A Review of the Proposed New Escort and Support Tugs for Tanker Operations in Prince William Sound

For:
Prince William Sound
Regional Citizens’ Advisory Council

By: Robert G. Allan P.Eng. FRINA, FSNAME
Executive Chairman
Mandate:

"To advise and provide input to PWSRCAC with regard to the design, testing and commissioning of the proposed new ECO (Edison Chouest Offshore) escort and support tugs for Prince William Sound."
Material available for review

- Escort Tug Drawings & Spec Sheet
- Support Tug Drawings & Spec Sheet
- Other Material/References:
  - [1] Valdez Tug Escort Simulations-Rudder Failure Simulations (Glosten - July, 2016)
  - [3] ASD 4517 Seakeeping Analysis Rev.10
  - "Tug Comparison Slide" - Powerpoint Slide
  - D2_Ross Utility AHTS for Alyeska Pipeline, Rev. P1
  - Transition Plan
  - Marine Contract Transition (pages 1 and 2)
  - New Vessels Description (08/25/16) - Powerpoint Slides
  - [4] New Vessels Description (09/12/16) - Powerpoint Slides
  - Participant Team Meeting 08/18/16 - Powerpoint Slides
  - [5] ADEC Memorandum: 11/21/2016 from M. Day to P. La Pella re "Vessel Intended use"
Basic Conclusions

• Both proposed tug designs indicate:

(a) A lack of thoroughness in proving “fitness for purpose”, particularly in terms of overall performance and seakeeping, and

(b) Failure to properly address the requirements for safe and sensible operation in the Alaskan climate and Metocean conditions.

• The following slides describe/illustrate why these conclusions were reached
Severity of Issues:

• Performance-related issues are critical to assuring that at least the same level of service is to be provided as by the Crowley fleet.

• “Climate” issues are not all critical to the vessel base mission but will certainly render the boats difficult to operate and to maintain well.
  • Some are critical to the safe operation of the boats and must be clarified with urgency.
  • Some other issues are simply matters of good design practise that could be revised (NOW!) at minimal cost to provide a safer and better operating environment for the crew, and result in less downtime and lower long term maintenance.
The Issue of Timing…

- It must be stated that waiting until completion of these vessels is much too late to identify any potential shortcomings in the designs. The potential design deficiencies identified in this report should be resolved immediately in order that changes can be made during production design or at early construction stages at lower cost and time impact than if only considered on completion.
Comments focused on…

• Performance Predictions

• General Design Configuration

• Suitability for Operation in Alaskan Environment
Escort Tugs

**Damen 4517:**

- **Loa** = 42.79 m (or 44.5)?
- **Beam** = 16.50 m (or 16.42)?
- **Draft** = ?? (5.45 m. mld) = 8.15 m. calc’d.
- **Power** = 9200 kW
- **BP** = 136 tonnes (150 S. tons)
- **Fs** = 146 tonnes @ 10 knots

Note: specific performance (thrust /HP) is very low for a Z-Drive tug (~16% below average)
Escort Tugs - Mission

- Tethered escort of ships (Primary Escort)
- Untethered escort of ships (Secondary Escort)
- Ice Reporting Vessel
- Ice Scout Vessel
- Sentinel Escort
- Emergency towing
- Hinchinbrook Tug (Hinchinbrook Sentinel Escort)
- Escorting Response Vessel
- Off-vessel firefighting
- Ship docking and un-docking
- Dispersant application (2 tugs only)
- Recovery, storage, lightering, and nearshore barge towing, support, and operation
- Skimming and recovered oil storage
Escort Tugs - Performance Predictions

• 4517 is larger and quite unlike any previous tug designs from Damen, so it is not valid to extrapolate performance predictions from other much smaller designs.
• No evidence has been provided to show that a model-testing program was performed to verify/refine this unique new design.
• The existing performance predictions are very limited in scope and do not prove performance in the full range of operating conditions.
• The seakeeping predictions are suspect in their scope and accuracy.

