London Offshore Consultants

**DP marine Operations**

growing operability but at what risk

by Capt. Rutger Bierman
1. Introduction to Dynamic Positioning
2. In the earlier years
3. Industry guidance and DP classes
4. Advantage and wide use of DP
5. Disadvantage and risks of DP
6. Risk Management through DP Assurance
INTRODUCTION TO DP

Dynamic Positioning (DP)
- A system which automatically controls a vessel’s position and heading exclusively by means of active thrusts

Dynamic Positioning (DP) System
- The complete installation necessary for dynamically positioning a vessel

- A complete DP System comprises a power system, thruster system and the DP-control system
INTRODUCTION TO DP
INTRODUCTION TO DP
An Overview of all systems involved in DP
INTRODUCTION TO DP
INTRODUCTION TO DP
IN THE EARLIER YEARS

- Cuss 1 - 1961
  - Joystick control and acoustic transponders

- Eureka - 1961
  - Using 3 analog controllers and taut wire
IN THE EARLIER YEARS

- SEDCO 455 - 1971
  ➢ built for Shell, it was the first DP drillship to use a riser and blow out preventer (BOP) for oil well drilling

- STEPHANITURM - 1978
  ➢ First purpose build Diving Support Vessel, specially to recover gold from HMS EDINBURGH
IN THE EARLIER YEARS

• In 1980, there were 65 DP vessels

• Number of DP vessels grew to 150 in 1985

• In 2011 the number of DP vessels operating in the world reached 2000.

• Numbers still increasing with more specialized vessels.
INDUSTRY GUIDANCE AND DP CLASSES

With growth came the need of Industry guidance.

The most recognized industry bodies are:

- International Maritime Organization (IMO)
- International Marine Contractors Association (IMCA)
- The Marine Technology Society (MTS)
- Class Societies Rules (ABS, DNV, LR, BV)
INDUSTRY GUIDANCE AND DP CLASSES

IMO Circular 645 – June 1994
Guidelines For Vessels With Dynamic Positioning Systems

• Defines redundancy for DP Equipment Class 1, 2 and 3.

• IMCA adopted IMO Circular 645 in full under IMCA M-113.

• Most Class and Flag States requirements for DP Systems are based on IMO Guidelines as a minimum.

• Charterers requirements are based on IMO Guidelines.
INDUSTRY GUIDANCE AND DP CLASSES

CLASS 1

Loss of position occurs in the event of a single failure

No redundancy in equipments

CLASS 2

Loss of position should not occur in the event of a single failure

Achieved through redundancy in equipments

CLASS 3

Loss of position should not occur in the event of a single fault including a completely burnt fire division or flooded watertight compartment

Achieved through redundancy in equipments and compartment segregation
ADVANTAGE AND WIDE USE OF DP

Advantage of using DP positioned vessels

- No tugs and anchor handling vessels required.
- Quick and easy location set-up.
- Excellent maneuverability.
- Rapid response to change in environmental conditions.
- Rapid response to changes in requirements of operations.
- Ability to work in any water depth.
- Avoid risks of damaging seabed hardware from mooring lines, anchors or spud cans.
- Avoid complex cross-mooring arrangements with vessels or fixed structures.
ADVANTAGE AND WIDE USE OF DP
ADVANTAGE AND WIDE USE OF DP
DISADVANTAGE AND RISKS OF DP OPERATIONS

Disadvantage of using DP positioned vessels

• High capital and operational expenditure.
• Higher fuel consumption.
• Might lose position during extreme weather.
• A breakdown of a small part can effect the function of the DP system.
• Over reliance on the DP System.
• Prone to human error.
DISADVANTAGE AND RISKS OF DP OPERATIONS

SIMOPS
DISADVANTAGE AND RISKS OF DP OPERATIONS

SIMOPS
DISADVANTAGE AND RISKS OF DP OPERATIONS

Close proximity operations
DISADVANTAGE AND RISKS OF DP OPERATIONS

Mumbai High
DISADVANTAGE AND RISKS OF DP OPERATIONS

In average 75 DP incidents are reported to IMCA yearly of which about half are for have a loss of position

Related Issues:

• DP computer or software issues
• Loss of power plant
• Loss of environmental sensors
• Loss of position reference systems
• Loss of propulsion
• Environmental conditions
• Human error
DISADVANTAGE AND RISKS OF DP OPERATIONS

*Learning the lessons, Reporting DP Incidents by Ian C. Giddings IMCA*
RISK MANAGEMENT THROUGH DP ASSURANCE

DP Assurance Process:

- Documentation and Procedures review
- DP Vessel Assurance Process
- DP Personnel Competence Assessment
RISK MANAGEMENT THROUGH DP ASSURANCE

