specified in the Resolution.

Industrial Personnel, meeting the minimum requirements as set out in the Resolution, need not be treated or considered as passengers under SOLAS reg. I/2(e).

Industrial Personnel may be carried on board ships meeting the provisions of the 2008 Special Purpose Ships Code or other standards, provided they meet an equivalent level of safety acceptable to the flag administration, taking into consideration the number of persons on board.

As most flag administrations have not implemented the Resolution into their national legislation, the flag administration's agreement on the safety criteria to be used will be required in the case of a project involving the carriage of more than 12 Industrial Personnel. Additionally, the way such a vessel will be certified has to be agreed.

It is assumed that flag administrations will apply this Resolution when the aggregate number of passengers and Industrial Personnel on board is more than 12. This should be confirmed with the relevant flag administration.
The interim solution will not guarantee a consistent approach and safety standard by different flag administrations, but it does provide a solution to the uncertainty around whether or not Industrial Personnel are to be considered passengers under SOLAS Chapter I.

The IMO is working to develop a mandatory instrument to set a consistent safety standard for vessels involved in the transport and accommodation of Industrial Personnel. The aim for this mandatory instrument is for it to be approved and adopted by 2020, entering into force from 2024. Consequently, there will be numerous existing ships operating in international trade when the code is adopted in 2020, and there may be even more existing ships pre-certified when the code comes into force in 2024 – eight years after the adoption of MSC. 418(97). Some countries have already developed standards that provide an equivalent level of safety, and e.g. Denmark is in the process of finalizing an interim standard for high speed offshore vessels carrying up to 60 persons.

There is a general support for a new SOLAS Chapter XV which addresses the new code. The code is mandatory for new ships. Some countries wish to make it mandatory for existing ships too. The latter is, however, subject to discussions since the requirements for existing ships have to be negotiated and agreed upon when the code is drafted.

This work is progressing and is being addressed by the IMO MSC SDC Correspondence Group.
5. CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions:
The difficulty in compiling an entire new set of rules for this purpose is that definitions, standards and other requirements easily go across definitions in existing rules, and thereby add to the already prevailing confusion of various sets of IMO regulations and industry standards. This is a general concern and since this is raised by stakeholders across the industry, the following recommendations for improvements are suggested.

Uncertainty has a price and cost related to designers’ need for clarification of definitions, assumptions, boundary conditions in relation to a framework of regulations, which in many cases is subject to interpretations and case by case approvals by authorities, makes the design process cumbersome and costly.

5.2 Recommendations:

5.2.1 From a Builder / supplier perspective:
It becomes apparent from a number of stakeholders that practical challenges arise from the fact that some of the international and national regulations are partly inconsistent or incompatible. This leads to conflicting goals which are challenging to manage.

Additional design work and extra compliance efforts are typically faced, e.g. the structural design of jacket structures of sub/stations according to ISO 19902 and Eurocode 3 respectively, that are required by the German BSH Construction Standard, are completely different.

Such situations lead to additional costs for design, double certification and sub/optimal designs, which are suffering from competitive disadvantages.
From the point of view of creating a level playing field it is noted that within a country’s EEZ all operators / ship managers of wind farm vessels are subject to the same requirements and are in general facing the same challenges. The enforcement, however, should be improved. Campaigns by the authorities have revealed that some of the vessels servicing the wind farms are not fully compliant. Due to the complexity in terms of interpretations, applied industry standards, equivalency considerations and other matters, the overall standard was not in all situations found satisfactory. These situations have raised concerns, and some operators have launched own initiatives to address them.

From Builders market perspective it is noted that e.g. German and Danish shipyards, that are committed to advanced shipbuilding and full compliance to all applicable standards, are currently less competitive due to a downward trend in prices and to some extent in standards.

Market access is therefore limited. During 2016 very few yards have been active in the production of offshore windfarm structures, and no shipyard in these two countries are as of start 2017 producing offshore service crafts or construction vessels.

Offshore windfarm projects in the German and Danish EEZ’s are costly for several reasons. With regard to compliance with standards significantly higher costs are associated with design and certification.

For all above mentioned reasons Danish Maritime promotes and recommends the use of reliable international standards for the purpose of providing a level playing field. Deviating regional or national standards should be avoided.

Obviously specialized ships and structures include new designs and arrangements with peculiarities. Such new vessels and their systems should be consistently regulated by dedicated and specific international regulations and standards from the IMO and ISO.

The north-western European shipbuilding industry does not for the time being consider the construction of offshore service craft, windfarm construction vessels or windfarm structures as priority products.

