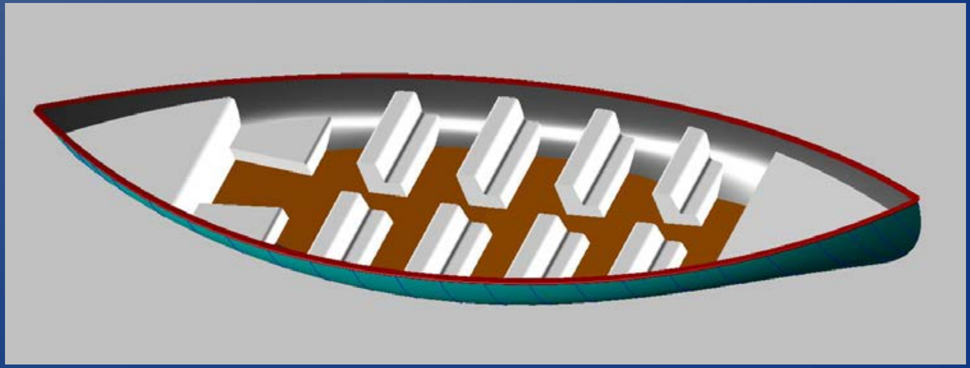
Recent Projects
Design by: Jim Antrim
Construction by: Berkeley Marine Center

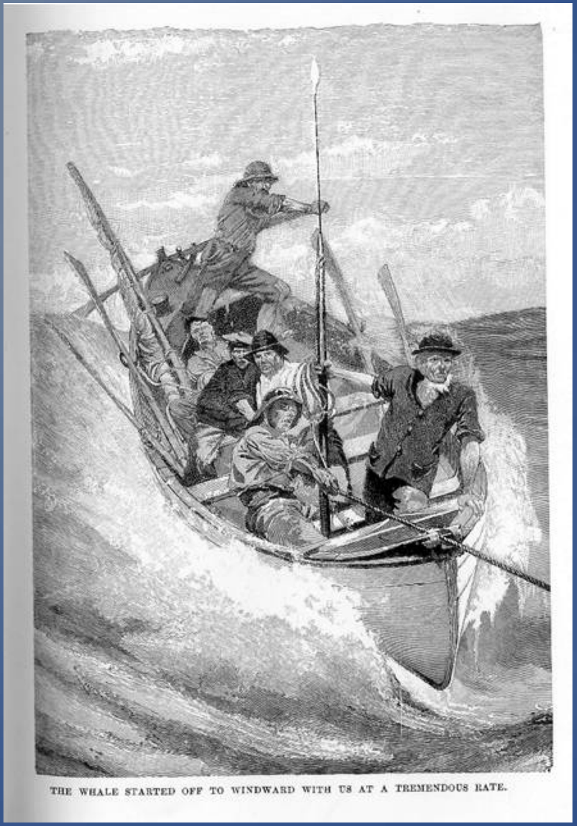
Rapid Transit – 49' Canting Keel Boat



30' Whaleboat for the *Ladies of the Lake*

the Whale boat

for the Oakland Women's Rowing Club (the Ladies of the Lake)



THE WHALE STARTED OFF TO WINDWARD WITH US AT A TREMENDOUS RATE.

The Nantucket Sleigh Ride

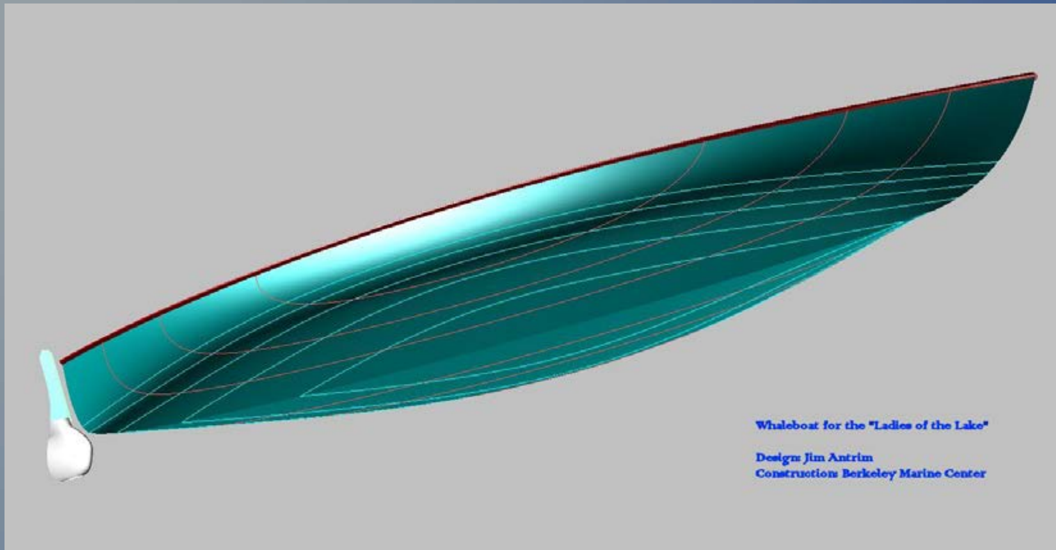
"Jim, we gotta do a whale boat!" - Cree Partridge

