Caterpillar Marine

BUILT FOR IT.

Caterpillar Propulsion

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Sales Manager - Americas
Caterpillar Propulsion

• Former BERG Propulsion started in 1912
• Controllable pitch propulsion 1929
• Over 6000 propulsion units delivered
Caterpillar Propulsion Facilities

Headquarters, Sweden

New sales production, Sweden

New sales production, Singapore

Aftersales production Sweden
Caterpillar Propulsion
-one of the world’s leading propulsion manufacturers
EXPERIENCE AND HYDRODYNAMIC EFFECTS OF OPERATING TWIN SCREW VESSELS WITH FEATHERING PROPELLERS DURING SLOW STEAMING
Propulsion Concepts – Slow Steaming

**Slow Steaming** – The concept of powering down a twin-prop vessel reducing its propulsive power by \( \approx 50\% \) yet maintaining \( \approx 80\% \) of the speed.
**Propulsion Concepts – Slow Steaming**

**Slow Steaming** – The concept of powering down a twin-prop vessel reducing its propulsive power by ≈ 50% yet maintaining ≈ 80% of the speed.

**Conventional Approach** – Powering down to 50% on both engines.
**Propulsion Concepts – Slow Steaming**

**Slow Steaming** – The concept of powering down a twin-prop vessel reducing its propulsive power by ≈ 50% yet maintaining ≈ 80% of the speed.

**BERG Feathering** – Shutting down one shaftline, allowing the other to maintain 100%!
Feathering minimizing drag and resistance

Locked propeller shaft with full pitch ahead.

Self-milling.

Locked propeller shaft with feathering.
CURRENT POWER AND PROPULSION CRITERIA

Equipment selection focused on contractual requirements:

- Bollard pull
- Sea trial speed

But these meet only some of the operational requirements, and just a small percentage of the operational time.
AHTS OPERATIONAL PROFILE

- Economy 9kts
- Cruising 12kts
- Standby
- DP medium
- Towing 65Tons
- Anchor handling 80Tons
- Bollard pull 150Tons
- Anchored

Power output vs Time [h]
**IS THE DESIGN OPTIMIZED?**

**Full power bollard pull**
- Only 3% of the time
- Only 5% of fuel costs

- **Power output**
- **Time [h]**

- **Total (ekW+kW)**
- **Time**

- **Economy 9kts**
- **Cruising 12kts**
- **Standby**
- **DP medium**
- **Towing 65Tons**
- **Anchor handling 80Tons**
- **Bollard pull 150Tons**
- **Anchored**

![Chart showing power output and time for different operations, with a note on the optimized design.](chart.png)
IS THE DESIGN OPTIMIZED?

Full power bollard pull
- Only 3% of the time
- Only 5% of fuel costs

Most of the operation

Economy 9kts
Cruising 12kts
Standby
DP medium
Towing 65Tons
Anchor handling 80Tons
Bollard pull 150Tons
Anchored

Power output

Total (ekW+kW)

Time [h]

 anchored
BUILDING BLOCK 1: ENGINE DATA

Example: Two engines with approximately the same power output
BUILDING BLOCK 2:
PROPELLER/HULL INTERACTION
Caterpillar’s Efficiency Workshop tool streamlines this benchmarking.

12kts + OPERATIONAL REQUIREMENT + RESISTANCE PROFILE & DATA + PROPULSION SOLUTION + POWER SYSTEM = Cost of ownership
Fuel Maintenance Performance Initial Cost
CASE STUDY
# INTRODUCING THE TEST SUBJECT: 160T AHTS

<table>
<thead>
<tr>
<th>Operational mode</th>
<th>Requirement</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Economy Speed</td>
<td>9kts</td>
<td>6%</td>
</tr>
<tr>
<td>Cruising</td>
<td>11kts</td>
<td>18%</td>
</tr>
<tr>
<td>Fast Transit</td>
<td>13kts</td>
<td>6%</td>
</tr>
<tr>
<td>Standby</td>
<td>2kts current, 5kts wind speed</td>
<td>20%</td>
</tr>
<tr>
<td>Dynamic position</td>
<td>2kts current, 10kts wind speed, DP2</td>
<td>20%</td>
</tr>
<tr>
<td>Towing</td>
<td>5kts speed, 70T force</td>
<td>9%</td>
</tr>
<tr>
<td>Anchor handling</td>
<td>2kts, 110T pull, 20T tunnel thrusters</td>
<td>6%</td>
</tr>
<tr>
<td>Anchored</td>
<td>Hotel load</td>
<td>15%</td>
</tr>
</tbody>
</table>

**Time Requirements**

- Min 160T Bollard Pull
- 13kts speed
- 75m
- DP 2
- 8000h/year
160T AHTS

- 2 x MaK 9 M 32 C engines @ 4500kW
- 2 x 4.2m main CP propellers
STANDARD DESIGN

Transit and standby mode
- 50% of the time
- 48% of fuel costs

Both engines used but inefficient at 30% average load.
INTRODUCING FEATHERING

• 17% lower fuel costs
• 28% lower maintenance costs
References

- Heavy Lift Vessel
- Patrol Boat
- Nuclear Fuel Carrier
- AHTS

+ Product and Chemical tankers, sailing yachts, RO-PAX ferries, Tugs and more.
Sea Trial Test

Graph showing the relationship between resistance and speed (knots) for different configurations of propellers and thrust. The legend includes:

- Hull Resistance
- Hull Resistance + 1 locked feathered propeller
- Hull resistance + 1 locked propeller in full pitch
- Thrust 1 propeller @ 4000 kW
- Thrust 2 propellers @ 4000 kW each
- Thrust 2 propellers @ 2000 kW each
- Actual Speed @ 2x4000 kW
- Actual speed @ 1x4000 kW + feathering
Main Conclusions

- Feathering can be applied to any vessel with more than one propulsion unit and with controllable pitch propellers
- Feathering increases efficiency and flexibility
- Caterpillar Propulsion has a large Reference list with feathering MPP
THANK YOU!