Further international work in IMO and ISO is important. Collaboration among the North Sea countries is very important for the development of joint regulatory initiatives. A consistent application of the new IMO “Interim recommendations on the safe carriage of more than 12 Industrial Personnel on board vessels engaged on international voyages” will contribute to a level playing field, and its practical application in the different EEZ will be interesting to follow.

Access to the offshore wind market is important. Decline of prices and inhomogeneous application of design and safety standards makes it less attractive for Builders to enter the market.

Northern European governments are generally committed to continue promoting the exploitation of offshore renewable energy. Recent developments in IMO as to the development of Interim recommendations on the safe carriage of Industrial Personnel – adopted at MSC 97 - followed by the work initiated towards development of a future IMO Industrial Personnel Code revive optimism in terms of improvements to the regulatory regime.

The EU FP7-OCEAN-2013 Logistic Efficiencies and Naval Architecture for Wind Installations (Leanwind) with novel developments has over a four-year project period addressed the following process steps: a) improved designs of gravity based foundations and steel substructures; b) further development of novel vessel concepts; c) Health & Safety risk control measures and d) testing of installation activities for a Gravity Based Structure, a turbine lifting system and a remote presence robot for O&M activities. All these project innovations are assessed of market, environmental and socio-economic impacts. The four-year Leanwind project will be concluded in November 2017.

The North Sea is important as a region with regional collaboration between countries with natural interests in the area. Health & Safety and other standards should not be an area in which companies compete, and it should be possible to align such standards. From outside it seems that
Energy Majors wish to do everything their own way to attract investors, and HSE has become an area they want to display as “the best in class”. Consequently, HSE becomes a “battlefield” and it affects the maritime contractors who will have to adapt procedures in order to get the job even though it does not necessarily lead to safer workplaces for seafarers and industrial personnel. Rather than a “battlefield” the North Sea should be a showcase for good collaboration to the benefit of industry and the people working in that industry. A good step towards the better has been the making and development of G+. A lot of expertise exists in this forum and we support the G+ Steering Committee initiative on working for higher involvement of the supply chain.

5.2.2 From an Operator perspective:

Serious operators have as a remedial action put significant effort into company standards / industry standards / harmonization for use in their own contracts for a range of vessel types. Furthermore, internal inspection teams conduct thorough surveys and assessments of all vessels before commencement of operations. Major operators have to some extent aligned their customer requirements through coordination work in the forum G+. Differences in national regulations and standards cause administrative challenges and confusion, sometimes leading to lower levels of safety due to different mind-sets e.g. on safety management. Consequently, operators have formulated standard vessel requirements for use in tender material and during vessel inspections. It is a vision that the offshore wind industry agrees on common standards for marine safety. The industry is in a good dialogue about common standards on offshore safety and there is a common understanding of this driving safety up and cost down at the same time.

Operators have indicated a wish for EMSA to take a more active role in promoting offshore renewable energy production in the EU.

Shipowners’ associations have supported the political initiatives taken to unify requirements for ships as this will facilitate smoother operations. A level playing field will enable fair market access and benefit the well-prepared operators in the future development of offshore wind farms in the North Sea.

5.2.3 From a Designer perspective:

Craft and vessel designs are typically approved by a Classification Society chosen by the vessel owners and the Flag Administration. For specialized vessels, e.g. built to the SPS Code, such designs are by some flags examined and approved on a case by case basis. This makes the design approval process long, and the approved design is not necessarily approved by other flags. Consequently, and since the rules for CTV are not harmonized and to some extent not developed for the purpose, the designers face challenges. Simultaneous compliance with rules of more than one flag state / class may not be possible. Rules and standards are sometimes even contradictory and focus on widely different areas.

In case several rule sets are to be complied with, the result becomes the most severe requirements among all the rules, and the result will be heavy, impractical and not cost effective. In some cases even double systems may be required to satisfy all involved parties. In particular high-speed craft but also other vessels suffer from excess weight as energy consumption goes up.

In looking to the future it is likely that the wind industry in the countries around the North Sea will endeavor to maintain their strong knowledge and experience platform. The knowledge gained may be useful in other markets. Standards help to a large extent to ensure that safety and other criteria are met. However, safety is also a matter for administrations of the International Governmental
Organizations IMO and ISO. Thus, we are likely to see a continued combination of IMO regulations, codes, guidelines and recommendations together with ISO standards and the industry stakeholder standards.

It is likely to be a significant challenge to navigate within this framework. It is difficult to single out a clear path. Statutory requirements together with industry standards form the regulatory infrastructure. A majority of parties to the UNFCCC Convention have ratified the Paris Agreement. The long-term goal on keeping the global temperature rise below 2 degrees has been generally accepted, and continued investments in offshore wind can be expected. The installed capacity has grown year by year, and further growth in particular outside Europe is expected.