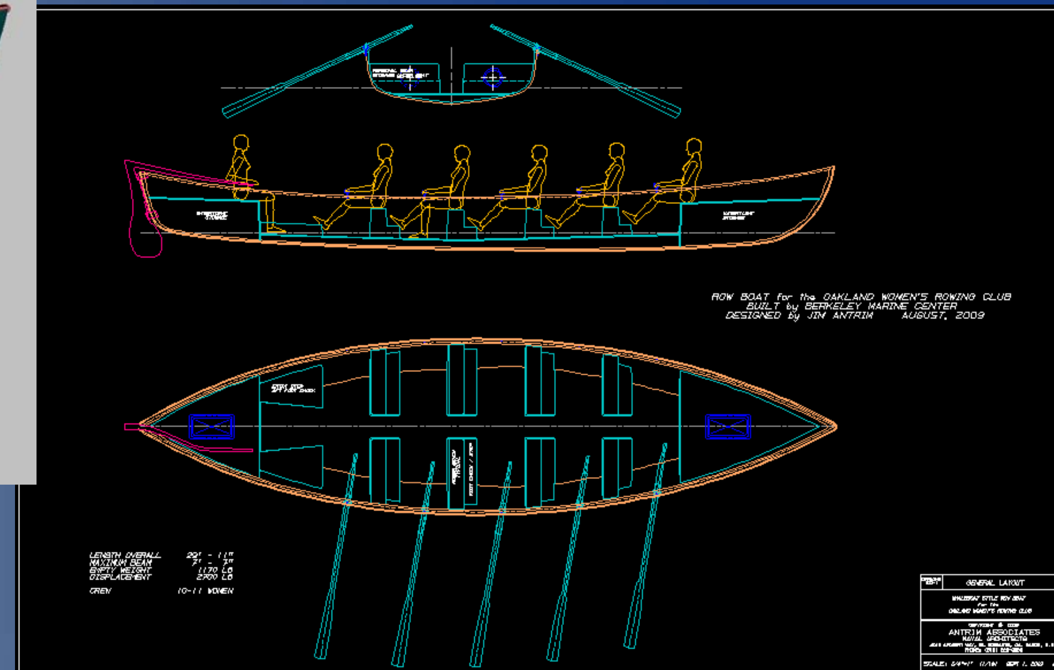
The Ladies of the Lake

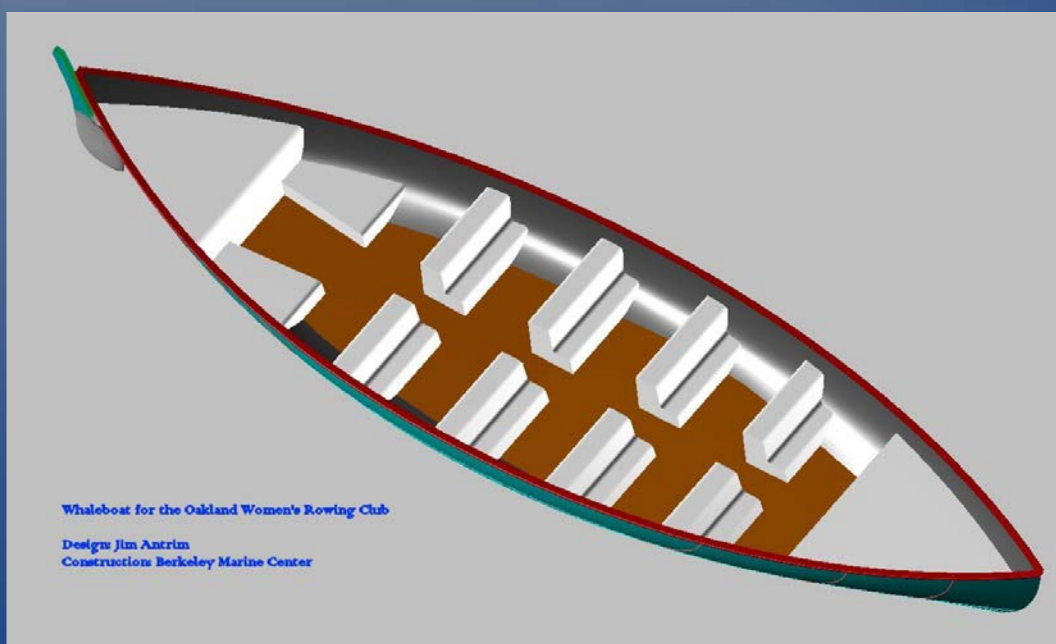
Sometimes when you meet the client, the game plan changes

