DP INTEGRATION AND TECHNOLOGY GROWTH ON WORKBOATS

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Presentation Outline

• Short History and Current Status
• Standard Configurations
• DP Class Notation and Certification
• Regulatory Agency Oversight
• Workboat Modes of Operation
• Operator Training and Retention
• Emerging Computer Technologies
• DP Integration In Ship Systems
• DP as part of Vessel Design Criteria
• DP Integration with Automation
• Cost Impact and Controlling Costs
• Future of DP on Workboats
Short History

- Demand for oil after 1950 required access to deeper water
- In 1961, first manual DP in M/V Cuss-1 and analogue system in M/V Eureka
- Initially all analogue with no redundancy
- Computer Industry maturity in 1970-1980’s resulted in increasingly capable DP systems
- 1980 there were over 65 vessels with some form of DP
- 1985 grew to over 150
- By 1999 there were over 500 vessels with DP installations that were increasingly becoming more reliable and redundant
Current Status

• Standard now is for all new construction OSV’s, PSV’s, to be delivered with some form of DP
  - Mostly DPS-0 in past now going to DPS-1 and DPS-2
• Recent emerging need for DPS on Crewboats servicing the deepwater rigs
• Recent increased demand for backfit of vessels to DP
  - New DPS and upgrade from DPS-0 to DPS-1
• Oil Industry and Regulatory Agencies mandating increased safety and reliability
  - resulting in vessels with higher levels of DP as well as “DP Notation”
  - increases new construction costs
Primary Regulatory Agencies

- **ABS** Steel Rules for Ships 2002
  - Part 4, Chap 3, Sec 5, Para 15
- **DNV** Rules for Class of Steel Ships 1990
  - Part 6, Chap 7, Sec 1-7
- **Lloyds** Rules for Class of Ships 2001
  - Part 7, Chap 4, Sec 1-7
- **IMO** Maritime Safety Committee
  - Circular 645 dated 6 Jun 1994
# Standard Configurations

<table>
<thead>
<tr>
<th>Subsystem or Component</th>
<th>Minimum Requirements in Group Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>ABS</strong></td>
</tr>
<tr>
<td><strong>Power Systems</strong></td>
<td></td>
</tr>
<tr>
<td>Gen and Prime Movers</td>
<td>Non-Redundant</td>
</tr>
<tr>
<td>Main Switchboard</td>
<td>1</td>
</tr>
<tr>
<td>Bus-Tie Breaker</td>
<td>0</td>
</tr>
<tr>
<td>Distribution System</td>
<td>Non-Redundant</td>
</tr>
<tr>
<td>Power Management</td>
<td>No</td>
</tr>
<tr>
<td>Optional - IMO</td>
<td>Optional - IMO</td>
</tr>
<tr>
<td>Thrusters</td>
<td>Non-Redundant</td>
</tr>
<tr>
<td>Hold Station with single thruster failure</td>
<td>No</td>
</tr>
</tbody>
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<tr>
<td></td>
<td>DPS-0</td>
</tr>
<tr>
<td><strong>ABS</strong></td>
<td></td>
</tr>
<tr>
<td><strong>DNV</strong></td>
<td>AUTS</td>
</tr>
<tr>
<td><strong>Lloyds</strong></td>
<td>DP(CM)</td>
</tr>
<tr>
<td><strong>IMO MSC/Cr645</strong></td>
<td>Not Recognized</td>
</tr>
<tr>
<td><strong>Control</strong></td>
<td></td>
</tr>
<tr>
<td>Auto Control – No. of Computer Sys</td>
<td>1</td>
</tr>
<tr>
<td>Manual Control – Joystick with auto heading</td>
<td>No</td>
</tr>
<tr>
<td>Single Levers for each Thruster</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Sensors</strong></td>
<td></td>
</tr>
<tr>
<td>Pos. Reference Sys.</td>
<td>1</td>
</tr>
<tr>
<td>Ext. Wind Sensors</td>
<td>1</td>
</tr>
<tr>
<td>VRS/MRU</td>
<td>1</td>
</tr>
<tr>
<td>Gyrocompass</td>
<td>1</td>
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<td><strong>Used only in DNV as a factor used to indicate the position keeping ability of the vessel with all thrusters operating, minimum effect of single thruster failure and maximum effect of single thruster failure</strong></td>
<td></td>
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<tr>
<td><strong>Environmental Regularity Number (ERN)</strong></td>
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</tr>
<tr>
<td><strong>Used only in Lloyds as a factor that gauges the percentage of time the ship can remain on station when subjected to a set of standard environmental conditions with all thrusters and then with most effective thruster inoperative</strong></td>
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</tr>
<tr>
<td><strong>Performance Capability Rating (PCR)</strong></td>
<td></td>
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</tr>
<tr>
<td><strong>Consequence Analyzer</strong></td>
<td></td>
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<tr>
<td><strong>Misc</strong></td>
<td></td>
</tr>
<tr>
<td><strong>UPS</strong></td>
<td>0</td>
</tr>
<tr>
<td><strong>Alt Control Station for backup Unit</strong></td>
<td>No</td>
</tr>
<tr>
<td><strong>FMEA</strong></td>
<td>Yes for ABS and DNV; No for Lloyds</td>
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DP Class Notation