The focus on energy asks for radical changes and new solutions e.g. extended use of lightweight materials such as Fibre Reinforced Plastics (FRP) or other composites.

No doubt FRP is a combustible material, however, while considering the many advantages such as low weight and reduced maintenance cost, it would be petty to reject the use of FRP. As of today, hardly any SOLAS convention vessels have been built in FRP, and the main reason for that is SOLAS Chapter II-2 Regulation 17 which was intended to be an opening but in reality not commercially viable due to the time and efforts involved in demonstrating a satisfactory alternative way towards compliance. If the route towards compliance remains complex and costly relative to traditional designs, building of commercial vessels in FRP or operation of same under Danish flag may not happen.

The maritime industry in Denmark has taken a constructive and scientific approach in their efforts to drive technological developments towards safer and more environmentally friendly ship designs and operations. Based on experience from operations, thorough analysis of incidents and other valuable information the industry takes a lead in the preparation of recommendations for the authorities on improved fire safety and environmental performance. These recommendations consider all relevant systems on a vessel and not only FRP structures.

At Danish Maritime we strongly believe that the suppliers to the marine industry, designers, shipbuilders and owners will benefit from these guidelines, and we recommend authorities in countries covered by this survey and beyond as applicable to make use of these guidelines.

Conflicting requirements and standards continue to be developed which is caused by a non-level playing field and creates barriers to some markets. Safety and environmental requirements differ, providing different conditions for the operators and their crews.

It would be desirable to have safety and operational standards for all types of vessels, depending on size, passenger and Industrial Personnel count, crew and cargo, regardless of building material. Also, it is desirable to have more clear technical standards for fire safety of FRP-vessels for different types of service / passenger count.

Focus on technology is important because that is the way a safer and more sustainable operation can be developed. Any contradictions in the regulations and standards should be avoided and the current practices and standards reviewed for the purpose of reducing unnecessary cost. This will benefit the business case for new investments and thereby contribute to CO2 reductions. No doubt offshore wind can contribute to the environmental performance. Research and engineering can give the necessary understanding to design and develop a modern risk-based regulatory platform. It is time for the industry to act.
6. REFERENCES

3. IMO Code for the construction, equipment and operation of Offshore Service Craft
4. BG Verkehr Standard Circular for Small Special Service Craft
5. UK Work Boat Code
6. DNV-GL Rules for Crew Boats
7. Bureau Veritas Rules for Offshore Service Vessels and Tugs
8. G+ Good practice guideline working at height in the offshore wind industry
9. IMCA: The International Marine Contractors’ Association: Revised Guidance on the Transfer of Personnel to / from Offshore Vessels and Structures
11. IJUBOA – the International Jack-up Barge Operators’ Association
   UK National Occupational Standards (NOS)
   1. Prepare the Jack-up Barge for offshore Operation.
   2. Transit the (non-propelled) Jack-up Barge to and from Operational Site.
   3. Position and Refloat the Jack-up Barge.
   4. Maintain the Stability and effectiveness of the Jack-up Barge at the Operational Site.
13. IJUBOA: GND-13-01 Minimum Manning Levels for Jack-up Barges
14. OCIMF – Oil Companies International Marine Forum
15. DNV-GL Developing a Homogeneous Approach to Offshore Wind O&M
16. NI DP Scheme
17. OPITO Standards Library
18. GWO Basic Technical Training Standard & Basic Safety Training Standard
19. EU FP 7 LEANWIND Supply Chain of Offshore Wind Farms www.leanwind.eu
20. ILO Maritime Labour Convention MLC
21. OHSAS 18001 Occupational Health (plant operation)
24. EU Leanwind: Logistic Efficiencies and Naval Architecture for wind installations with novel developments
7. **LIST OF SYMBOLS AND ABBREVIATIONS**

a. **Symbols:**
- **Δ** (Delta) displacement (ton)
- **Hs** significant wave height in meter (m)

