

# Calypso dingy crane project ideas

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## History & Motivation

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## In the beginning...

- Calypso is an Island Gypsy 36 Europa
- When I purchased Calypso (in 1997) she came with a hard sailing dingy, which was kept on the flybridge deck.
  - & there was a fixed boom crane to launch & retrieve the dink.
- The hard dink was sold as we preferred to use our Achillies 10' dink.
- Thus began the multi-year "I wish this was easier" saga...

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## Old Crane Issues:

- The fixed crane arm was made for the sailing dink & its dimensions were never right to reach a balance point for the Achillies.
  - Could not handle dink as a single unit
    - Had to launch dink then,
    - Lower and put motor on dink,
    - then put accessories into the dink
    - Reverse the process to put it all away again.
  - This much hassle makes us avoid using the dink for "quick trips"
  - 25 years ago, I did that for "weekend use", now I just don't bother unless the dink will be in the water for several days.

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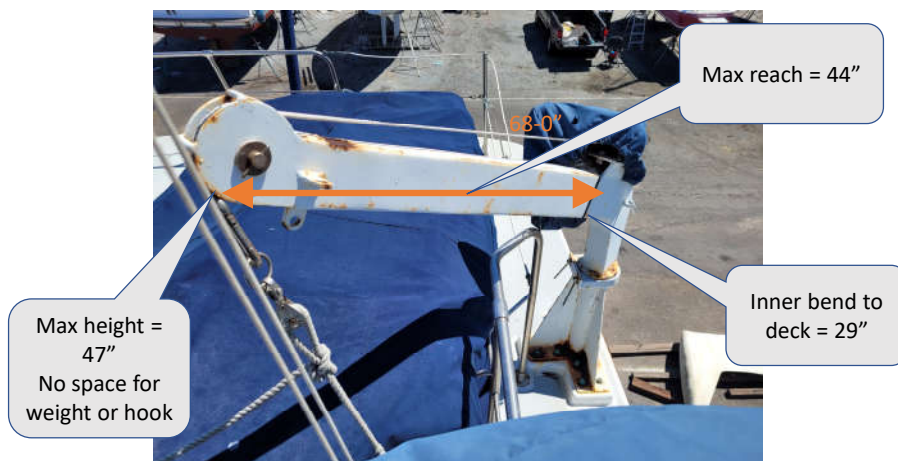
## The 2022 straw for this camel's back...

- The old crane was steel and slowly deteriorated over the years
  - The rust gradually overcame my ability to repaint the crane
- In Dec 2022, the crane mount started leaking and water was entering the saloon.
  - The crane was no match for the water from the 2022 Calif atmospheric rivers.
  - I removed the dink from calypso & it went to the garage.
  - Then I removed the crane, & the FB deck FRP was temp patched to eliminate the leaks. All is now again dry inside.
  - Since then, I've had no way to use the dink.
- SO.... Project Time: Design a replacement dink crane

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## Core problem: Old crane reach to low & short

Some old crane key dimensions



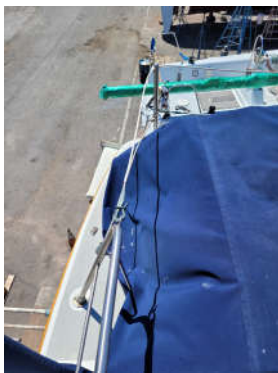
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## Dink deck pics



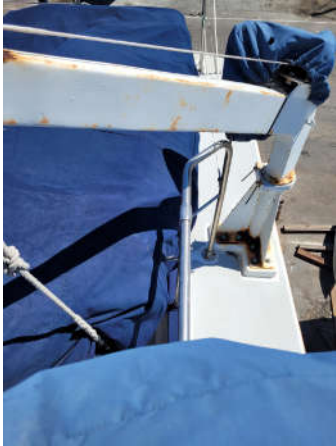
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## Dink deck pics



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## Base mount, railing & aft stanchion