New goals:

1. Stable platform for easy boarding
2. Low maintenance
3. Improved rowing ergonomics over previous boat
4. Easy to board and move around
5. Easy to row


Whaleboat for the "Ladies of the Lake"
Design: Jim Antrim
Construction: Berkeley Marine Center


ROW BOAT for the OAKLAND WOMEN'S ROWING CLUB
BUILT by BERKELEY MARINE CENTER
DESIGNED by JIM ANTRIM AUGUST, 2009
LENGTH OVERALL
MAXIMUM BEAM
EMPTY WEIGHT 1170 LB
DISPLACEMENT 2700 LB
CREW 10-11 WOMEN
GENERAL LAYOUT
ANTRIM ASSOCIATES


Whaleboat for the Oakland Women's Rowing Club
Design: Jim Antrim
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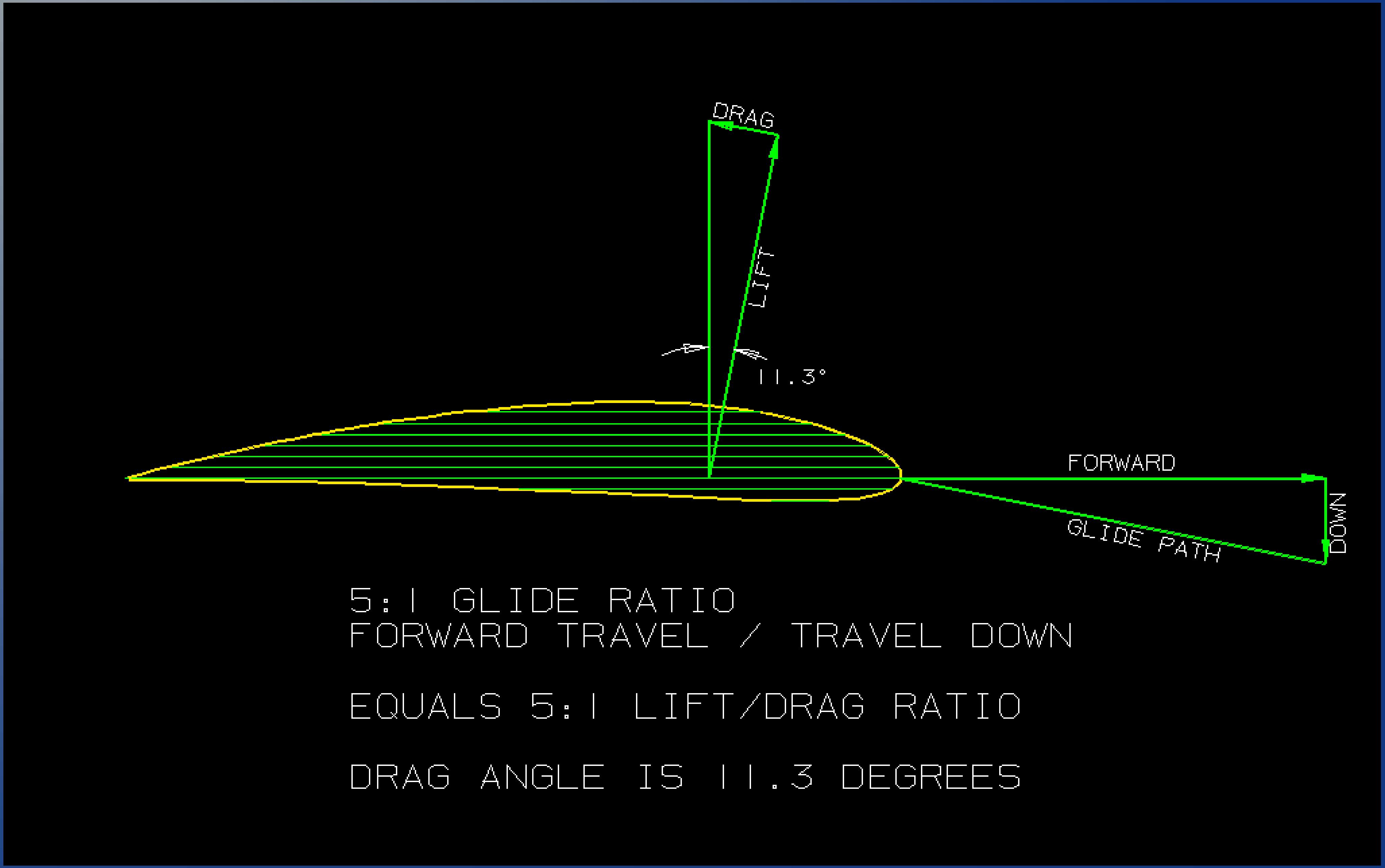
Glide Ratio = Lift/Drag Ratio
a measure of fluid dynamic efficiency



