Turnkey Retrofit Ballast Water Treatment Systems (BWTS)
INTRODUCTION

Harris Pye is an innovative global service provider for the marine, offshore oil and gas, and industrial sectors respectively. Harris Pye Engineering has diverse capabilities and specialises in repairs, upgrades and conversions.

Operating on a 24/7 basis, we are confident and reliable in providing high quality assistance globally. Our organisation offers complete solutions from design manufacture to installation, in order to meet our clients individual requirements and budgets from our specialist workshops worldwide.

INNOVATION

Over the decades, the Group has continued to develop a wide variety of services and expertise. The 2014 Group turnover has been confirmed at above £ 100 million all attributed to marine and offshore/onshore oil and gas industries.
From a staff strength of 10 in 1976, we have now established a total of 1000+ employees.
Harris Pye Green Solutions:

We offer the following turnkey solutions:

- Ballast Water Treatment Systems
- Exhaust Gas Scrubber Systems
- Low Sulphur Diesel Oil Conversions
- Waste Heat recovery boilers
IMO Ballast Water Management Convention (BWMC) status:

- 51 countries have now signed the BWMC totalling 34.87% of Gross World Tonnage with Peru being the most recent (ratification needs 30 countries totalling 35% of GWT).
- Finland (0.14%) are close to signing which will take the total %GWT to 35.01% and ratification.
- Ireland, Italy, India and Panama have all commenced endorsement.
- Australia, Argentina, Brazil, Maldives, Spain and Syria are signatories to the BWMC (subject to ratification) so their %GWT will be added to the total once it passes 35% and is ratified.
- IMO now updates the %GWT every month to take into account new buildings, scrapping and ref flagging and this can cause a noticeable change – it was +0.02% at the end of May this year.
- It is widely anticipated that the required 35% GWT will be achieved later this year.
- The Ballast Water Management Convention will enter into force 12 months after the required 35% GWT is achieved – expected to be mid 2017.
- Any vessel completing Special Survey after this date must install an IMO approved Ballast Water Treatment System to renew the IOPP Certificate.
- There are 60,000+ vessels to be retrofitted...
- There are 90+ approved BWTS available from 75 manufacturers but it is widely expected that many of these systems will disappear with perhaps only 10-15 surviving in the long term.
- The list of IMO approved Ballast Water Treatment Systems as of April 2016 can be found here: http://www.imo.org/en/OurWork/Environment/BallastWaterManagement/Documents/Table%20of%20BA%20FA%20TA%20updated%20April%202016.pdf
USCG status:

- USCG rules entered into force on 1st January 2016 requiring any vessel with less than 1500m³ and more than 5,000m³ of ballast water to install a USCG Type Approved BWTS at their next scheduled docking (not Special Survey).
- There are currently **NO** USCG Type Approved Ballast Water Treatment Systems
- As there are currently no USCG approved systems, ship owners have been able to apply for an ‘extension letter’ and latterly a ‘supplementary extension letter’ waiving the requirement to install a USCG Type Approved BWTS at their next scheduled docking.
- All IMO approved BWTS have been given AMS (Alternative Management System) approval – a 5 year approval from USCG for use and installation to meet USCG requirements.
- AMS does not mean USCG Type Approval.
- It is highly unlikely that the AMS certification will be renewed when it expires (2018 onwards) especially if there are any USCG Type Approved systems.
- A number of BWTS claim to have completed USCG Type Approval testing but no system has yet fully completed all testing. There are 3 elements – land based, ship based and environmental testing. The first two are operational tests and the environmental testing is to confirm that the equipment is fit for prolonged use in a marine environment.
- It is anticipated that the first USCG Type Approval will be issued in 4Q/2016
USCG status continued:

- 4 Ultraviolet treatment type BWTS (Hyde, Trojan, Desmi and Alfa Laval) passed all USCG tests using the MPN (Most Probable Number) test method but the USCG advised in November 2015 that they would not accept this test method. To limit power required to operate the system, UV BWTS tested against MPN which is a quantitative method to assess the number of viable cells (the number which can reproduce) left alive after treatment. UV systems can kill all organisms but require far more power to do so. The USCG advised that MPN was not an equivalent alternative to the FDA-CMFDA stain test which measures whether organisms are living or dead and on that basis rejected testing by MPN. All 4 companies have lodged an appeal and it may be that the appeal will be successful as there is strong lobbying for the acceptance of MPN due to its widespread use for testing drinking water etc.

- It is believed that the USCG is unlikely to issue a Type Approval certificate for just one BWTS or one technology (which could be a contributory factor in the UV ruling) as this would give an effective monopoly to that system for any vessel due for its next scheduled docking where there would be no choice but to install that one and only Type Approved system.

- The USCG has recently completed a ‘Practicability Review’ which has identified that there is no technology available to achieve a significant improvement in ballast water treatment quality. The USCG will therefore retain the IMO D-2 standards for the foreseeable future.

- Status of USCG type approvals - 33 BWTS makers have advised their intention to submit for United States Coastguard Type Approval – none have yet achieved this
IMO D-2 Ballast Water Standard

Regulation D-2 Ballast Water Performance Standard requires that discharged ballast meets the following standards:

- Organisms >50 μm $\Rightarrow$ <10 per m3
- Organisms < 50 & >10 μm $\Rightarrow$ <10 per ml
- Indicator microbes (bacteria):

  $\Rightarrow$ *Vibrio cholera*: 1 CFU per 100 ml
  $\Rightarrow$ *Escherichia coli*: 250 CFU per 100 ml
  $\Rightarrow$ Intestinal *Enterococci*: 100 CFU per 100 ml
How to meet the D-2 Standard?