- Assignment at specific request and verifies full compliance with all requirements
- Larger than just the DP System
  - Thrusters, engines, steering, controls certificated
  - Extensive Second Tier environmental testing required for all control systems
- Results in considerable cost increase
- Very difficult for backfit DP systems
- Alternative may be IMO Flag State Verification and Acceptance Document (FSVAD)
Regulatory Oversight

- Rules initially developed for Drill Rigs and DP Drill Vessels that operate DP 24/7
- Only recently have they been applied to rapid expansion of DP on Workboats
  - Resulted in some issues relating to interpretation of rules to workboats
  - Owners perceived inconsistent interpretation and enforcement
- Owners feel need to have clear consistent regulations among all agencies
  - Some areas still leave room for interpretation
  - Specific example is ABS definition and requirements for Second Tier Control Equipment
Regulatory Oversight

- Workboat Industry would benefit from clarification of regulatory requirements
- Consider that workboats operate DP differently than Rigs and DP Drill Vessels
  - Rigs operate DP 24/7 – workboats do not
- Regulatory agencies should consider split between Rigs and Workboats to provide
  - Single consolidated set of rules specific to workboats that meets the needs of the oil industry to be safe and reliable at reasonable cost
- Concerns and clarifications should be published
  - Use Internet Websites for any clarifications and responses to questions
  - Benefits all users
Workboat Modes of Operation

• Standard Modes for Workboats
  - Dynamic Positioning
  - Hold Heading or Autopilot
  - ROV Following
  - Joystick
  - OFF

• Consider Enhanced Modes
  - Roll/Pitch/List/Trim
  - Added Navigation Information when not in DP Mode
  - ECDIS or Radar Overlay during OFF/Autopilot/Joystick
Operator Training and Retention

- Training for Rig DP Operators is clearly defined and extensive
- Not the case for Workboat DP Operators
  - No regulation requirement specifies training
- Minimal to no formal training
  - Most is On-The-Job Training under instruction
- Vessel Operators complain of losing trained Captains to other Operators
Emerging Computer Technologies

• Most innovative technology has occurred in the past 5-10 years along with the growth of computers
  - Faster Processors
  - Increased Computer Memory Availability
  - Higher Level PLC’s with built in redundancy and “hot backup”
  - Improved Computer Networking and dual networks with higher data speed and greater reliability
  - Remote Access to computers via satellite or cellular links

• “Technology Savvy” Captains and Owners are demanding higher levels of technology and increased systems integration
  - Younger Captains grow up with computers and video games and understand the technology available
DP Integration – Ship Systems

• DP must integrate with controls for engines, thrusters, steering and external sensors
  - Can result in up to 4 different vendor involvement
• Requires “DP Integration Meetings” and Communications among vendors
  - Someone must act as integrator
  - Someone has to provide “The Switch”
• Owners and shipyards are looking for full package solutions from single vendor
  - Moves responsibility for integration away from shipyard
  - Single vendor responsible for all items and warranty results in less personnel callouts at commissioning and during operations
  - Significantly decreases cost of the overall package
DP As Vessel Design Criteria

• Currently vessels are designed and built without consideration for DPS – just another added system
• DP is major portion of the vessel’s mission and is affected by many ship design factors
  - Thruster Type, Location and Power
  - Hull Design Factors
  - Sensor Type and Location
• With increased demand for DP – vessels should be designed from bottom up with DP considered
  - Design Naval Architects need to become more familiar with DPS and design impact on DP Operations
  - Will increase the DP capability and environmental operational envelope and could reduce fuel and basic operating cost
Along with demand for increased levels of DP there is now demand for increased Automation:
- More control from the pilothouse
- Decreased Manning in Engine room - ACCU Notation

Result is use of redundant alarm and control system using Dual Network technology:

Multiple dual redundant networks will be installed if DP is also networked:
- Less cable to run on the vessel - less cost
- Less components to maintain - less cost
- Increased reliability of the dual system
DP Impact on Vessel Cost

• Two Primary Cost Drivers
  - Level of the DP selected
  - “Notated” or not “notated”

• Related Costs - Increased Level of DP
  - More labor due to more complex installation
  - Additional sensors and thrusters for redundancy
  - Increased Operating Costs of additional equipment
DP Impact on Vessel Cost

• Related Costs – DP Notation
  - Second Tier Testing Requirements of Controls
  - Additional certifications for thrusters and engines
  - Additional Plan Submittal Requirements

• Additional Cost due to use of Multiple Vendors
  - Loss of any Single Vendor Discounts
  - Additional Techs on vessel during checkout and trials
  - Additional Tech callouts required from different vendors during operational problems
Controlling Costs

• Design the vessel from the “bottom up” as a DP Vessel to reduce vessel operating costs
• Network multiple systems together to reduce cable runs and mitigate complexity
• Use Single Source DP Integrator responsible for all aspects of the DP installation and post-delivery operation and maintenance
Future of DP on Workboats

• Expect DP on all new construction workboats and many larger crewboats
  - Primarily DPS-1 with increased DPS-2
• Demand for Safe and Reliable Operations by Oil Industry will
  - Increase regulation and Notation Requirements
  - Increased Computer redundancy necessitating DPS-1 with two full computers or DPS-2
  - Result in tighter audits and verification of DP
• Concurrent Trend of Increased Automation resulting in more Systems Integration
  - More use of Dual Network technology
• Increased cost of higher level systems and integration could result in necessity for higher dayrates