GLIDE RATIOS
of some flying things

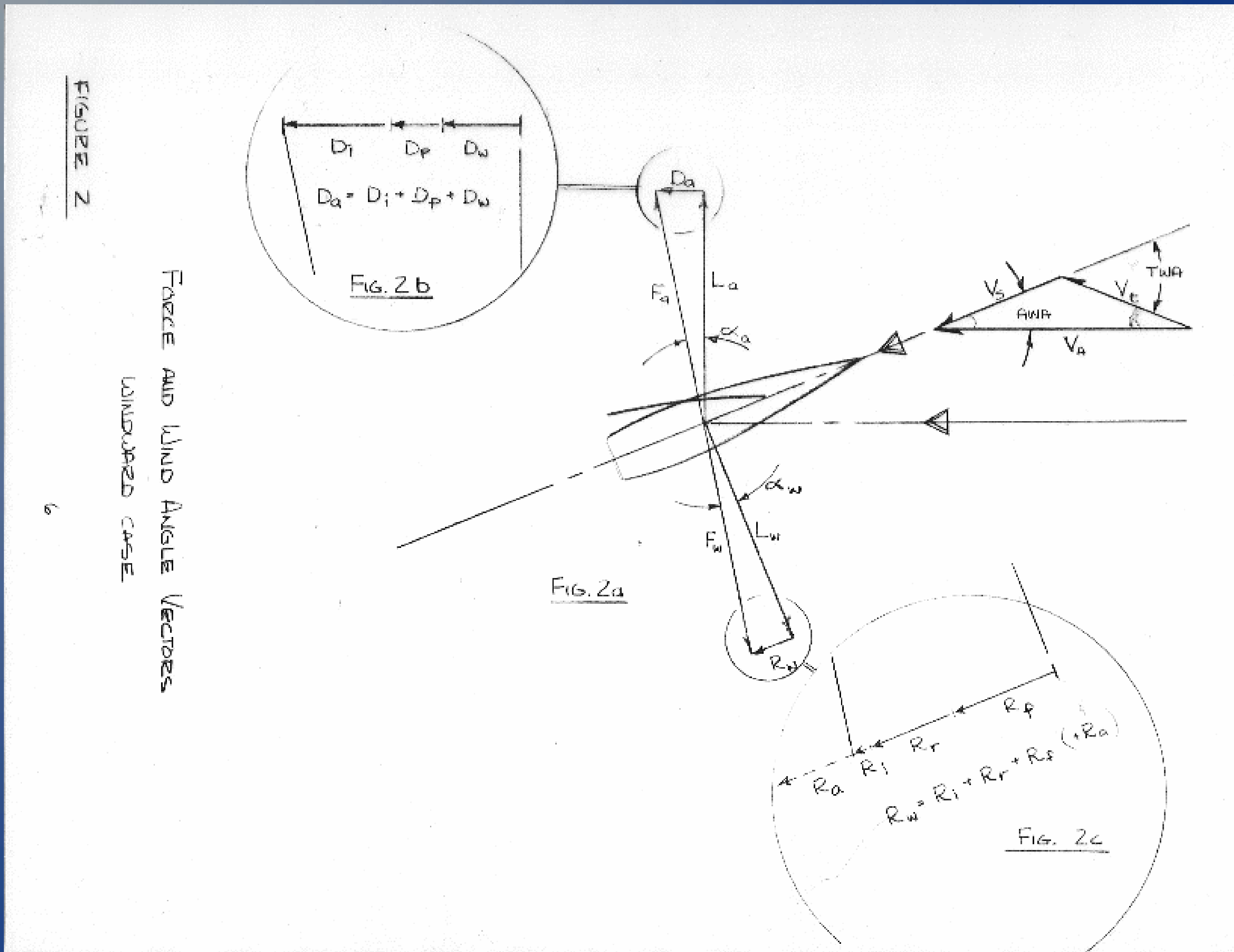

Space Shuttle Atlantis 4.5:1 glide ratio


Stemme ST-VT 50:1 glide ratio


Flying Squirrel 2:1 glide ratio

More Glide Ratios

Speed and Force Vectors of Sailing



A sailboat is sort of like a bird or an airplane except.....

The wing on the left side is lifting up
(the sails)
But the wing on right side is “lifting” down
