Information Note

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Development and Introduction of New DP Vessel Mission Functionalities

1 Overview

The development of mission-specific Dynamic Positioning (DP) control system modes and functionalities is crucial as DP is applied to increasingly challenging marine projects. Vendors, owners, energy companies, and class societies collaborate to develop and test these functionalities. This industry-wide cooperation allows for advancements in deep-water operations, complex subsea infrastructure development, and monopile installation using DP. Overall, these innovations have enabled the offshore industry to achieve new frontiers in safe and efficient project execution.

Guidance on the various mission specific applications of DP vessels can be found in IMCA M103.

2 IMO

The IMO MSC Circ. 1580, published in 2017, acknowledges the impact of mission-related systems on the DP control system in chapter 3.1.2:

***Mission related systems**:*

3.1.2 If *external forces from mission-related systems (cable lay, pipe lay, mooring, etc.) have a direct impact on DP performance, the influence of these systems should be considered and factored into the DP system design. Where available from the DP system or equipment manufacturer, such data inputs should be provided automatically to the DP control system. Additionally, provisions should be made to provide such data inputs into the DP control system manually. These systems and the associated automatic inputs should be subject to surveys, testing and analysis specified in paragraph 5.1*.

Developers and operators must verify and validate automated sensor inputs into DP systems through FMEA and test processes to ensure stability. If there is any uncertainty about the failure response of an input, a manual input method must be available. All novel applications should assess their impact on station-keeping performance in both healthy and unhealthy states.

Development Process of New DP Modes and Functions Related to Mission Equipment

IMO 1580, chapter 3.1.1 states:

Insofar as is practicable, all components in a DP system should be designed, constructed and tested in accordance with international standards recognised by the Administration.

In addition, the last sentence of chapter 3.1.2 reads:

These systems and the associated automatic inputs should be subject to surveys, testing and analysis specified in paragraph 5.1.

In general, software development is covered under the umbrella of the ISO/IEC 27001 certification standards. In addition, DP control systems are subject to Type Approval by class societies on a case-by-case basis.

3 Offshore Renewable Energy industry

With the rise of the Offshore Renewable Energy industry, significant advancements are occurring in marine DP operations for wind farms. Initially centred on bottom-fixed wind turbines, the focus is now also on floating wind markets. These marine operations differ from the traditional offshore oil & gas industry, presenting new challenges. Specialised DP vessels are being developed for various phases of a wind farm's life cycle, alongside large, mission-specific equipment to expedite the installation of increasingly larger wind farm structures.

The dimensions and weight of wind turbines are increasing significantly, necessitating larger handling equipment and greater forces for the DP system to manage. A recent advancement in the Offshore Renewable industry is the motion-compensated Pile Gripper, capable of handling and guiding monopiles over 1000 tons. This innovation enables the use of DP for monopile handling, eliminating the need for time-consuming and costly anchor spreads. Consequently, DP usage in this area significantly enhances operational efficiency.

4 Pile Gripper Systems

Pile Gripper control systems can be interfaced with the DP control system, to provide motion compensation and maintain the monopile's upright position during seabed installation. Dedicated software modules are required to enable collaboration between control systems and allow the DP system to compensate for earth bound effects. Contact between a DP-controlled vessel and the sea floor can cause significant instability in the DP control system if not properly managed.

5 Lifting Systems

Large cranes, capable of lifting monopiles, transition pieces, nacelle units, and blades, are part of the mission equipment on Wind Turbine Installation Vessels (WTIV). The crane control system can be interfaced with the DP control system during lifting phases.

6 Gangway Systems

For access to wind turbines, various complex gangways have been developed, a type of marine operation known as Walk-to-Work (W2W), also used in the oil & gas industry. Some W2W gangways have integrated crane functions for equipment transfer. The transfer mode and control segregation from crane to gangway modes must be fully understood, along with the impact on the vessel's DP system. All gangways must undergo FMEA and verification trials to ensure fail-safe operation, this should also be integrated into the vessels main DP FMEA and the FMEA Proving Trials program.

Some gangway control systems can be interfaced with the DP control system. Initially, this interface visualises the gangway's movement and limitations on the DP control system HMI, serving as a passive data transfer. More advanced interfaces enable the gangway and DP control systems to work together, compensating for vessel movements to maintain stable gangway access to wind turbines or production platforms. In some cases, the gangway can be utilised as a position reference system for the DP Control system. When these features are implemented, understanding the fault tolerance of these systems and their impact on station-keeping integrity is crucial.

Gangways connected to platforms can use the DP status light system as a traffic light system to inform personnel of the vessel's operational DP status. On some Floatel units, an automatic lift-off is initiated when Yellow or Red DP status is activated, with a delay and audible/visual alarm before the lift-off. Automated abandonment systems need careful design to ensure safety for personnel and minimise impact on the DP system. The fault tolerance of the lift-off functionality must be verified and validated to ensure minimal risk to personnel.

Note: The sensors for interfacing control systems must meet the control system OEM's specifications and be of high quality. Redundancy of such sensors is recommended.

To summarise this Information Note, developing mission-specific Dynamic Positioning (DP) features is critical to meeting the changing demands of complicated offshore operations, notably in the renewable energy sector. Through collaborative innovation and rigorous safety validation, the industry is improving DP systems to interact with specialist equipment, resulting in safer and more efficient project execution. The continuous development and testing of these functions will help the offshore sector overcome operational issues and achieve better efficiency in both traditional and renewable energy projects.

The IMCA Marine DP committee encourages all the key players of the offshore DP industry to collaborate in the development and testing of new DP modes and functionalities related to mission equipment and related operations

For more information, please contact richard.purser@imca-int.com

7 Related Guidance

- IMCA M103 – Guidelines for the design and operation of dynamically positioned vessels
- IMCA M166 – Code of Practice on Failure Modes and Effects Analysis (FMEA)