SeaStream™
A new direction for DP
Dynamic positioning (DP) is a computer-controlled system used to maintain a vessel’s position and heading by automatically activating propellers and thrusters to counteract the displacing effects of the external environment.

Sensors provide information to the control system which incorporates a mathematical model of the vessel including information about the vessel’s dynamics, its machinery and its responses to environmental and other displacing forces.

The model information together with the sensor data enables the DP system to calculate the required output for each thruster and propeller to achieve and maintain the desired position and heading.

GE’s SeaStream™ solutions are designed to enable management of multiple data streams with unprecedented flexibility for effective maritime operations.
The experience to redefine DP

We know DP, deeply. Since the 1970’s we’ve built more than 800 systems, from joystick maneuvering and “simple” DP to multi-redundant DP and Thruster Assisted Mooring Systems (TAMS). Our technological range is coupled with front-line, hands-on expertise in all vessel types. No one is better positioned to develop the DP system you need.

By applying our engineering intelligence, and understanding your maritime operations, we’ve evolved DP to the next level. The result: a new range of DP systems developed to deliver the reliability, efficiency and effectiveness you demand.

SeaStream™ DP
It’s a new direction in DP.
It’s the mariner’s DP.
SeaStream™, GE’s latest range of DP systems is a mariner-focused solution, enhancing situational awareness and rebalancing attention from system management to true seamanship.

**It delivers the following benefits:**
- Unprecedented flexibility for effective maritime operations.
- An energy-efficient nautical system to reduce operational costs and emissions.
- A fully integrated system configured for optimum power & propulsion performance.

GE’s new direction in DP control systems sets new standards of excellence in ship positioning and directly addresses the needs of ship owners, shipbuilders and DP operators.

This mariner-friendly package of controls and displays acknowledges the unique skills and high expectations of the mariners operating the system, allowing them to re-focus on seamanship and ship handling rather than becoming distracted by DP system management.

Side-by-side consultation at every level of the industry has guided the development and application of our advanced technology and control techniques. It’s one of the ways we ensure that our DP systems integrate with and enhance the flexibility effective maritime operations.

The DP system provides a comfortable, reduced-stress working environment enabling the operator to fulfil his duties safely and efficiently.
<table>
<thead>
<tr>
<th>Features</th>
<th>Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intuitive graphic interface</td>
<td>Easy to use – quick to learn for DP operators switching from other DP systems</td>
</tr>
<tr>
<td>26-inch touch sensitive multi-touch screen</td>
<td>Reduced need for data processing by operator; increased focus on seamanship</td>
</tr>
<tr>
<td>Configurable displays show data in clear and uncluttered form</td>
<td>Easier and faster system navigation</td>
</tr>
<tr>
<td>Operator/task specific information prioritization</td>
<td>Improved focus on positioning the vessel rather than manipulating the control system</td>
</tr>
<tr>
<td>Screen tilt angle adjustable</td>
<td>Enables standing or seated operation</td>
</tr>
<tr>
<td>Screen display available in different language versions</td>
<td>Improved focus on the task in hand for non-English speakers</td>
</tr>
<tr>
<td>Slimline console design, at home on any vessel’s bridge</td>
<td>Saves space and complements various bridge designs</td>
</tr>
<tr>
<td>Directly connects user with the wealth of features and improves access, interpretation and manipulation of all connected data and systems</td>
<td>Helps reduce potential operator error</td>
</tr>
<tr>
<td>Intuitive in operation in both routine and adverse operating conditions</td>
<td>Helps improve decision-making in routine and pressurized operating conditions</td>
</tr>
<tr>
<td>Suitable for use by operators with all levels of experience</td>
<td>Helps minimize the time taken for operators to become proficient in its use including speedy transition from other manufacturers’ DP systems</td>
</tr>
<tr>
<td>A full range of system configurations</td>
<td>Adaptable to any configuration: Joystick, DP1, DP2, DP3 and Thruster Assisted Mooring</td>
</tr>
<tr>
<td></td>
<td>Comprehensive range of sensors including taut wire, GNSS, laser, radar, hydroacoustic, inertial platform, gyrocompass, wind sensor, motion reference unit etc.</td>
</tr>
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</table>
An energy-efficient nautical solution

GE’s expertise in DP and in power and propulsion systems has prompted the development of DP capabilities which impact on fuel economy, emissions, machinery wear, and machinery maintenance (time/cost). Operational costs are reduced and overall system up time/availability may be increased.