(keel & rudder)
And that makes it want to flip over

And the wing on the left side is in air

But the wing on the right side is in water

And it is flying sideways
(can you dig it?)

SPEED POTENTIAL

$$\frac{V_S}{V_T} = \frac{\sin(TWA - AWA)}{\sin(AWA)}$$

MAXIMUM $\frac{V_S}{V_T}$ @ $TWA = 90° + AWA$

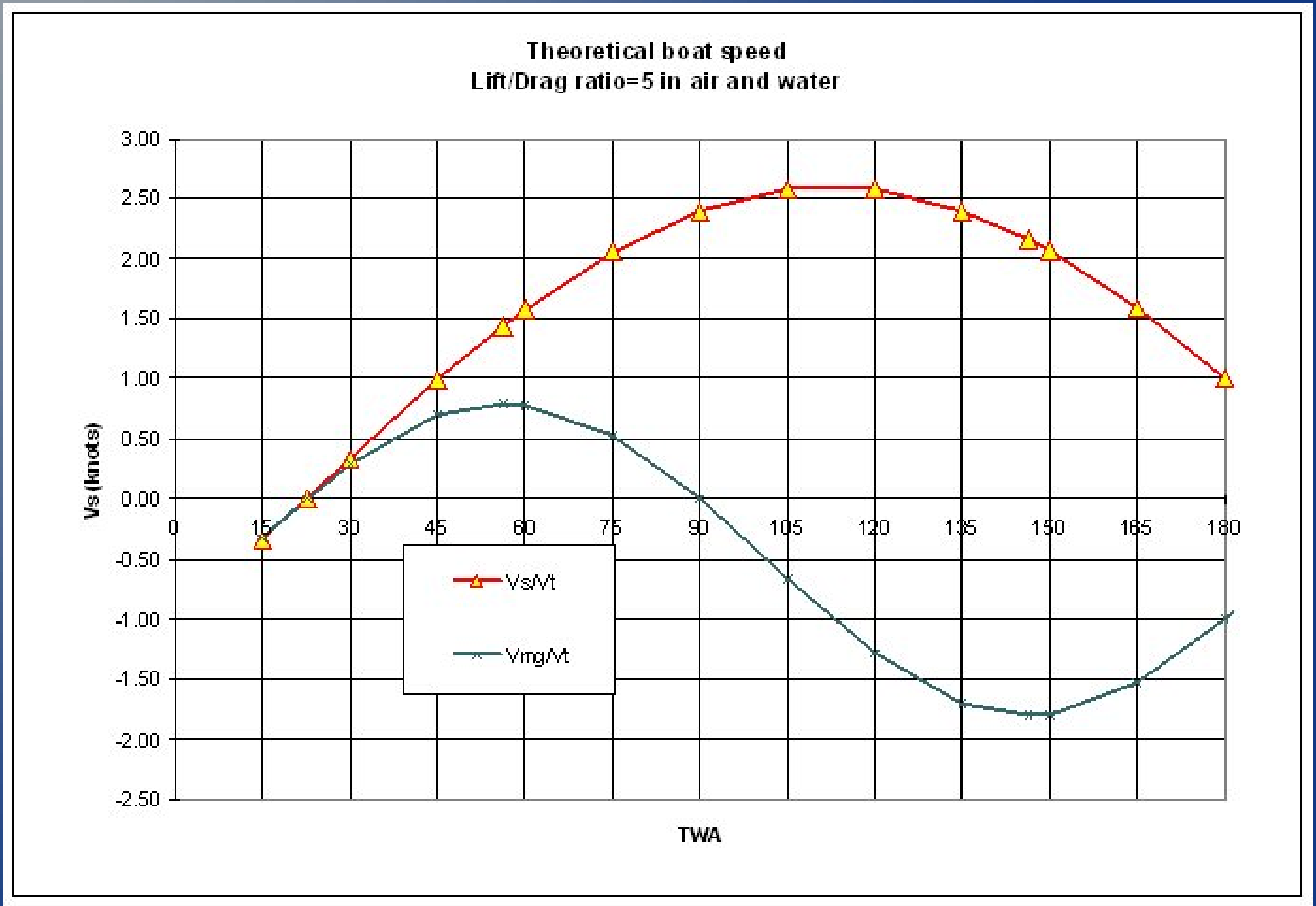
$$\text{MAX } \frac{V_S}{V_T} = \frac{1}{\sin(AWA)}$$