It is remarkable that for an investment in five (5) such critical escort/rescue towing vessels no serious attempt has been made to verify every aspect of performance through model testing or even by CFD analysis. This is considered a very serious omission.
Indirect Performance Predictions

- Only performed for calm conditions
- Based on a fairly simplistic method
- Based on 44.5m length, but most drawings indicate shorter, so results will be less. **Must be clarified**

<table>
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<th>6</th>
<th>8</th>
<th>10</th>
<th>unit</th>
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</tr>
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<td>Steering force</td>
<td>922</td>
<td>590</td>
<td>1583</td>
<td>125</td>
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<tr>
<td>Braking force</td>
<td>94.0</td>
<td>60.1</td>
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<td>247</td>
<td>1582</td>
<td>474</td>
<td>1935</td>
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<td>25.2</td>
<td>161.3</td>
<td>48.3</td>
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**Speed: 10 knots**

- Braking force [kN]
Seakeeping Performance

- Use of “Shipmo PC” as the predictive tool:
  
  This software can be extremely unreliable for predicting motions of vessels such as tugs with low length/beam ratios (< 3), and especially so when those vessels have large appendages such as an escort skeg and Z-drives, and even more unreliable in more extreme sea states.

- Report Conclusion:

  According to the predicted information from this analysis, the vessel is capable of successfully conducting towing operations, escorting operations, and making up connections in conditions with 4.50 m significant wave heights and beyond.

**BUT...**

- Analysis only done for 0 and 1 knot speeds (Escort at 10 knots!)
- Deck wetness only evaluated for aft deck
- Sea states well above 4.5 m will be encountered
Particulars

- Discrepancies in main dimensions raise questions about performance predictions

From GA “Particulars” Sheet

<table>
<thead>
<tr>
<th>DIMENSIONS</th>
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<tbody>
<tr>
<td>LOA</td>
<td>42.79 m (140.38')</td>
</tr>
<tr>
<td>LWL</td>
<td>40.99 m (134.47')</td>
</tr>
<tr>
<td>Breadth</td>
<td>16.50 m (54.13')</td>
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<tr>
<td>Depth of Hull</td>
<td>7.00 m (22.96')</td>
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<tr>
<td>Total Depth including skeg</td>
<td>9.70 m (31.82')</td>
</tr>
<tr>
<td>Draft (est. @ 98% consumables)</td>
<td>5.45 m (17.88')</td>
</tr>
<tr>
<td>Freeboard (est. @ 98% consumables)</td>
<td>1.55 m (5.09')</td>
</tr>
<tr>
<td>Gross Tonnage (ITC est.)</td>
<td>&gt; 500</td>
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</table>

9.7 - 1.55 = 8.15 m (26.75') draft

From “Tugsim” Performance Prediction Report

<table>
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<th>2.2 Principal dimensions</th>
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<tbody>
<tr>
<td>Length o.a.</td>
<td>44.50</td>
</tr>
<tr>
<td>Breadth mld.</td>
<td>16.42</td>
</tr>
<tr>
<td>Depth mld.</td>
<td>7.00</td>
</tr>
<tr>
<td>Draught aft (max)</td>
<td>7.25</td>
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<tr>
<td>Displacement</td>
<td>1639 t</td>
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Escort Tugs – General Design Issues

- Fo’c’sle Deck creates a large “pool” – potential risk in high seas
Escort Tugs – General Design Issues

- Tug has a very large skeg and high windage; a bow thruster would significantly enhance ship-handling operations at low speed.
Escort Tugs – General Design Issues

- **Fendering deemed inadequate** for PWS operations by experienced Masters

  - Use larger fenders
  - Add more large size fenders
Escort Tugs – General Design Issues

- **Bow height** (start of fender strake) very low for Gulf of Alaska operations

Bow shape is extremely “bluff”, resulting in high speed loss in waves.

Height of bow fender strake is extremely low and will be a problem in rough seas. Should be raised as high as possible.
Escort Tugs – General Design Issues - Miscellany

- No info provided re ice-strengthening; no Ice Class notation
- Galley excessively large; refrigerators oriented transversely
- No separate crew lounge space
- No exercise room
- No lavatories accessible to bridge and MCR
- Berths located on outboard bulkheads: cold, max motions
- Double bunks outboard i.w.o. portlights (needs clarification)
Suitability for Alaskan Environment … info needed

