YP Ship Structures

By: LCDR Tyler Scharar
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YP-676 & YP-703: YARD PATROL CLASS

YP-676 (Wood):
- Heavier
- Shorter
- Narrower
- Slower
- Less midshipmen fit
- More maintenance
- Combustible

YP-703 (Steel/Alum):
- Lighter
- Longer
- Wider
- Faster
- More midshipmen fit
- Aluminum melts

<table>
<thead>
<tr>
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<th>YP-676 Class</th>
<th>YP-703 Class</th>
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<tbody>
<tr>
<td>Length, LOA / LPP (ft)</td>
<td>108 / 102</td>
<td>119 / 109</td>
</tr>
<tr>
<td>Beam (ft)</td>
<td>24</td>
<td>27.9</td>
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<tr>
<td>Draft (ft)</td>
<td>8</td>
<td>7.5</td>
</tr>
<tr>
<td>Speed (kt)</td>
<td>12</td>
<td>12.6</td>
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<tr>
<td>Range (n.m.)</td>
<td>1,800</td>
<td>1,680 @ 10 kt.</td>
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<tr>
<td>Propulsion</td>
<td>12V-71N Detroit diesel engine (437 SHP @ 2,100 RPM); 2 props</td>
<td>2x Cat C-18 diesel engines (2x 715 BHP @ 2,100 RPM); 2 props</td>
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<tr>
<td>Crew</td>
<td>2 officer, 4 crew, 24 midshipmen</td>
<td>4 officer, 6 crew, 30 midshipmen</td>
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Note: YP-676 Class ships: 676, 681, 683, 684, 686-692, 694, 695, 698, 700, 701
YP-703 Class ships: 703-708
Figure 6.11 – Typical Transverse and Longitudinal Strength Members
YP-676 (Wood)
Location: Bottom, Front, Centerline

- Longitudinal Keel (12in x 12in rectangle)
- Transverse Frame (4in x 10in rectangle)
- Transverse Floor (6in x 10in rectangle)
- Gabbard ‘A’ Strake Plating
Location: Waterline, Midships, Starboard

- **Transverse Frame** (4in x 10in rectangle)
- **Strake Plating** (where hull bottom turns up to hull sides)
- **Longitudinal Hull Stringer** (3in x 8in rectangle)
Location: Main deck looking up to bottom of O-2 Level, Aft, Centerline

Deck Girder
(1 foot tall L-shape) longitudinal holding up O-2 level

Deck Beam
(1 foot tall L-shape) transverse holding up O-2 level
YP-703 (Steel Hull / Aluminum Superstructure)

Location: Bottom, Front, Centerline

Longitudinal Keel with holes for people and wires
(several feet tall flat plate)

Transverse Floor
(1 foot tall L-shape)

Gabbard ‘A’ Strake Plate

Longitudinal
(4in tall flat plate)
Location: Bottom, Midships, Port

- **Bilge Strake Plate**
- **Transverse Floor** (1 foot tall L-shape)
- **Longitudinal** (4in tall flat plate)
Longitudinal (4in tall flat plate) runs continuous, while Transverse Floor (1 foot tall L-shape) has hole cut in it.

Through-Hull sensor (such as depth finder)
Transverse Wall (with holes to allow people and utility pipes through), similar to structural or watertight walls use to prevent torsion.
Take-Aways to Consider:

• Keel is the largest and most important structural member
• Transverse members are like a rib cage, designed to withstand the hydrostatic pressures of the water on the hull
• Longitudinal members are designed to resist bending moments (hogging & sagging), and thus more important in longer ships (>300ft)
• Bending stress (= \( \frac{M \cdot y}{I} \)) is zero psi at the neutral axis (it runs bow-to-stern somewhere above the keel and below the deck). Bending stress is largest when ‘y’ (distance above or below neutral axis) becomes largest. Thus keel and deck require larger longitudinal members than hull sides.
• Transverse walls resist torsion (twisting like an empty can)
• Strake (plating) is reinforced against shear (tearing up/down) at the Gabbard strake (by keel), Bilge strake (bottom turns up into side), and Sheer strake (main deck)
• Wood is most often cut into rectangles, whereas metal can be shaped into L, T, C or flat plates to increase second moment of area ‘i’ (i.e. resist bending) with less weight than just a rectangle
• Aluminum weighs less than steel and resists corrosion better, so it creates a lower center of gravity when used for a superstructure. But... it melts easier in a fire, so requires shielding. And causes bi-metallic corrosion and fatigue cracks where the steel hull and aluminum structure attach to each other b/c the metals bend at different rates when the ship hogs/sags.