Documentation and Procedures for Review:

• Failure Mode And Effect Analysis (FMEA)
• Vessel Specific Operations Manual
• DP Checklists
• DP Capability plots
• DP Footprint records
• Master/Chief Engineer standing orders for DP Operations
• Company guidance for DP Operations
• Activity Specific Operating Guidelines (ASOG)
RISK MANAGEMENT THROUGH DP ASSURANCE

**DP Capability Plot**

**Version**: StatCap v. 2.10.0

**Input file reference**: foot_3420_B.scp

**Last modified**: 2014-08-08 11:53

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
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<tbody>
<tr>
<td>Length overall</td>
<td>87.0 m</td>
</tr>
<tr>
<td>Length between perpendiculars</td>
<td>83.0 m</td>
</tr>
<tr>
<td>Breadth</td>
<td>18.8 m</td>
</tr>
<tr>
<td>Draught</td>
<td>5.8 m</td>
</tr>
<tr>
<td>Displacement</td>
<td>6900.0 t (Cb = 0.73)</td>
</tr>
<tr>
<td>Longitudinal radius of inertia</td>
<td>20.8 m (= 0.25 * Lpp)</td>
</tr>
<tr>
<td>Pos. of origin ahead of Lpp(2)</td>
<td>0.0 m</td>
</tr>
<tr>
<td>Wind load coefficients</td>
<td>Calculated (Blendermann)</td>
</tr>
<tr>
<td>Current load coefficients</td>
<td>Calculated (Strip-theory)</td>
</tr>
<tr>
<td>Wave-drift load coefficients</td>
<td>Database (Scaled by Breadth/Length)</td>
</tr>
</tbody>
</table>

**Total current direction offset**: 0.0 deg

**Wave direction offset**: 0.0 deg

**Wave spectrum type**: JONSWAP (gamma = 3.30)

**Wind spectrum type**: NPD

**Current - wave-drift interaction**: OFF

**Load dynamics allowance**: 1.0° STD of thrust demand

**Additional surge force**: 0.0 tf

**Additional sway force**: 0.0 tf

**Additional yawing moment**: 0.0 tf.m

**Additional force direction**: Fixed

**Density of salt water**: 1026.0 kg/m³

**Density of air**: 1.226 kg/m³ (15 °C)

**Power limitations**: OFF

**Thrust loss calculation**: ON

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>1 TUNNEL</td>
<td>-34.7</td>
<td>0.0</td>
<td>13.6</td>
<td>-13.6</td>
<td>105</td>
<td>9/10</td>
<td></td>
</tr>
<tr>
<td>2 AZIMUTH</td>
<td>31.8</td>
<td>0.0</td>
<td>14.1</td>
<td>-8.7</td>
<td>100</td>
<td>500</td>
<td></td>
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<tr>
<td>3 AZIMUTH</td>
<td>-40.0</td>
<td>-4.0</td>
<td>35.4</td>
<td>-21.8</td>
<td>100</td>
<td>2000</td>
<td></td>
</tr>
<tr>
<td>4 AZIMUTH</td>
<td>-40.0</td>
<td>4.0</td>
<td>35.4</td>
<td>-21.8</td>
<td>100</td>
<td>2000</td>
<td></td>
</tr>
</tbody>
</table>

**VARIABLE WIND AND WAVES**

- Limiting 1 minute mean wind speed in knots at 10 m above sea level

- Wind direction, coming-from [deg]

- Wind speed: Automatic

- Significant wave height: DNV (ERN)

- Mean zero up-crossing period: DNV (ERN)

- Rotating tidal current: 1.00 knots

- Rotating wind induced current: 0.000°UW knots

**Case number**: 4

**Case description**: Loss of main SWB @ 1kts

**Thrusters active**: T2, T4

**Rudders active**:
# RISK MANAGEMENT THROUGH DP ASSURANCE

**Part B** Activity Specific Operational Guidelines (ASOG and SIMOPS) for the vessel "__________"

### Green Status - Continue normal operations (must match CAM).

### Blue Status - Advisory - Inform Captain / Consult Captain / Risk assess - Consider ongoing and upcoming operations.

### Yellow Status - Safely stop operations and move to a drift off area more than 500m from installation. Default worksite to 200m on DP, 200m to 500m on DP Joystick. May work drift off after, Risk Assessment, approval from Operations Manager, Charterer **NO Personal Transfers OR No hose work permitted if vessel is in Yellow status.**

### Red Status - Cease operations - Leave 500m zone/work area Immediately into a drift off area. **IF ALL Manual control systems are working you might be able to work drift off after conducting Risk Assessment outside 500m and after approval from Operations Manager and Charterer**