∴ LOWEST AWA FOR OPTIMUM TWA GIVES HIGHEST $\frac{V_S}{V_T}$

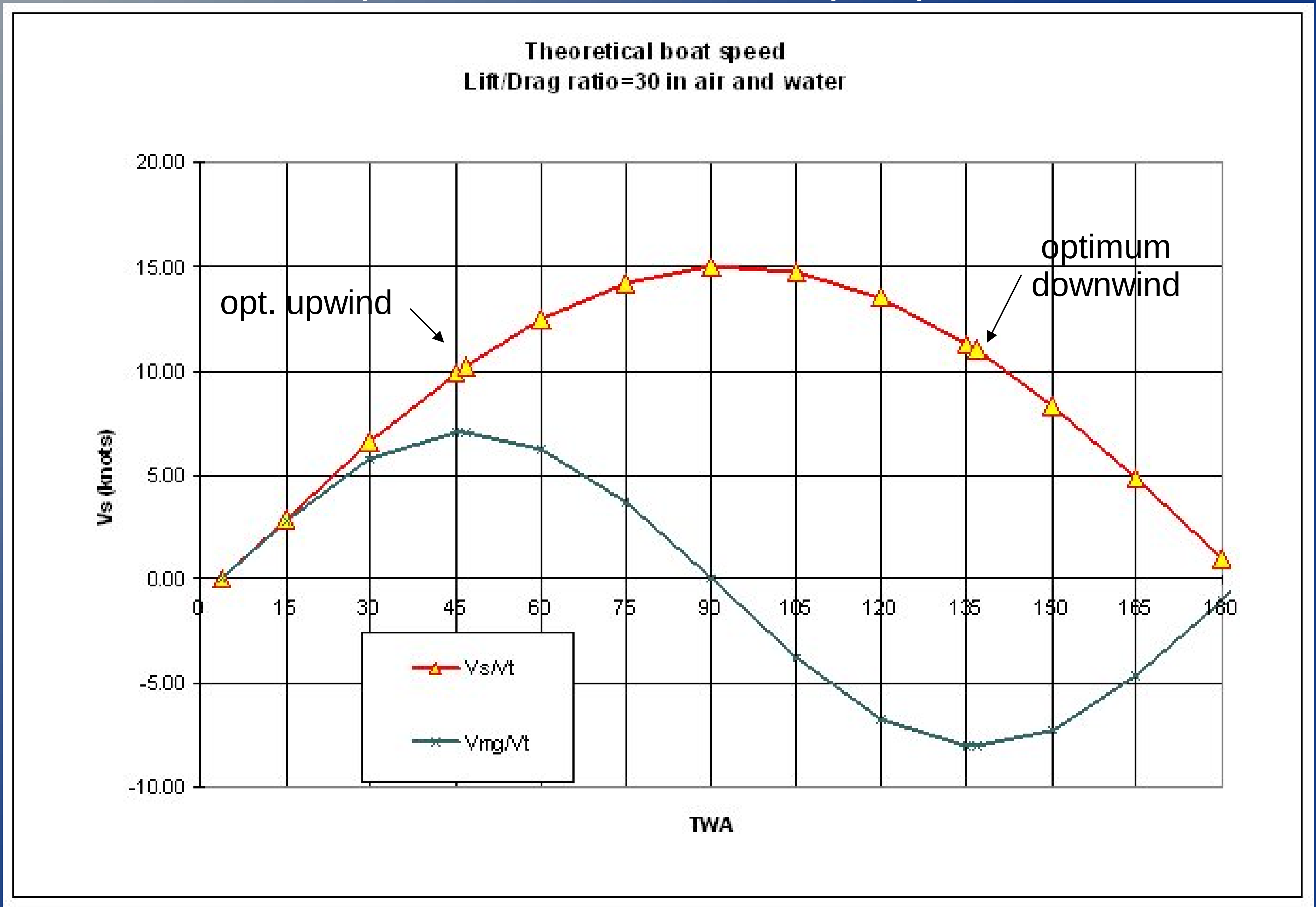
AWA	90°	75°	60°	45°	30°	15°	0°
TWA (OPT.)	180°	165°	150°	135°	120°	105°	90°
V_S/V_T	1	1.035	1.155	1.414	2.00	3.864	∞

