Operational Benefits of Gyro Roll Stabilisers for Offshore Vessels

Presented by Paul Steinmann

15th March 2019
Presentation Overview

1. Introduction to Gyro Stabilizers
2. Operational Benefits for Offshore Vessels
What is a Marine Gyro Stabilizer?

• Piece of mechanical equipment that bolts down to hull structure
• Purpose is to reduce rolling motion
• Use gyro-dynamics to create large torques to oppose rolling motion
• In engineering space or convenient location
• Nothing in contact with the water
• No appendages required
• Behavior readily predicted - no hydrodynamics
• Roll motion can be virtually eliminated at all speeds including zero speed
Vessel Interfaces

- Simple bolt down installation (like an engine bed)
- Cooling sea water
- 24 VDC
- 3-phase or 1-phase AC Power
- Touch Screen on bridge
- Can interface to ship control system
- Ethernet comms
Components of a Gyro
Principal of Operation

1. Flywheel RPM creates angular momentum (vector)

2. Waves cause the vessel to roll, applies rotation to flywheel in roll axis

3. Rolling motion combines with the spinning flywheel to create precession motion

4. Precession motion combines with the spinning flywheel to create stabilizing torque
Flexible Installation Location

✓ Multiple units will work together

✓ Can be mounted off center-line

✓ Can be mounted high or low (structure dictates)

✓ Can be mounted forward or aft
  ▪ Avoid forward location if slamming
  ▪ Vessel trim dictates
Interaction with Other Systems

- Improves performance of heave compensation systems
- Improves performance of DP systems
- Will work with transom interceptors
- Will work with other stabilizers (flume tank, fins etc)
- Multiple gyros will work together
- Improves sonar and radar performance
- No interfacing required between systems
Gyros in Operation
Opposite Spin Direction
What Gyro Stabilisers Do – Tug Beattie

Location: off Fremantle, Western Australia

Rottnest Island

Fremantle
Operational Benefits of Gyro Roll Stabilisers for Offshore Vessels
Walk-to-Work

- Reduce motions that need to be compensated by articulated gangway
- Reduced power for gangway
- Increased operational window
- Increased comfort in transit
Survey Vessels

• Full stabilising torque available at survey speeds
• Improved data accuracy / quality
• Reduced lost data days
• Happier client team and survey crew
• Better decision making
• Smaller vessels possible
Windfarm Crew Transfer

- Reduced rolling reduces breakaway from bow transfer connection
- Improved comfort in transit
- Increased operational availability
- Safer transfers
Improved Diver LARS Operations

- Diver LARS operation in wider range of conditions
- Increased safety
- Reduced WOW
- More working days
Safer Crew Transfer

- Billy Pugh transfers without deck rolling
- Faster
- Safer
- Increased options for vessel orientation
Faster, Safer Boat Launch Ops

- Faster and Safer operations
- Increased weather envelope
- Range of headings now possible
  (head sea not required)
- Launch in lee of vessel while drifting
Wider Heli-Ops Window

- Extend the operability of Heli-Ops with decreased rolling motions
- Range of headings now possible
  (head sea not required)
- Faster and Safer operations
- Increased weather envelope availability
- All deck operations safer and faster
Superstructure Impact When Alongside

- Keep supply vessel upright
- Prevent superstructure impacts when alongside a rig or larger floater
• Lower rolling reduces prop and thruster emergence
• Reduced load variation on propulsion / DP systems
• Lower fuel burn (or higher speeds) in waves
Improved Course Keeping

- Roll and Yaw and highly coupled
- Reduced rolling leads to lower heading variations
- Reduced load on steering machinery
- Lower fuel burn (or higher speeds) in waves
Increased Crew Comfort

- Reduced fatigue
- Better decision making
- Increased endurance
- Improved recruitment
  - better candidates
- Improved morale
- Reduced crew turnover
Thank you for your attention,

Any questions?
VEEM Gyro Stabilizers
VEEM Gyro Models

Four Models – Vessels from 65 tonne to 300+ tonne

**VG120SD**
Applications
Vessel Displacement
65 – 120 tonne

**VG145SD**
Applications
Vessel Displacement
80 – 150 tonne

**VG260SD**
Applications
Vessel Displacement
100 – 300 tonne

**VG1000SD**
Applications
300 – 900+ tonne

Multiple units for larger vessels
VG120SD

Application Vessel Displacement
65 – 120 tonne

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated Stabilizing Torque</td>
<td>120 kN.m</td>
</tr>
<tr>
<td>Mass</td>
<td>2755kg</td>
</tr>
<tr>
<td>Angular Momentum</td>
<td>52 k.N.m.s</td>
</tr>
<tr>
<td>Power</td>
<td>16 ekW</td>
</tr>
<tr>
<td>Length</td>
<td>1.63 m (64&quot;)</td>
</tr>
<tr>
<td>Rated RPM</td>
<td>4800</td>
</tr>
<tr>
<td>Width</td>
<td>1.56 m (61.4&quot;)</td>
</tr>
<tr>
<td>Cooling Water</td>
<td>60 lpm</td>
</tr>
<tr>
<td>Height</td>
<td>1.15 m (45.3&quot;)</td>
</tr>
<tr>
<td>Noise Running</td>
<td>57 dBA</td>
</tr>
</tbody>
</table>
### VG145SD

