Managing Dynamic Positioning (DP) Operations

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IOSH Offshore Conference – Tools for the trade
19 October 2017
IMCA OPERATIONAL STRUCTURE

- **BOARD**
- **CEO**
  - **OPERATIONS COMMITTEE**
    - **CORE COMMITTEES**
      - HSSE (Health, Safety, Security & Environment)
      - Contracts & Insurance
      - Competence & Training
      - Lifting & Rigging
      - Marine Policy & Regulatory Affairs
    - **DIVISION COMMITTEES**
      - Diving
      - Marine
      - Offshore Survey
      - Remote Systems & ROV
    - **REGIONAL COMMITTEES**
      - Asia-Pacific
      - Europe & Africa
      - Middle East & India
      - North America
      - South America
    - **TECHNOLOGY COMMITTEES**
      - To be established: but now IMCA has the structure in place if it needs to add these in future
IMCA MARINE DP COMMITTEE

MEMBERSHIP

- Maximum 12 members
- At least 50% contractor companies
- At least 1 DP consultant company
- At least 1 equipment supplier
- At least 1 DP training establishment

- Copy recipients
  - Interested individuals
  - Receive committee updates
  - Currently 18 companies represented
IMCA MARINE DP COMMITTEE

FUNCTION & OBJECTIVES

• Review & revise existing DP guidance
• Produce new DP guidance if required

• Represent IMCA at DP related forums
• Contribute to IMCA DP workshops

• Advise on the IMCA DP reporting scheme
• Promote DP station keeping reporting

• Provide industry with DP related lessons learnt
ACHIEVEMENTS

More than 20 DP related documents reviewed and revised during 2016

Document revision programme established

- A new interactive DP event reporting form introduced
- Timely production of the annual DP event review
- DP station keeping event annual summary spreadsheet
- Quarterly DP event Bulletin introduced

<table>
<thead>
<tr>
<th>IMCA DP Incident Code</th>
<th>Initiating Event</th>
<th>Main Cause</th>
<th>Secondary Cause</th>
<th>Comments</th>
<th>Could this happen on your vessel?</th>
<th>What if any additional safety points need to be taken</th>
<th>Is this covered in the vessel’s IMCA</th>
<th>Recommendations to improve vessel, DP procedures, IMCA and DP drills</th>
</tr>
</thead>
<tbody>
<tr>
<td>1601</td>
<td>Change of vessel centre of rotation from centre of the vessel to the OAS location on the port stern</td>
<td>Computer – DP software malfunction</td>
<td></td>
<td>Prior to future operations the vessel was set up on DP on three separate occasions with the centre of rotation as the OAS and on each occasion the DP system reacted as expected and safely successfully</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1602</td>
<td>After a period of five hours with the wind sensor selected a wind sensor was re-enabled to the DP</td>
<td>Computer – Buffer was full due to excessive wind difference alarms</td>
<td></td>
<td>Concern was expressed regarding the mathematical model and how it can be affected when no wind sensor information is reached; especially after an extended period of time. Following this event, the master’s standing orders were updated to include the following statement, “When wind sensors have been disabled for a period of time the vessel must be in a safe area when they are re-enabled to the DP order”</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1603</td>
<td>Failure of diesel generator</td>
<td>Power – Diesel Generator No. 3 stopped due to a faulty valve</td>
<td></td>
<td>With only one generator feeding each side of the bus bar when the generator tripped it caused a loss of power to that side of the bus bar. This caused the DP system to become unavailable for DP and the vessel maintained position with the two remaining thrusters. The mechanical recovery system functioned as designed and the four thrusters that tripped were restarted. The vessel maintained position within one meter throughout.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1604</td>
<td>Failure of mode selector</td>
<td>Computer – Failure of mode selector ROU A &amp; B</td>
<td>Manual input – failure to understand and act on the</td>
<td>A DP alarm indicating a fault with mode selector ROU A was generated that day before this event. This alarm instigated</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Successful DP station keeping workshop held in Amsterdam June 2016
AGENDA