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## Crane Functional goals

- Launch & retrieve dink as one assembly (w OB, tanks, gear etc.)
  - Drop it in, use it, lift it back up and store it on FB
  - OB is normally stored on FB railing. I'd like the ability to move OB from rail to dink & back.
    - => Need to raise & lower boom under load (to adjust boom arm effective radius)
    - The dink is not a hard bottom. So OB on dink transom is OK for short hops, but the cantilevered OB weight on the dink transom worries me.
  - Crane reach to dink balance point
    - Guessing at location – so need some fine balance tuning adjustment (lift harness can do this)
    - Some adjustment range built in, in case dink balance changes in future
    - Or we get a new dink (!)
  - Lighter crane weight than steel crane (less boat trim impact)
    - AL 6061; Finish (Power coat or Awlcraft)
    - NOT steel to lower crane maint
  - Boom rotation: Has to rotate about 180 degrees (OB rail to dink transom incl port side of boat)

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## Project reality constraints

- I'd love to have a full power, extendable crane –
  - But that's overkill for Calypso and not reasonably within the budget.
- Calypso's mast not viable.
  - No boom, not engineered for the loads required.
- 80/20 approach ?
  - 80% of hydraulic power crane functionality for 20% of the cost?
- What is 80% for me?
  - Dink power launch & retrieve
  - No need for power crane rotation
  - No power arm extension
    - But do need to be able to place to vertical lift line location
    - I think adjustment amount I need can be had via a boom & topping lift.

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## Design simplification constraints

- New crane to use old crane base (pad, hole pattern, existing pwr wiring, backing plate)
- 12v power comes from deck, thru center of pipe to winches.
  - Will probably need wiring extension for addtl new crane height
  - 2 elec winches: dink lift, boom lift
  - Wireless remotes would be convenient
  - Operate 1 winch at a time, so no double pwr draw issues.
- Design for current Achillies dink and allow for possible future hard bottom dink replacement.

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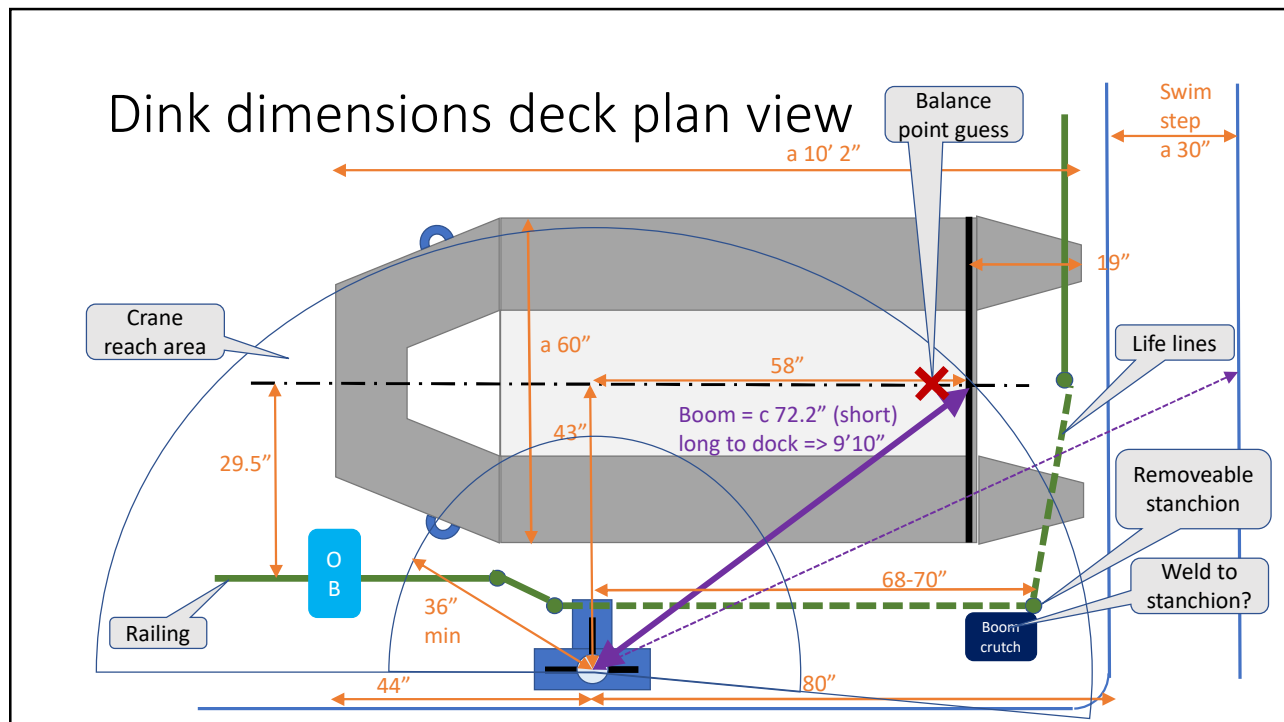
## Fabrication constraints