**Application Vessel Displacement**

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
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</thead>
<tbody>
<tr>
<td><strong>Rated Stabilizing Torque</strong></td>
<td>145 kN.m</td>
</tr>
<tr>
<td><strong>Mass</strong></td>
<td>3000 kg</td>
</tr>
<tr>
<td><strong>Angular Momentum</strong></td>
<td>70 k.N.m.s</td>
</tr>
<tr>
<td><strong>Power</strong></td>
<td>16 ekW</td>
</tr>
<tr>
<td><strong>Length</strong></td>
<td>1.63 m (64&quot;)</td>
</tr>
<tr>
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</tr>
<tr>
<td><strong>Noise Running</strong></td>
<td>57 dBA</td>
</tr>
</tbody>
</table>

**Application Vessel Displacement**

80 – 150 tonne
## VG260SD

### Application Vessel Displacement

- **100 – 300 tonne**

### Rated Stabilizing Torque

- **260 kN.m**

### Mass

- **5650 kg**

### Angular Momentum

- **100 k.N.m.s**

### Power

- **32 ekW**

### Length

- **2.1 m**
  - (6’ 9”)
- **Rated RPM**
  - **3000**

### Width

- **2.07 m**
  - (6’ 8”)
- **Cooling Water**
  - **120 lpm**

### Height

- **1.47 m**
  - (4’ 8”)
- **Noise Running**
  - **71 dBA**
**VG1000SD**

*Application Vessel Displacement*

**300 to 900+ tonne**

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
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</thead>
<tbody>
<tr>
<td><strong>Rated Stabilizing Torque</strong></td>
<td>1000 kN.m</td>
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<tr>
<td><strong>Mass</strong></td>
<td>20.1 tonne</td>
</tr>
<tr>
<td><strong>Angular Momentum</strong></td>
<td>520 k.N.m.s</td>
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<tr>
<td><strong>Power</strong></td>
<td>115 ekW</td>
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<tr>
<td><strong>Length</strong></td>
<td>3.35 m (11')</td>
</tr>
<tr>
<td><strong>Rated RPM</strong></td>
<td>1940</td>
</tr>
<tr>
<td><strong>Width</strong></td>
<td>3.1 m (10' 2&quot;)</td>
</tr>
<tr>
<td><strong>Height</strong></td>
<td>2.4 m (7' 10&quot;)</td>
</tr>
<tr>
<td><strong>Noise Running</strong></td>
<td>73 dBA</td>
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</table>
Touch Screen Control
**Touch Screen Control**

**Precession Angle**

<table>
<thead>
<tr>
<th>AFT</th>
<th>70</th>
<th>60</th>
<th>50</th>
<th>40</th>
<th>30</th>
<th>20</th>
<th>10</th>
<th>0</th>
<th>20</th>
<th>30</th>
<th>40</th>
<th>50</th>
<th>60</th>
<th>FW</th>
<th>70</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>25°</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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**Roll Angle**