• IMCA and the Marine DP Committee
• Maintaining position
• Elements of the DP system
• Regulatory requirements
• Operational activity planning
• Defining the operational mode
• Activity Specific Operational Guidance (ASOG)
• Available guidance
MANAGING DP OPERATIONS
MAINTAINING POSITION

- Manual thruster control
- Joystick control
- Automatic DP
- 4 Point Moor
- DP Mooring assist
- Self-elevating vessels
Consists of three sub-systems

- Power system
- Thruster/propulsion system
- DP control system
  - Heading sensor
  - Wind sensor
  - Motion sensor
  - Position reference systems
- Some say four!
  - The DP Operator
    - Key DP Personnel
IMO MSC Circular 1580 Guidelines for Vessels and Units with Dynamic Positioning (DP) Systems

- Section 4 Operations
  - Use decision support tools
  - DP System functioning correctly
    - Location checklists
  - Set up for the appropriate mode of operation
    - Activity Specific Operational Guidelines
Guidance on Operational Activity Planning (IMCA M220)

Operational activity planning addresses the following:

1. defines the appropriate configuration for the location and vessel activity
2. defines limits for equipment and operational parameters for the location and activity
3. defines actions to be taken by key vessel personnel
4. presents operational guidance in an easy to understand decision support tool
Requires a thorough knowledge of:

- the DP system
- the DP FMEA
- the industrial mission
- vessel location
- risk assessments
Critical Activity Mode (CAM)

- Vessel meets maximum level of redundancy
- No single failure will exceed the identified worst case failure
  - Defines the most robust configuration
  - Identifies equipment required
  - Methods of operation

<table>
<thead>
<tr>
<th>Condition</th>
<th>Green</th>
<th>Advisory</th>
</tr>
</thead>
<tbody>
<tr>
<td>Notify Master, chief engineer and all other</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>senior project critical personnel</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
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<tr>
<th>Condition</th>
<th>Continue normal operations</th>
<th>Informative/consultative status (risk assess)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Switchboard configuration</td>
<td>All bus ties open</td>
<td>Any other configuration</td>
</tr>
<tr>
<td>Bow thrusters 1, 2 and 3</td>
<td>Thrusters tested to 100% in</td>
<td>Thrusters not capable of 100% command or</td>
</tr>
<tr>
<td></td>
<td>both directions on manual</td>
<td>problems present</td>
</tr>
<tr>
<td></td>
<td>and DP at field arrival</td>
<td></td>
</tr>
<tr>
<td>Engine room manning</td>
<td>Manned</td>
<td>Not manned</td>
</tr>
</tbody>
</table>

Should be used for all critical activities
Generally, a vessel only has one CAM
Task Appropriate Mode (TAM)

- Risk based dependant on vessel operation
- A single failure could result in worst case failure

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<tr>
<td>Notify Master, chief engineer and all other senior project critical personnel</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>If environmental conditions exceed agreed limits</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Proximity of other surface vessels</td>
</tr>
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<tr>
<td>Switchboard configuration</td>
<td>Bus ties closed</td>
<td>Environmental conditions exceed agreed limits</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Close proximity of other surface vessels</td>
</tr>
<tr>
<td>Bow thrusters 1, 2 and 3</td>
<td>Thrusters tested to 100% in both directions on manual and DP at field arrival only two of three thrusters required</td>
<td>Thrusters not capable of 100% command or problems present</td>
</tr>
<tr>
<td>Engine room manning</td>
<td>Engineer contactable but not necessarily in engine room</td>
<td>Engineer unavailable</td>
</tr>
</tbody>
</table>

Operation is not so critical and redundancy is not essential

A vessel may have several task appropriate modes
MANAGING DP OPERATIONS
WHEN MIGHT YOU WORK IN TAM?