- I can do the detail CAD & CAM design and fab most of the parts.
  - 6061 Al is easy to work with (this could be fun).
  - It helps when you a lathe and a CNC mill ;-)
- What I don't have are sufficient Al welding skills or equipment.
  - Fab welding will need to be farmed out.
  - I'll need to find a flexible welder as this project will be a custom one off

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## Dink & Crane Sketches

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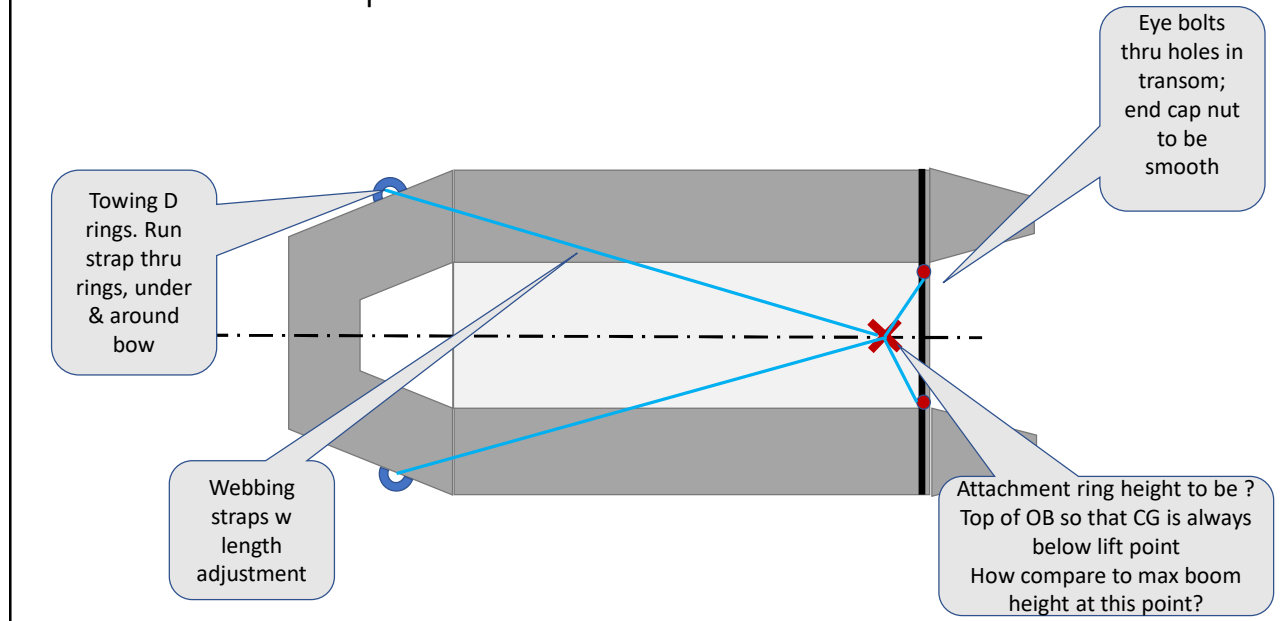
## Abandoned feature idea