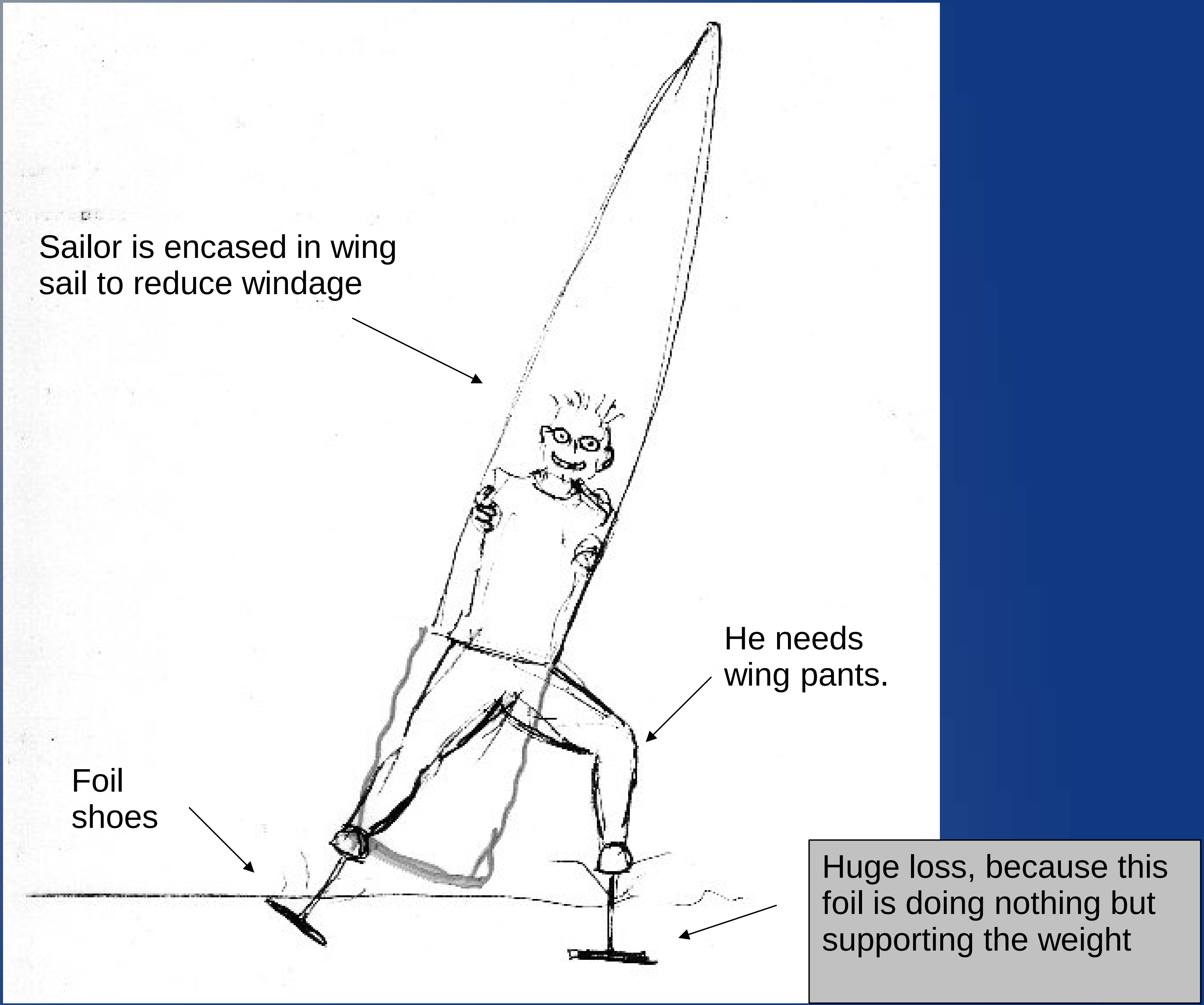
$$AWA = \alpha_a + \alpha_w$$

L/D=5 , only slightly better than the space shuttle
Curve is shifted to the right by AWA = 22.6 deg (sum of drag angles)



If only we were as good as a CONDOR
(iceboats are in this ballpark)




Sailor is encased in wing sail to reduce windage
He needs wing pants.
Foil shoes
Huge loss, because this foil is doing nothing but supporting the weight

That's nice, Jim, but what the heck does all this have to do with the BOATS you are supposed to be talking about?