Where the time to terminate operations is short rather than long:

- DP MODU on standby or not connected to the seabed
- DP PSV delivering targets to a platform prior to operations beginning

Working in open water:

- DP construction vessel on the leeside and more than 500 m from a surface or mission critical subsea asset
- A diesel electric subsea support vessel may operate with closed main switchboard bus tie breakers, as opposed to open bus tie breakers when performing open water subsea activities and the consequences of loss of position and or heading are acceptable.
MANAGING DP OPERATIONS
ACTIVITY SPECIFIC OPERATIONAL GUIDANCE

- Green
  - Normal operations
- Blue
  - Advisory status

- Yellow
  - Degraded status
- Red
  - Emergency status

<table>
<thead>
<tr>
<th>Activity Specific Operating Guidelines – Outline</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Green</strong></td>
</tr>
<tr>
<td>Normal operations – all systems fully functional and operating within acceptable performance limits.</td>
</tr>
<tr>
<td><strong>Blue</strong></td>
</tr>
<tr>
<td>Advisory status – approaching performance limits or reportable alarm status. Operations may continue whilst risks are being assessed. A failure has occurred that does not affect DP redundancy.</td>
</tr>
<tr>
<td><strong>Yellow</strong></td>
</tr>
<tr>
<td>Reduced status – pre-defined performance limits reached, component or system failure resulting in loss of redundancy. The vessel maintains position although the vessel has lost its redundancy.</td>
</tr>
<tr>
<td><strong>Red</strong></td>
</tr>
<tr>
<td>Emergency status – pre-defined operational or performance limits exceeded, component or system failure resulting in loss of control or position.</td>
</tr>
</tbody>
</table>
### Activity Specific Operating Guidelines for the DP Vessel xxxx on Project xxxx

*This setup only applies when the vessel is carrying out DP operations on the xxxx project.*

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<thead>
<tr>
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<th>Yellow</th>
<th>Red</th>
</tr>
</thead>
<tbody>
<tr>
<td>Action</td>
<td>Continue normal operations</td>
<td>Informative consultative status</td>
<td>Prepare to suspend operations and initiate contingency plan (be ready to move off)</td>
<td>Abandon operations DP reliant operation to stop</td>
</tr>
<tr>
<td>Current and predicted weather conditions</td>
<td>Within operating limits</td>
<td>Approaching operating limits</td>
<td>Exceeding operating limits</td>
<td></td>
</tr>
<tr>
<td>Heading loss</td>
<td>No heading alarms or warning</td>
<td>If heading warning limit reached (&gt;3°)</td>
<td>If heading alarm limit reached (&gt;5°)</td>
<td></td>
</tr>
<tr>
<td>Shaft generator loading</td>
<td>SG1 and SG2 &lt;45%</td>
<td>Any SG approaching 50%</td>
<td>Either &gt;50% or failure of a generator</td>
<td></td>
</tr>
<tr>
<td>Collision</td>
<td>No collision imminent/minimum approach &gt;500 m</td>
<td>Minimum approach will be &lt;500 m</td>
<td>Potential for collision</td>
<td>Collision imminent</td>
</tr>
</tbody>
</table>
Valuable in field guidance

- Guidance on operational activity planning (IMCA M220)
- A guide to DP-related documentation for DP vessels (IMCA M109)
- Guidance on the transfer of personnel to and from offshore vessels and structures (IMCA M202)
- Guidance on simultaneous operations (SIMOPS) (IMCA M203)
- Guidance on operational communications (IMCA M205)

Core IMCA DP guidance documents

- Guidelines for the design and operation of dynamically positioned vessels (IMCA M103)
- The training and experience of key DP personnel (IMCA M117)
- Guidance on failure mode and effects analysis (IMCA M166)
- Guidance for developing and conducting DP annual trials programmes (IMCA M190)
Improving performance in the marine contracting industry