<table>
<thead>
<tr>
<th>Mode</th>
<th>Operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy Efficient Mode</td>
<td>Automatic position and heading control. Using predictive software to anticipate position variation and to limit thrust changes if the vessel is predicted to remain within the ‘soft’ operating window. If the vessel is predicted to move outside its ‘hard’ operating window the system develops optimum thrust to remain within that window. Advanced algorithms are used to optimize vessel heading to further reduce power consumption and limit thruster/machinery wear and tear.</td>
</tr>
<tr>
<td>Relaxed DP</td>
<td>Automatic position and heading control with a smoothed thrust demand leads to fuel savings and a reduction of stress on machinery. Relaxed DP can also be used when only relatively poor position measurement signal quality is available.</td>
</tr>
<tr>
<td>Minimum Power DP</td>
<td>Automatic position and heading control. The DP system automatically calculates the optimum heading needed to reduce the total forces acting on the vessel and thus reduce power needed to counteract them.</td>
</tr>
<tr>
<td>Weathervaning</td>
<td>Automatic position control. The vessel’s heading is allowed to settle into the environment enabling a reduction in the DP vessel’s overall power consumption.</td>
</tr>
</tbody>
</table>
Simulated drillship example of fuel usage and NOx emissions

Table 1 and Table 2 use the probabilities of the different wind speeds to produce a weighted mean figure, which reflects the average fuel and NOx rates over a one year period.

From Table 2 the mean fuel saving by using “Energy Efficient mode - fixed heading” is estimated as 11% of total, while in “Energy Efficient mode - optimum heading” the saving is estimated at 12%. This equates to either 2664 kg or 2880 kg of fuel per day. The estimated annualised fuel saving equates to around $ 0.8 million a year based on a bunker price of $ 0.8/kg.

From Table 2 the NOx emissions are estimated as being reduced by about 5 kg/hr which equates to between 21% and 23%.

<table>
<thead>
<tr>
<th>Wind speed (m/s)</th>
<th>NOx in “Normal DP” (kg/hr)</th>
<th>NOx in Energy Efficient mode - fixed heading (kg/hr)</th>
<th>NOx in Energy Efficient mode - optimum head” (kg/hr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>24.5</td>
<td>18.8</td>
<td>18.7</td>
</tr>
<tr>
<td>10</td>
<td>24.8</td>
<td>19.5</td>
<td>19.3</td>
</tr>
<tr>
<td>15</td>
<td>27.3</td>
<td>22.2</td>
<td>21.2</td>
</tr>
<tr>
<td>20</td>
<td>32.9</td>
<td>29.4</td>
<td>26.3</td>
</tr>
<tr>
<td>Weighted mean</td>
<td>25.4</td>
<td>20.0</td>
<td>19.6</td>
</tr>
</tbody>
</table>

Table 2: NOx emissions at different wind speed. 3600kW non DP load included

<table>
<thead>
<tr>
<th>Wind speed (m/s)</th>
<th>Fuel used in “Normal DP” (kg/hr)</th>
<th>Fuel used in Energy Efficient mode - fixed heading (kg/hr)</th>
<th>Fuel used in Energy Efficient mode - optimum head” (kg/hr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>947</td>
<td>835</td>
<td>834</td>
</tr>
<tr>
<td>10</td>
<td>966</td>
<td>852</td>
<td>848</td>
</tr>
<tr>
<td>15</td>
<td>1011</td>
<td>905</td>
<td>887</td>
</tr>
<tr>
<td>20</td>
<td>1115</td>
<td>1017</td>
<td>970</td>
</tr>
<tr>
<td>Weighted mean</td>
<td>971</td>
<td>860</td>
<td>854</td>
</tr>
</tbody>
</table>