Installation of a BWTS using the following technologies:

**MECHANICAL**
- Filtration
- Hydro-cyclone

**PHYSICAL**
- Thermal
- Ultraviolet
- Ultrasound
- Cavitation
- De-oxygenation

**CHEMICAL**
- Disinfection
- Biocides
- Electro-chlorination
Retrofit options – shipyard or in-service?

In service offers:

- Time
- Flexibility
- Assurance
- Ease of commissioning
- Contingency...

Shipyard issues:

- Time constraints
- Inflexible
- Access restrictions (cranes)
- Concurrent/conflicting work
- Risk of ‘Critical Path’
- Minimal window for commissioning
- No contingency
Retrofit process of selected BWTS:

- Preliminary design (conceptual installation)
- 3D Scan and Survey (proof of concept)
- Initial engineering (system layout via computer modelling)
- Detailed engineering & design (isometrics for structural and piping spools)
- Submission to Class of required documentation for approval
- Material purchase
- Pre-fabrication (GRE/Polyethylene lined/Galvanised)
- Installation (Harris Pye’s own riding squads)
- ‘As Built’ drawings and Operating Manual
- Commissioning (ITP)
- Training
## Timeline for turnkey retrofit installation:

<table>
<thead>
<tr>
<th>Description</th>
<th>Timeline</th>
<th>Accountable Party</th>
</tr>
</thead>
<tbody>
<tr>
<td>System selection</td>
<td></td>
<td>Ship-owner</td>
</tr>
<tr>
<td>Desktop survey</td>
<td>5 days</td>
<td>Harris Pye</td>
</tr>
<tr>
<td>3D Scan and Full ship survey</td>
<td>21 days</td>
<td>Harris Pye</td>
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<tr>
<td>Modelling</td>
<td>30 days</td>
<td>Harris Pye</td>
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<tr>
<td>Approval</td>
<td>7 days</td>
<td>Ship-owner &amp; BWTS maker</td>
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<tr>
<td>Full Engineering</td>
<td>60 days</td>
<td>Harris Pye</td>
</tr>
<tr>
<td>Material Purchase</td>
<td>14 days</td>
<td>Harris Pye</td>
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<tr>
<td>Pre-fabrication</td>
<td>21 days</td>
<td>Harris Pye</td>
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<tr>
<td>Installation</td>
<td>26 days</td>
<td>Harris Pye/Shipyard</td>
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<td>Commissioning and IOPPC renewal</td>
<td>6 days</td>
<td>Class, BWTS maker &amp; Harris Pye</td>
</tr>
<tr>
<td>Live BWTS</td>
<td>0 days</td>
<td>Ship-owner</td>
</tr>
<tr>
<td><strong>Total:</strong></td>
<td><strong>6 months...</strong></td>
<td></td>
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Harris Pye has recruited a new Design Office Manager and has optimised BWTS retrofit installations:

- 3D scan and survey report within 2 weeks with conceptual modelling
- Full retrofit installation from initial BWTS selection to installed and commissioned within 6 months
3D modelling examples

- Single ultraviolet BWTS installation with pipe runs for ballasting and de-ballasting in place as conceptual modelling of installation

- Tie-ins to existing ballast system installed during in-water survey with diver fitted blanks to ensure sufficient isolation
• Double ultraviolet BWTS installation model to provide redundancy

• Modelling allows validation that twin BWTS installation can be installed standing vertically, horizontal pointing fore/aft (as shown) or pointing port/starboard.

• Foundations and platforms for maintenance and operation not shown for clarity
Section of existing ballast system modified to allow installation of any BWTS technology:

- Common discharge rail used as filter/BWTS supply and return with former de-ballasting isolation valve becoming BWTS by-pass valve
- Purple line is UV de-ballasting connection (if required) – blank flange on manifold rather than welded end
- Sampling point
- Neutralisation injection point (for electro-chlorination or chemical BWTS) not shown for clarify
- New valve installed to allow de-ballasting for UV BWTS. Open continuously for electro-chlorination or chemical BWTS
Isometric drawing of common discharge rail produced for fabrication
Complete BWTS model with loops colour coded for clarity
Design model for filter installation in electro-chlorination BWTS
Model in ‘point cloud’ from 3D scan showing piping run between ballast pump motors
• Structural foundation assembly ready for skid mounted BWTS to be installed

• Foundation can be pre-fabricated and installed onboard or built up in situ dependent upon amount of access

• 3D Scan and Survey will assess access for BWTS installation

• Detailed engineering will produce an optimised design
Access route to install BWTS identified during survey and proven as fit for purpose by 3D modelling
Project planning

Detailed project plan produced and discussed with client as part of front end planning.
A Safe System of Work...

Risk assessments completed for all stages of installation which may identify the requirement for a full HAZOP study.
Pre-fabrication

With facilities in the Middle East, Asia, Brazil and the United Kingdom Harris Pye offer an efficient and cost-effective alternative to on-site production, globally. Maintaining the highest standards across our facilities ensures quality is not compromised in any way. Owners will benefit from local and globally discounted supply chain costs and reduced installation time during service.

Harris Pye skilled personnel pre-fabricating pipe spools prior to Harris Pye riding squads installing onboard the vessel
See us at SMM in Hamburg on 8th - 9th September