- Extend reach to lift from swim step or dock when sterned in?
  - Initial measurements say this would change boom length from 6' to 10' min.
    - That's a lot more loading...
  - I had considered an extendable inner section in the boom to get the extra reach
    - Could use a fast pin to make two length boom
    - Scrapes inner section finish
  - Issue: vertical lift line vs aft deck FB overhang.
    - I could maybe still use 6' boom to lift from dock on port side onto aft deck
      - With grunt work since the lift line can't be over the covered deck
    - Gut feel is that this is making life too complicated.

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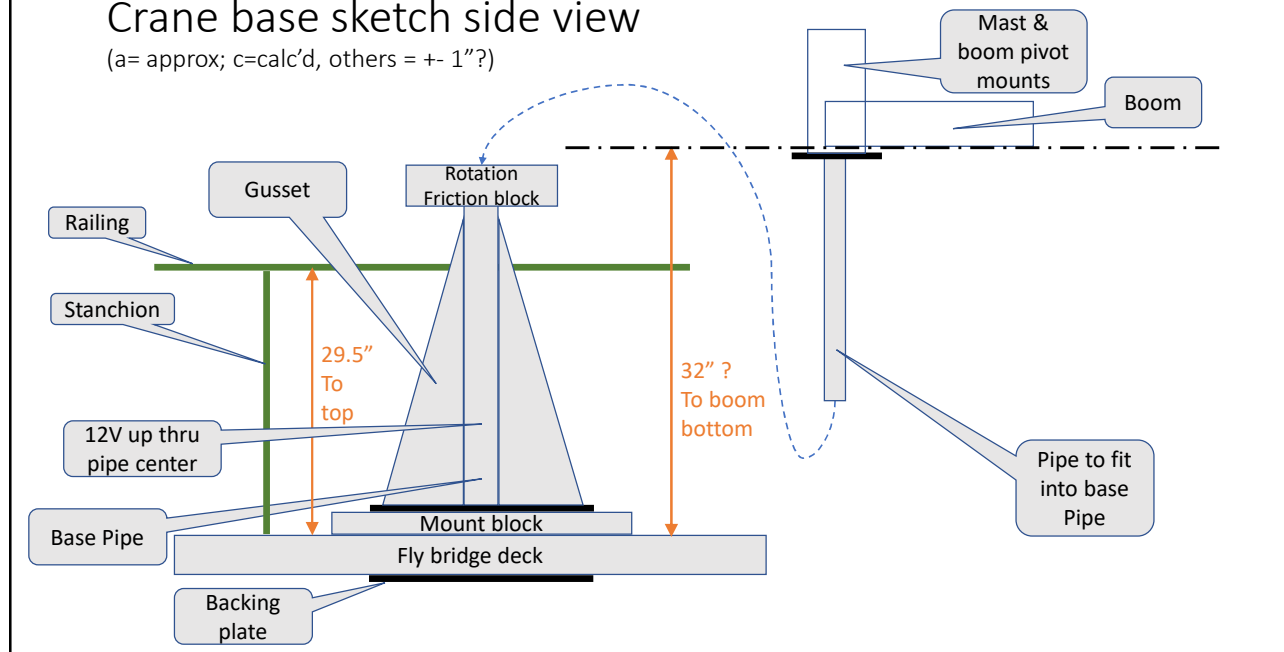
## Dink harness plan view



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## Crane base sketch side view

(a= approx; c=calc'd, others = +/- 1"?)