<table>
<thead>
<tr>
<th>15</th>
<th>10</th>
<th>5</th>
<th>0</th>
<th>5</th>
<th>10</th>
<th>15</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- **Peak**: 3°
- **RMS**: 2°
Touch Screen Control
VEEM Gyro Projects
<table>
<thead>
<tr>
<th>Project Name</th>
<th>Customer</th>
<th>Description</th>
<th>Scope of Supply</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beattie</td>
<td>VEEM</td>
<td>18m Harbour Tug</td>
<td>1 x VG120 Sea Trials</td>
<td>2015</td>
</tr>
<tr>
<td>MY Anemeli</td>
<td>Van Der Valk Shipyard, Holland</td>
<td>27m Motor Yacht</td>
<td>1 x VG120 At new build</td>
<td>2016</td>
</tr>
<tr>
<td>MY Lanakai</td>
<td>Yachting Developments, New Zealand</td>
<td>38m Motor Yacht</td>
<td>2 x VG120 At new build</td>
<td>2016</td>
</tr>
<tr>
<td>MY Tango</td>
<td>MY Tango</td>
<td>42.5m Motor Yacht</td>
<td>1 x VG120 Retrofit</td>
<td>2016</td>
</tr>
<tr>
<td>Hull 4015</td>
<td>Westport Yachts, USA</td>
<td>40m Motor Yacht</td>
<td>2 x VG120 At new build</td>
<td>2017</td>
</tr>
<tr>
<td>Hull # 120</td>
<td>Van Der Valk Shipyard, Holland</td>
<td>32m Motor Yacht</td>
<td>1 x VG145 At new build</td>
<td>2017</td>
</tr>
<tr>
<td>Powerplay</td>
<td>VEEM</td>
<td>64’ Sportfish</td>
<td>1 x VG120 Retrofit</td>
<td>2017</td>
</tr>
<tr>
<td>Hull #122</td>
<td>Van Der Valk Shipyard, Holland</td>
<td>28m Motor Yacht</td>
<td>1 x VG120SD At new build</td>
<td>2018</td>
</tr>
<tr>
<td>Spirit of Romo</td>
<td>Talsma Shipyard, Holland</td>
<td>Patrol Vessel converted to Motor Yacht</td>
<td>1 x VG120 Retrofit</td>
<td>2018</td>
</tr>
</tbody>
</table>

Continued over page
## Projects

<table>
<thead>
<tr>
<th>Project Name</th>
<th>Customer</th>
<th>Description</th>
<th>Scope of Supply</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Couach 3700</td>
<td>Chantier Naval Couach, France</td>
<td>37m Motor Yacht</td>
<td>1 x VG145 At new build</td>
<td>2018</td>
</tr>
<tr>
<td>FCS5009</td>
<td>Damen Ships, Holland</td>
<td>50m Offshore Supply Vessel</td>
<td>2 x VG260SD Sea Trials</td>
<td>2018</td>
</tr>
<tr>
<td>42m PB</td>
<td>Freire Shipyard, Spain</td>
<td>42m Patrol Vessel At new build</td>
<td>1 x VG260SD At new build</td>
<td>2018</td>
</tr>
<tr>
<td>Hull 706</td>
<td>Feadship De Vries, Holland</td>
<td>49m Motor Yacht</td>
<td>2 x VG145SD At new build</td>
<td>2018</td>
</tr>
<tr>
<td>Ovation</td>
<td>Jim Smith Boats, USA</td>
<td>100’ Sportfish</td>
<td>1 x VG145SD At new build</td>
<td>2018</td>
</tr>
<tr>
<td>MV Patriot</td>
<td>Braveheart Marine, Holland</td>
<td>25m Fast Crew Transfer Vessel</td>
<td>1 x VG120SD Retrofit</td>
<td>2018</td>
</tr>
<tr>
<td>FCS7011</td>
<td>Damen Ships, Holland</td>
<td>70m Fast Crew Transfer Vessel</td>
<td>1 x VG1000SD At new build</td>
<td>2018</td>
</tr>
<tr>
<td>116</td>
<td>Hargrave Yachts, USA</td>
<td>116’ Motor Yacht</td>
<td>1 x VG120SD</td>
<td>2018</td>
</tr>
</tbody>
</table>
Projects