- Measures to prevent ice/snow plugging the freeing ports in the fore deck well?
- Measures for deck heating in all exposed working areas to prevent ice/snow accumulation?
- Methods/locations for protected/heated storing of mooring and other working lines?
- Means of protecting winches from water ingress into shelters and from freezing spray?
Suitability for Alaskan Environment … info needed

- Prevention of freezing in potable water and fresh water ballast tanks adjacent to the shell?
- Protection from freezing in ALL piping systems and especially those exposed to weather such as drain lines?
- Are any topsides deck drains routed inside deckhouses?
- All window wipers must be equipped with heating elements and provision for adding anti-freeze to window-washing solution
Support Tugs

- **Damen 3212**
- Very standard terminal/assist tug

- **Loa** = 31.25 m
- **Beam** = 13.00 m
- **Draft** = 5.45 m
- **Power** = 4480 kW
- **BP** = 65.8 tonnes
- **Fs** = not defined

Note: specific performance (thrust /HP) is very low for a Z-Drive tug (~16% below average)
Support Tugs - Mission

- Tethered escort of ships under ~ 90k DWT (Primary Escort)
- Untethered escort of (all?) ships (Secondary Escort) *(limited hull speed vs. longer tugs)*
- Ice Reporting Vessel
- Ice Scout Vessel
- Sentinel Escort *(definition?)*
- Emergency Towing *(within limited sea states?)*
- Off-vessel fire-fighting (two tugs only)
- Ship docking and undocking
- Recovery, storage, lightering, and nearshore barge towing, support, and operation
Very Significant Concern

• "We do not intend to prove or test this [tethered escorting of < 90K dwt tankers] during contract transition. Our intention is to perform testing following a successful transition."

ADEC Memorandum: 11/21/2016 from M. Day to P. La Pella re "Vessel Intended use"

(a) What are the performance criteria?
(b) What happens if the vessels fail to demonstrate satisfactory performance?
Support Tugs - Performance Predictions

• Very little information about performance is provided beyond the indicated BP of 65.8 tonnes from 4,480 kW. These figures indicate a very poor specific performance. Typically, that much power (6,005 BHP) should deliver closer to 75 tonnes BP. This discrepancy should be explained/resolved soonest.

• Provide evidence that
  • the tug complies with USCG Towline Pull Stability criteria
  • the tug complies with a recognized escort stability criteria

• Provide full details of indirect escort (Fs and Fb) capability at 8 and 10 knots, within recognized escort stability criteria

• Demonstrate that the fixed pitch propellers will not cause the engine to stall in the full range of operating conditions during indirect escort operations
Support Tugs - General Design Configuration

- Interior layout inappropriate for the Alaskan environment and should be reviewed in detail.
- Specific issues are:
  - Lack of a wet room or even wet gear lockers at the entry
  - The small tables in the mess will accommodate two people each at best, not the 6 or 7 persons indicated
  - Bunks in the staterooms are located against the cold exterior bulkheads;
Support Tugs – Deck Equipment

• Forward hawser winch appears inadequate for escort work
  • Only single drum
  • Not clear if escort-rated

• Need details of the arrangement of the stern tow-pin/roller system for review/approval

• Details of stern fendering and towing arrangement to be provided and reviewed/approved by Masters familiar with local towing operations and conditions.
Support Tugs - General Design Configuration

• Need details of the Fi-Fi system
• Ladder from fore deck to boat deck is too steep and potentially dangerous. All ladders and gratings should be GRP to minimize risks in snow/icy conditions.
• Deck locker space is totally inadequate for towing gear etc., especially in the cold climate.
Support Tugs - Suitability for Operation in Alaskan Environment

- All the same issues as for the escort Tugs
  - De-icing
  - Heated rope stores etc
  - Freeze prevention in piping etc
- Interior Layout is very problematic
Conclusion

• **Major Performance & Seakeeping Issues**
  – Escort Tug: needs urgent attention; might involve some hull shape alterations
  – Support Tug: complete lack of information available at present

• **Arrangement Issues**
  - mainly impacts crew comfort, fatigue, housekeeping and crew safety
  - could be easily changed now for little or no cost
  - most critical on support tugs

• **Climate Suitability Issues**
  - critical on both classes of tug
  - no details available to define what measures being taken
  - if missing, could be easily changed now for little or no cost

*Deferring decisions on these issues will ultimately result in high costs and significant delays*