

Background

Welaptega specializes in the measurement of subsea mooring cables and chains. Chains must be cleaned to a bare metal condition before inspection, which is accomplished using one of two existing ROV operated rotary cleaning tools. The objective of this project was to design a new cleaning tool or modify an existing tool to reduce time required to clean mooring chains.



Image retrieved from <http://www.welaptega.com/rusticles-spotted-in-deepwater-mooring-system-in-west-africa/>

Preliminary Concepts

Scraper Chain

This was an aggressive chainsaw-style tool with a large contact area and custom links optimized for high material removal rate.



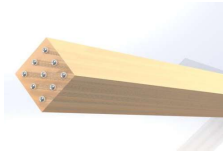
Whisk-Style Tool

This was a rotary tool shaped like an egg beater or whisk that would scrape growth from the chain using replaceable blades made from a soft metal.



Reinforced Floggers

These were similar to the existing polyurethane floggers except that they were reinforced with a strong metal core for added strength.



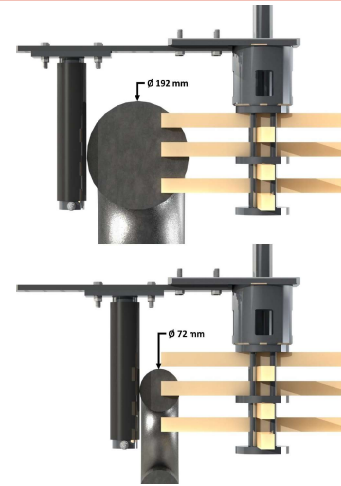
Indexing Attachment

This was an add-on that could be fitted onto either of the two existing tools to assist the operator with positioning and maintaining solid contact.



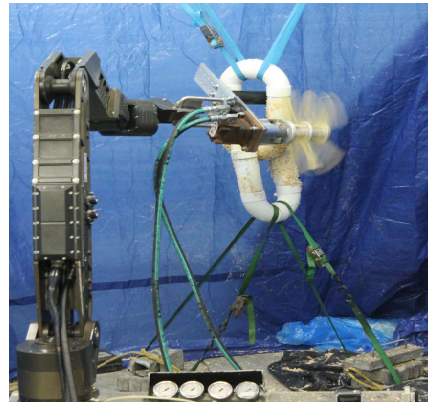
Design Details

- The indexer prototype is an attachment that is compatible with Welaptega's rotary flogger cleaning tool, and can be adjusted to accommodate mooring chain cross-sectional diameters ranging from 72 mm to 192 mm.
- During operation, the indexer holds the cleaning tool in place, resulting in improved contact, and eliminating lost time caused by accidental tool jumps.
- The indexer prototype was made primarily from 3/8 in. thick 6061-T6 Aluminum plate, and a section of 2 in. diameter schedule 80 6061-T6 Aluminum pipe.
- Machining of the prototype was completed by the Design Team with the help of the machine shop technicians at the Michelin Creation Lab on Sexton Campus.

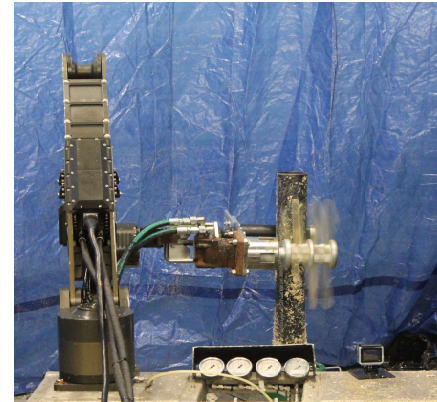


Prototype Testing

- The prototype was tested at Dominion Diving Ltd. in Dartmouth, NS on Thursday, 21-Feb-2019.
- Dry land tests were performed using the existing rotary flogger cleaning tool with and without the indexer prototype.
- Both tests used simulated marine growth made from Gorilla Glue and aspen wood chips.



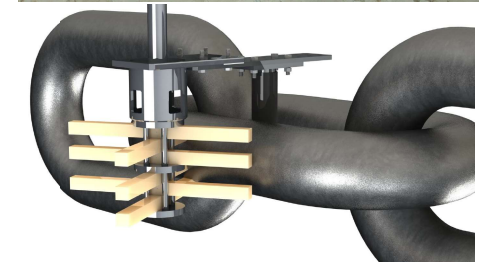
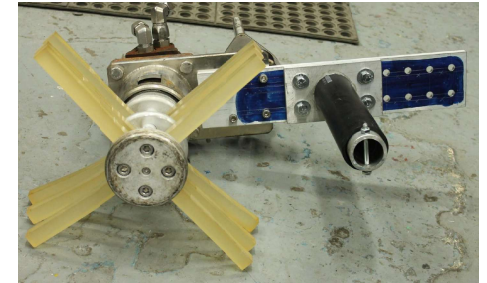
Test #1 used chain links made from PVC pipe, as shown above. This was a qualitative test, designed for the purpose of observing the indexer in operation and obtaining operator feedback.



Test #2 used a 3 ft. straight section of carbon steel pipe, as shown above. This was a quantitative test, designed for the purpose of recording the frequency and duration of tool jumps that occur with the existing tool. This helped with estimating the potential for time savings that may be achieved with the indexer.

Results & Recommendations

- The total cost of the indexer prototype and testing setup was \$389.94.
- During testing without the indexer, time spent regaining tool position after losing contact with the chain surface accounted for approximately 17 – 19 % of the total cleaning time.
- The indexer successfully helped the operator to maintain cleaning tool contact during both tests, which has provided the client with sufficient justification to continue developing this concept.
- During testing, some fasteners loosened as a result of vibrations during operation. For this reason, lock washers have been added to the revised design.
- At the request of the client, shear pins have also been added to the revised design to provide a mechanical safeguard that will prevent the ROV from becoming stuck during operation.



Acknowledgements

Team 5 would like to acknowledge Patrick Hennessey and the rest of the staff at Welaptega for their support during this project. Additional acknowledgements are extended to the staff at Dominion Diving for their enthusiasm and cooperation during testing, as well as the Sexton Campus Machine Shop technicians for their help with prototype fabrication.