Gyro(s): 1 x **VG260SD**

Vessel: 42m Aluminium
Fisheries Patrol

Images Courtesy of Freire Shipyard, Spain
Projects

Gyro(s): 2 x VG260SD
Vessel: 50m Steel
Damen Sea Axe

Images Courtesy of Damen Ships, The Netherlands
Gyro(s): 1 x \textit{VG1000sd}

Vessel: 70m Aluminium
Damen Sea Axe
Walk-to-Work
Projects

Gyros: 1 x **VG120SD**

Vessel: Javelin 25.25
Multi-Purpose Vessel

Images Courtesy of Braveheart Marine, The Netherlands
Projects

Gyro: 1 x VG120

Vessel: MV Beattie
   17m Steel Tug
   In-house Testing
Projects

Gyro: 1 x VG120

Vessel: ‘Powerplay’
VEEM Test Boat
Viking 64’
Projects

Gyro: 1 x VG120

Vessel: MY Anemeli
27m Motor Yacht

Image Courtesy of Van Der Valk Shipyards, The Netherlands
Projects

Gyro: 1 x **VG145**

Vessel: 32m Motor Yacht
Van Der Valk
Raised Pilot House

Images Courtesy of Van Der Valk Shipyard, The Netherlands
Projects

Gyro: 1 x VG145

Vessel: 28m Motor Yacht
Van Der Valk
Raised Pilot House
Explorer Yacht

Images Courtesy of Van Der Valk Shipyard, The Netherlands
Projects

Gyro(s): 1 x **VG120**

Vessel: MY Tango
42.5m Motor Yacht
Projects

Gyro(s): 2 x \textit{VG120}

Vessel: 40m Westport MY

Images Courtesy of Westport Yachts, USA
Projects

Gyros: 2 x **VG120**

Vessel: MY Lanakai
38m Sportfish

Image Courtesy of MY Lanakai

Image Courtesy of Michael Peters Yacht Design, USA
Projects

Gyros: 1 x **VG145SD**

Vessel: Ovation
100’ Sportfish

Image Courtesy of Jim Smith Tournament Boats, USA
Projects

Gyros: 1 x VG145

Vessel: Chantier Naval Couach
3700 Fly
37m Motor Yacht

Images Courtesy of Chantier Naval Couach, France
Projects

Gyros: 2 x VG145 SD

Vessel: Feadship De Vries
49m Fast Motor Yacht
Projects

Gyros: 1 x **VG120**

Vessel: Spirit of Romo
25m Patrol Vessel
Motor Yacht Conversion

"SPIRIT OF ROMO"
PRINCIPAL DIMENSIONS

<table>
<thead>
<tr>
<th>Description</th>
<th>Dimensions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length Overall</td>
<td>25.600M</td>
</tr>
<tr>
<td>Length Between Perpendiculars</td>
<td>12.000M</td>
</tr>
<tr>
<td>Breadth moulded</td>
<td>6.000M</td>
</tr>
<tr>
<td>Depth moulded (Midship)</td>
<td>3.200M</td>
</tr>
</tbody>
</table>
Contact

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Web www.veem.com.au
Web Links

http://veempropellers.com/
http://veemgyro.com/
http://www.veem247.com/
http://www.timcasthollowbar.com

Gyro Stabilizer Videos
https://vimeo.com/veemgyro
Introduction to VEEM Ltd
VEEM’s History

Our Continuing Story

1968
Operations commenced

1972

1976

1980

1984

1988

1992

1996

2000

2004

2008

2012

2016

2018

1968: Operations commenced

1976: Miocevich brothers assume control of the business

1982: Quality System accreditation and Implementation of ERP System

1987: ABE framework adopted

1988: Acquired SS Engineering

1992: Interceptor style propeller released and patents obtained

1994: ABE framework adopted

1995: Integrated SS Foundry and VEEM Corp

1996: Propeller Export commenced

2000: New workshops combining Osborne Park into Canning Vale

2004: Interceptor style propeller released and patents obtained

2005/6: ABE framework adopted

2008: VEEM Ltd established

2009: Propeller Export commenced

2010: IPS workshops acquired

2011: Gyro assets acquired

2012: Fast loop manufacturing process implemented four year $30m LCS contract with Austal Ships secured

2015: Gyro released

2016: Conquest Propellers released

2017: VG145 launched

2018: VEEM lists on the ASX

VG145 launched
About VEEM

We are a **Manufacturer of Sophisticated Marine Products**. To build on that - we have taken a two-prong approach to meet the needs of the growing local and international SuperYacht, commercial, naval and recreational sectors:

1. Meeting the needs of the marine industry supply-chain by being a reliable supplier, specifically for high compliance requirement products.
   - Generally where there are stringent standards such as Class survey, DEF-STAN, NAVSEA, NES standards.
   - Unique products – Precision and high spec castings and components requiring flexible manufacturing.
   - Over years build capacity to handle up to 25 tonne assy, cast to 16 tonne.

2. Developing sophisticated marine products which have a high technical and capital barrier to entry.

VEEM high speed propellers fitted to the Armidale Class Patrol Vessels
Australian high technology marine equipment specialist

- VEEM is a Perth based high-technology specialist manufacturer of premium marine propulsion and gyro-stabilisation systems
- Passionate about design and engineering excellence
- An industry leader with an outstanding brand and reputation built over 50 years
- A long term investor in R&D and technology, which has created significant intellectual property and barriers to entry
- VEEM operates the world’s most advanced fixed pitch propeller manufacturing facilities.
- VEEM has released a range of large, heavy duty gyro stabilizers for boats between 80 and 3000 tonnes
Facility Overview

- HQ and factory located in Perth, Western Australia
- ASX VEE
- 2 hectare site (additional site under development)
- Dedicated project management offices
- Factory area - 11,000 m² under roof
  - 2 additional sites for assembly and storage
  - Being relocated in Q4 in a new facility
- 50 years in business (established in Oct 1968)
- Annual sales activity approx $45M
- Staff approx 160
- ISO 9001 certified