Table 1: Fuel usage at different wind speeds. 3600kW non DP load included
GE as a full system integrator
Positioning DP in the Big Picture

At GE, we see the whole ship. That’s because we design and supply so much of it, from gas turbines and diesel engines to rotating machines, variable speed drives, drilling systems and automation and control. We power, propel and position the industry. As engineers with broad vision, we understand the role of the DP control system relative to the entire vessel’s operations; its integrated role in a network involving power generation and distribution equipment, propulsion and maneuvering machinery, digital controllers, electrical systems and more.

GE’s new SeaStream™ DP incorporates application-specific software to provide individually tailored solutions designed to meet the exact operational requirements of each ship. Operational requirements vary dramatically from ship to ship and GE’s extensive library of solutions is available with task specific features and functions.

Specialist DP application modules include facilities for:
• Survey ships
• Cruise liners
• Cable lay/repair vessels
• Drilling vessels (drillships and semi-submersibles)
• Shuttle tankers
• Pipelaying vessels
• Platform Supply Vessels (PSVs)
• Dredgers
• Heavy lift vessels
• Offshore Support Vessels (OSVs)
• Naval ships

Control modes and features
Task specific control modes enable the ship to be maneuvered and positioned to best suit the needs of each individual maritime operation.

Maneuvering
• Hand Pilot
• Joystick Control with Manual Heading
• Joystick Control with Automatic Heading
• Autopilot
A class act – complying with regulations and guidelines

Class 1 - In addition to the single DP system an independent back-up joystick system may be required. GE’s joystick can optionally include DP functionality.

Class 2 - No single equipment failure will render the system inoperable. GE can supply Class 2 compliant triple voting systems which exceed the regulatory minimums and provide an even higher level of overall system integrity.

Class 3 - Triple redundancy in terms of equipment provision and an overall system design. GE’s optional quad DP system solution exceeds the regulatory minimum levels of DP control system equipment redundancy to provide an even higher level of overall system integrity. In effect the system can be seen as a “Class 3 +” which positively impacts overall system availability.

The system meets all major classification society and regulatory requirements including Det Norske Veritas, Lloyd’s Register of Shipping, Bureau Veritas, American Bureau of Shipping, Norsok, US Coast Guard and International Maritime Organization recommendations.
And more: A focus on availability
We understand the vital importance of vessel availability—and our service focus keeps us actively engaged, both when things are going right, and when they go wrong.

**Diagnostics and Trending**
GE’s DP is designed for high fault tolerance and incorporates:
- Self-diagnostic routines
- Operator guidance and support to identify and resolve system errors
- Standard features such as an inbuilt multi-channel chart recorder and an optional dedicated history station/black box logger

**Remote Support**
ViSor Connect is GE’s remote diagnostic and support system based on highly secure satellite communications links.

ViSor Connect enables GE experts, regardless of their geographical location, to ‘look over the shoulder’ of the DP operator or technician physically at the equipment, and advise and assist on fault finding and resolution.

**After-Sales Service and Support**
GE offers a wide range of after-sales service and support packages tailored to a single vessel or to an entire fleet. These packages are delivered via a world-wide network of support bases. Some of the key benefits of a GE support package are:
- Single point of contact
- Reduced call-out rates
- 24/7 support
- Rapid mobilization of engineers
- Routine maintenance visits
- Dry docking support
- Training
- System health checks
- Spares management
- Obsolescence management

GE also provides managed system upgrade paths for its ‘legacy’ systems and has significant experience of replacing systems from other manufacturers with a minimum of disruption to ship’s infrastructure.
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