b. **Abbreviations:**
- **AC** alternating current
- **ALARP** as low as reasonably practicable
- **ALS** accidental limit state
- **BS** British standard
- **CCTV** closed circuit television
- **CMID** common marine inspection document (by IMCA)
- **CTV** crew transfer vessel
- **DNVGL** Det Norske Veritas Germanischer Lloyd
- **DP** dynamic positioning
- **EEZ** exclusive economic zone
- **EIA** environmental impact assessment
- **EWM** extreme wind speed model
- **FLS** fatigue limit state
- **FMEA** failure mode and effects analysis
- **G+** global offshore wind health and safety organisation
- **GMDSS** global maritime distress and safety system
- **GWO** global wind organization
- **HAT** highest astronomical tide
- **HAZID** hazard identification
- **IACS** international association of classification societies
- **IJUBOA** international jack-up barge operators’ association
- **IMCA** international marine contractors’ association
- **LAT** lowest astronomical tide
- **LL** live loads
- **LOLER** lifting operations and lifting equipment regulations
- **LSA** life-saving appliances
- **MCA** maritime and coastguard agency (UK)
- **MOA** maximum operational acceleration
- **MOB** man over board
- **NI** nautical institute
- **nm** nautical mile (1852 m)
- **Q&M** operation & maintenance
- **OCIMF** oil companies’ international marine forum
OIM offshore installation manager
OPITO offshore petroleum industry training organisation
OSS offshore sub-station
PFPE personal fall protective equipment
PLB personal locator beacon
PPE personal protective equipment
PTW permit to work
PUWER provision and use of work equipment regulations
RA risk assessment
RIB rigid-inflatable boat
RMS root-mean-square
SAR search and rescue
SCANDA supervisory control and data acquisition
SIMOPS simultaneous operations
SMS safety management system
TP transition piece
UPS uninterruptible power supply i.e. unit to provide electricity continuously in the event of a blackout of the power
W2W walk-to-work
WTG wind turbine generator
8. APPENDIX – QUESTIONNAIRE USED

Survey – Company/organisation conducting design, construction, operations or other activities related to Offshore Wind

<table>
<thead>
<tr>
<th>Name of Organisation</th>
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<tr>
<td>Scope of practice</td>
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<tr>
<td>Contact person &amp; Title</td>
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<td>E-mail</td>
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<td>Phone number</td>
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1. Industry standards

a) Which national and international industry standards, classification rules or other requirements are applied in your company? List title & reference.

| List: |

b) Kindly categorise (Safety, Design, Construction, Operation, Environment, Occupational Health or other) and list standards applied? List details as per category.

<p>| List: |</p>
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<td><strong>c)</strong></td>
<td>Please provide practical examples on how the above mentioned requirements are applied? Kindly – if possible - provide attachments to explain actual procedures and practices from your activities.</td>
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<tr>
<td><strong>d)</strong></td>
<td>How is compliance with the above requirements typically ensured? – elaborate with examples.</td>
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</table>
| **e)** | Do the requirements cause a challenge for you?  
1. Practical?  
2. Cost?  
3. Other?  
Kindly explain with examples. |
| **f)** | Are your competitors facing the same requirements and challenges? If yes, how do they comply?  
- If no, why? Please elaborate. |
| **g)** | Based on the above what is the consequence for your activities / business?  
E.g. in terms of market access, additional cost, competitiveness or other? Please provide examples. |
h) How much internal capital was spent on ensuring compliance in your company in 2015 and 2016?

<table>
<thead>
<tr>
<th>2015:</th>
<th>2016:</th>
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Has your organization defined objectives and a vision for compliance?

If yes, how are they defined? (Kindly split into Safety, Design, Construction, Operation, Environment, Occupational Health or other as applicable)

Objective:

Vision:

i) What areas are priorities for the future?

Priorities:

2. Collaboration

a) Are you collaborating with other organisations in any of the following ways?

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<th>Yes</th>
<th>No</th>
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<td>Formalized collaboration with national &amp; international industry and public sector</td>
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<tr>
<td>Formalized collaboration with only industry</td>
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<tr>
<td>Participation in formal networks</td>
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<tr>
<td>Participation in centres</td>
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<td>Informal collaboration</td>
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<td>Standardisation projects</td>
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<tr>
<td>Other (please specify)</td>
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b) Would you like to collaborate more towards common standards?
c) If yes, with whom and in which areas?

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<th>Organisations:</th>
<th>Areas:</th>
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d) How important is North Sea collaboration and why?

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<th>Fairly important</th>
<th>Not so important</th>
<th>Not important at all</th>
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Comments:

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e) What facilitates or prevents such collaboration?

Answer:

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3. Which specific offshore wind projects are you leading/participating in during 2016-2017?

<table>
<thead>
<tr>
<th>Title of project</th>
<th>Contact person</th>
<th>Client</th>
<th>Partners/sub-contractors</th>
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4. General about Offshore Wind

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<tr>
<th>a)</th>
<th>What factors prevent your market access in the offshore wind field?</th>
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<th>b)</th>
<th>What factors enable you to have success in the offshore wind field?</th>
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<th>Any other comments:</th>
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Thank you for your cooperation.
This project has been supported by the Maritime Industry and has received funding from The Danish Maritime Fund