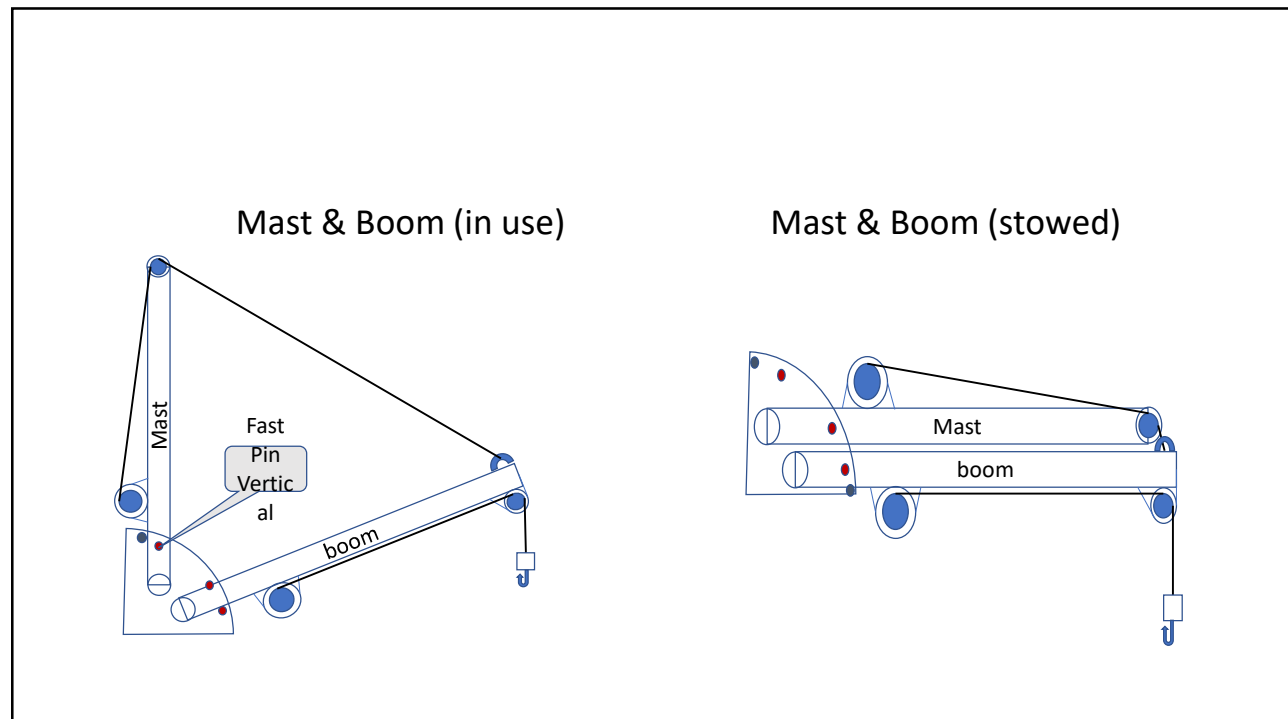


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# 1<sup>st</sup> Idea: Fold away mast & boom

Folding crane assembly to stow along port side fly bridge lifelines when not in use.

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## Misc design issues

- Lift point height vs dink CG vs max boom height at transom
  - Is there enough? This is what drives vert height of boom when stowed in horiz position.
- Strength concerns
  - Boom and mast cross sections & Size – what is required?
    - Cantilever beam calcs?
  - Load design point? 1000 lbs sounds like plenty
    - Dink 100lb, OB 75 lbs, fuel 85 lbs, misc equip 75 lbs
    - Water in dink when retrieving... max full =  $27 \text{ ft}^3 = 1700 \text{ lbs!}$ 
      - Way over kill – would lift just a couple of inches of dead water then drain to lift more.
    - Impulse loading loads as dink bounces on way up?
  - Pivot box has to keep boom and mast in a vertical plane
    - This would be a problem with a goose neck approach
- Pin holes, pivot holes –
  - Delrin bushings for low friction, Al/SS corrosion separation?
  - Make pins from Al rod? Strength ok? (shear thru pin force would be most likely)

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## Idea 1 status

- The primary appeal of this approach was not needing to see the mast when not in use.
  - It could all fold up horizontally to minimize visual impact.
- Disadvantage of this concept is that one has to “set up the crane” for use.
  - That counteracts the desire to “just use” the crane to launch the dink.
- I took this idea far enough to engage a NA for prelim loading calcs –
  - Prelim engineering calcs way this approach is hard to make string enough. All the forces are concentrated in the “hinge pivot” plate.
- Status: abandoned in favor of concept 2 suggested by NA.