<table>
<thead>
<tr>
<th>Condition</th>
<th>Green</th>
<th>Advisory</th>
<th>Yellow</th>
<th>Red</th>
</tr>
</thead>
<tbody>
<tr>
<td>Notify Master, Chief Engineer, Deck, Client if on board and Surface Facility</td>
<td>NO</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Vessel operating as Class 1 or 2</td>
<td>Vessel working as Class 2</td>
<td>Possible the DP redundancy could be lost</td>
<td>Vessel is Class 1 OR Class 2 working as Class 1</td>
<td>Affecting Station Keeping</td>
</tr>
<tr>
<td>Personal transfer by approved crane operations with permits in place.</td>
<td>Vessel working as Class 2 and Day light hours ONLY</td>
<td>Failing light</td>
<td>Hours of darkness - Stop crew transfers</td>
<td>Hours of darkness - Stop crew transfers</td>
</tr>
<tr>
<td>Fuel Transfers with permits in place</td>
<td>Vessel working as Class 2 and Day light hours ONLY</td>
<td>Failing light</td>
<td>Hours of darkness - Stop fuel transfers</td>
<td>Hours of darkness - Stop fuel transfers</td>
</tr>
<tr>
<td>Heavy Lifts (36inch Pipe, wellheads, etc.)</td>
<td>Vessel working as Class 2</td>
<td>Possible the DP redundancy could be lost</td>
<td>Vessel is Class 1 OR Class 2 working as Class 1</td>
<td>Affecting Station Keeping</td>
</tr>
<tr>
<td>Weather Forecast</td>
<td>Within operating limits below</td>
<td>Forecast is for approaching operating limits</td>
<td>Forecast is for exceeding operational limits</td>
<td>N/A</td>
</tr>
<tr>
<td>Drift test outside 500m</td>
<td>Drift Test or DP system predictions indicate drift off.</td>
<td>Indicates drift ON, request to work drift off. Record in deck logbook the rank/position of the person requesting vessel to work drift off.</td>
<td>If drift on and the DP vessel has no redundancy</td>
<td>Thrusters, or generator, or main engine are above TAGOS limits</td>
</tr>
<tr>
<td>Drift On - Wind</td>
<td>Less than 20 Kts</td>
<td>Approaching set limit</td>
<td>Thrusters, or generator, or main engine are above TAGOS limits</td>
<td>Thrusters, or generator, or main engine are above TAGOS limits</td>
</tr>
<tr>
<td>Drift On - Sea &amp; Swell</td>
<td>Sea less than 2.0m at 5 sec and Swell less than 1.5m</td>
<td>Approaching set limit</td>
<td>Thrusters, or generator, or main engine are above TAGOS limits</td>
<td>Thrusters, or generator, or main engine are above TAGOS limits</td>
</tr>
<tr>
<td>Drift Off - Wind</td>
<td>Less than 25 Kts</td>
<td>Approaching set limit</td>
<td>Thrusters, or generator, or main engine are above TAGOS limits</td>
<td>Thrusters, or generator, or main engine are above TAGOS limits</td>
</tr>
</tbody>
</table>
RISK MANAGEMENT THROUGH DP ASSURANCE

DP Vessel Assurance Process:

• Condition and Suitability Survey
• IMCA Common Marine Inspection Document (CMID)
• OCIMF Offshore Vessel Inspection Questionnaire (OVIQ)

To be checked:
• As build systems and redundancy in relation to FMEA.
• Annual DP trials and FMEA proving trials records.
• DP Footprints taken.
• Planned Maintenance on DP system.
• DP unusual event and DP incident records.
• Check Work history.
RISK MANAGEMENT THROUGH DP ASSURANCE

DP Personnel Competence Assurance:

• CV’s DP Operators, Marine Engineers and ETO.

• DP Log Books and Training Certificates. (As per IMO circular 738 / IMCA M117)

• DP Familiarization Program on board.

• Interview DP personnel on knowledge of the Vessel, FMEA and Company Policies.

• Records of DP Emergency Drills carried out.
DP Assurance provide a thorough assessment of the readiness of the vessel, DP system, DP operational procedures and manning.

The DP Assurance process can be captured in one report.

All deficiencies identified during the DP Assurance survey can be captured in one register, which makes it easy to track the close out of these deficiencies for vessel owners, charters and oil majors.
RISK MANAGEMENT THROUGH DP ASSURANCE

Further Risk Management control would be the use of a 3rd party for:

- MTS GAP Analysis on FMEA.
- Witnessing of Mobilization or Field Arrival trials.
- Preparation of ASOG.
- Monitoring of DP System upgrades.
- Lessons learned from DP Incident Investigation.
END OF PRESENTATION

Thank you