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Subj: Preliminary Engineering for Gangway, Dock & Barge System

The following is a preliminary engineering assessment for some of the major structural aspects of the proposed Gangway, Dock & Barge System. The system consists of a detachable Barge, constructed similarly to a standard 4 barrel x 4 barrel Rolling Boat, but with some special features, such as an offset engine bracket, an integral axle, and a fold-out wing on one side only. The Dock utilizes standard Rolling Boat parts, to create a 4 barrel x 3 barrel wide pontoon. A pin connection allows the Dock and Barge to function as one large pontoon while at rest. Additionally, the Dock and Barge sections can be moved together under the power of the outboard motor to transit to the launching ramp. Finally, the Gangway section provides shore access from the Gangway, and is again, constructed from standard Rolling Boat Parts.

BARGE STRUCTURE

The barge is to be designed to similar specifications as previously analyzed Rolling Boat models. At only 4 barrels long x 4 barrels wide, the standard 2" x 1" x 0.125" 6061-T6 aluminum tubing will provide adequate longitudinal bending resistance. To withstand the potential shear loads, 1.5" x 0.125" or 1" x 0.1875" 6061-T6 flatbar should be used for the longitudinal straps. The straps of the new series of boats, with 40.875" barrel spacing will be slightly more highly loaded, due to the flatter angle, but not so much that it presents a problem.

The existing end cap design can be utilized. The highest loads on the end cap structures are due to the cantilevered wings. Since the barrels have the same volume, the maximum support reactions at the wing hinges will remain the same.

DOCK/BARGE CONNECTION

The pinned connection between the Dock and Barge should be made with 5/8" stainless steel pins, to withstand the loads due to launching and trailering. The 5/8" pin does not have to be used when moored, without the bottom truss rails connected. One idea to consider is to manufacture a tapered pin, that will serve as a drift for connecting the two.

DOCK STRUCTURE

The Dock is to be a 4 barrel long x 3 barrel wide floating structure, which will remain attached to the Gangway, and serve as the mooring point for the Barge. The structure was preliminarily analyzed by assuming that the maximum longitudinal load would be imposed by completely submerging the pontoon by pressing down at amidships. The structural weight, including barrels and plywood deck, was estimated to be 815 lb. With a 5126 lb load required to submerge the



pontoon, the longitudinal rails would be subjected to a bending stress of 2800 psi, and the straps would be subjected to axial stresses of 9990 psi. Both of these values are below the 3.0 factor of safety level of 12,300 psi.

DOCK STABILITY

A preliminary estimate of the stability of the dock was developed. Based on the assumed weight of 815 lb, five people at 160 lb each (800 lb total) crowded to one side would cause the deck edge to be very near the waterline. ABYC H-35 rules for a three-pontoon boat show a calculated weight capacity of 1470 lb for this vessel. Assuming that the Dock is to hold one half of the possible 600+ lb Gangway, the persons capacity for the proposed Dock, when not connected to the Barge, should be set at 5.

GANGWAY STRUCTURE

The Gangway is to be constructed using standard Rolling Boat 2" x 1" x 0.125" rails, endcaps, and 1" x 0.1875" FB longitudinal strapping, but without flotation barrels. Structural calculations show that this section would be capable of safely handling the load of 5 people crowded at mid-span, when built to a length of 24'. A 24' span, with plywood decking and rails was estimated to weigh just over 600 lb. This condition would put a 700 lb load on the end of the Dock, which will most likely be the maximum weight that can be sustained on one end. As a preliminary estimate, this limit of 5 people for the Gangway is logical. With the Barge attached to the Dock, the system response will be better.

MOORING ARRANGEMENT

The arrangement show for anchoring the structure appears adequate. Leaving the Gangway upper end free to rotate on its rollers is a wise decision, which will allow the Dock and Barge to sway slightly on its moorings, without inducing lateral stresses in the Gangway. The only suggestion is to utilize 3/16" or 1/4" Stainless (304) plates for the wear contact points under the rollers. Aluminum will corrode rapidly when subject to constant abrasion, and stainless is the industry standard for civil and shipbuilding contact points that cannot hold paint.

SUMMARY

The concept evaluated appears to be workable from an engineering standpoint. If there is a weak link in the system, it is the capacity and stability of the Dock. At only three barrels wide, the estimated capacities stated above may not be adequate to meet the owner's goals. If that is the case, the Dock could be enlarged, either through the use of wings, or by making the Dock four barrels wide.