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## Idea 2: Simplified fixed mast design.

Seemed silly to solve dink assembly problems just to replace them with Crane set up problems.

Pursued folding idea far enough to have prelim mechanical design calcs done by naval Architect.

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## NA inputs 2022-10

Here's a concept sketch. I've done enough engineering to know that tube & pipe sizes are workable. Your concept with the raisable control arm required a big diameter control arm and the loads on the fixing pin locations were pretty high, so I came up with the attached version. It does leave a 5-1/2' tall tube sticking up but I think it is stronger, lighter and simpler to build. Note that the boom lift line is a 2:1, which means the tension in that rope is similar in scale to the weight lifted. (winches are pulling similar loads)

My comment: Not sure 2:1 topping is needed. Using a power winch and even cheap winch ratings are 5x more than the 500lb design dead weight.

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## NA inputs 2022-10

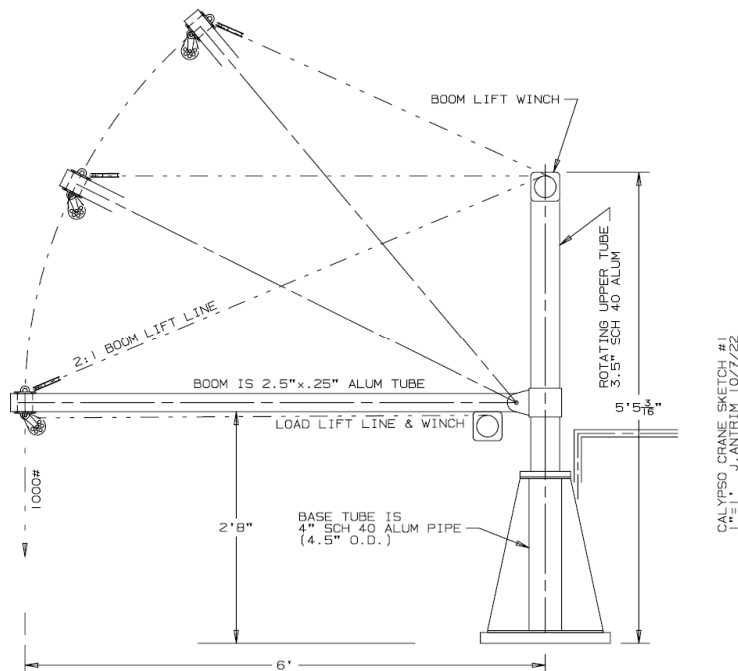
I ran the calculations for a 1000# lift load as you suggested; but I think we should consider that to have a 2:1 safety factor in it. In other words, avoid lifting more than 500#. The structure can take a bigger load but at something like 1400# you may be bending things. I think to design for a higher load makes everything too beefy and I would start wondering about ripping the base out.

My comment: mat & boom matl for design calcs is 6061 schedule 40 pipe

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## NA design 1 10-22

(scale not correct for  
pasted picture)



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## Boom swing thoughts

- Feeling untrusting of a boom on a goose neck – too much free motion
  - Leaning toward a rotating upper mast assembly, similar to old crane
    - That aspect of old crane has worked well for many years
    - Control depends on mast rotation friction, intend to use a friction clamp like the old crane had.
- This implies boom and mast attachment “box” has to be rigid as it will be the torque load area. Has to transfer boom swing to pipe rotation.
- Old crane has never lifted out of base – so not a worry with new crane either?
- Rotation is < 1 turn total so no prob with 12v wires wrapping around
- Lines to dink can be used to handle dink swinging (as done today)
  - With winch remotes, this would become a one man operation.

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## Other ideas?

Anyone have some other nifty idea for consideration?

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