Excellent question!
To make the boat fast, we want to make the lift (side force) high, and the drag low.
That gives us a high L/D ratio

To make the side force high, we make the stability, or righting moment of the boat very high.

OK, so how do you make the righting moment high?

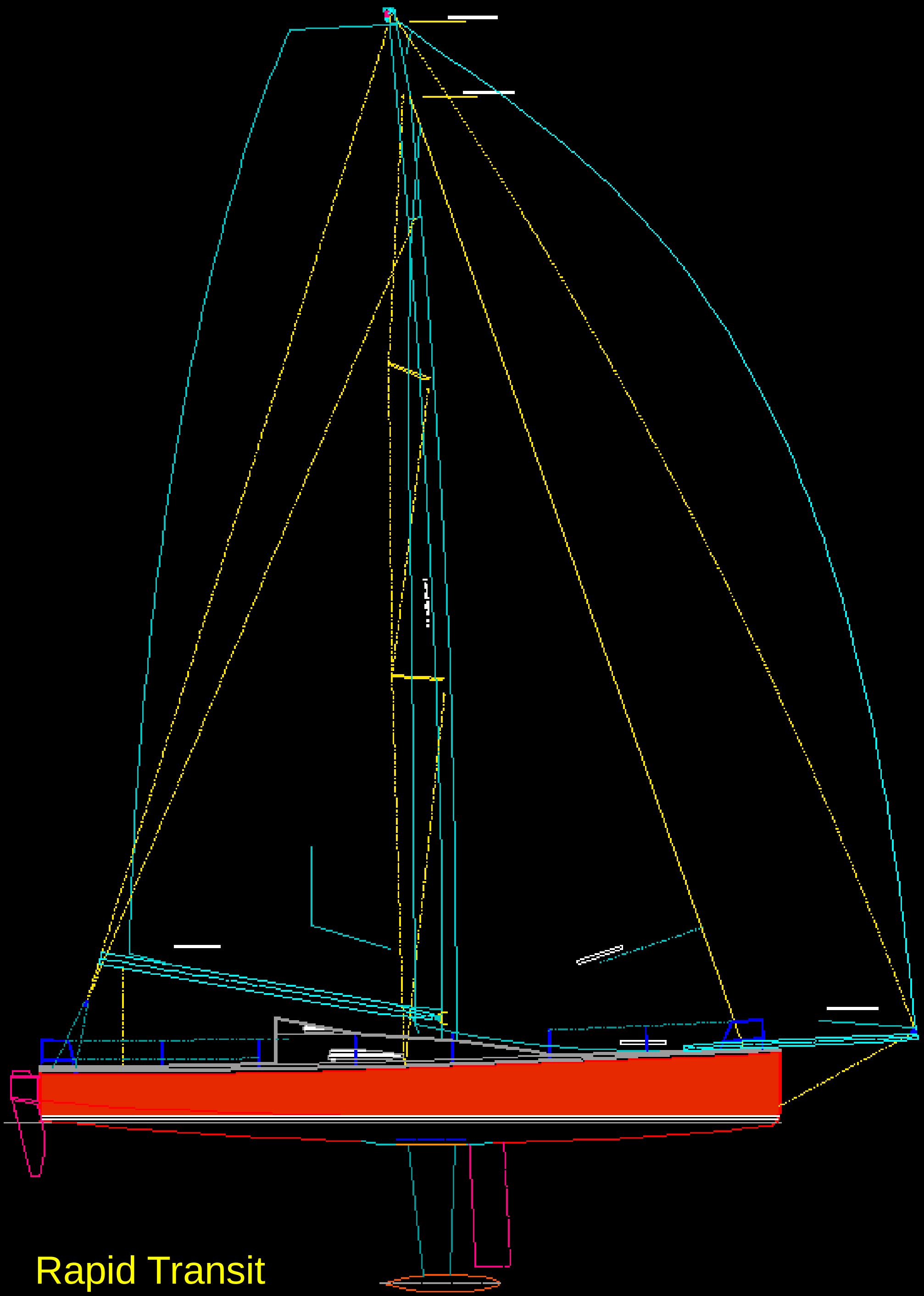
(no bad jokes please)

1. By moving the buoyancy to leeward

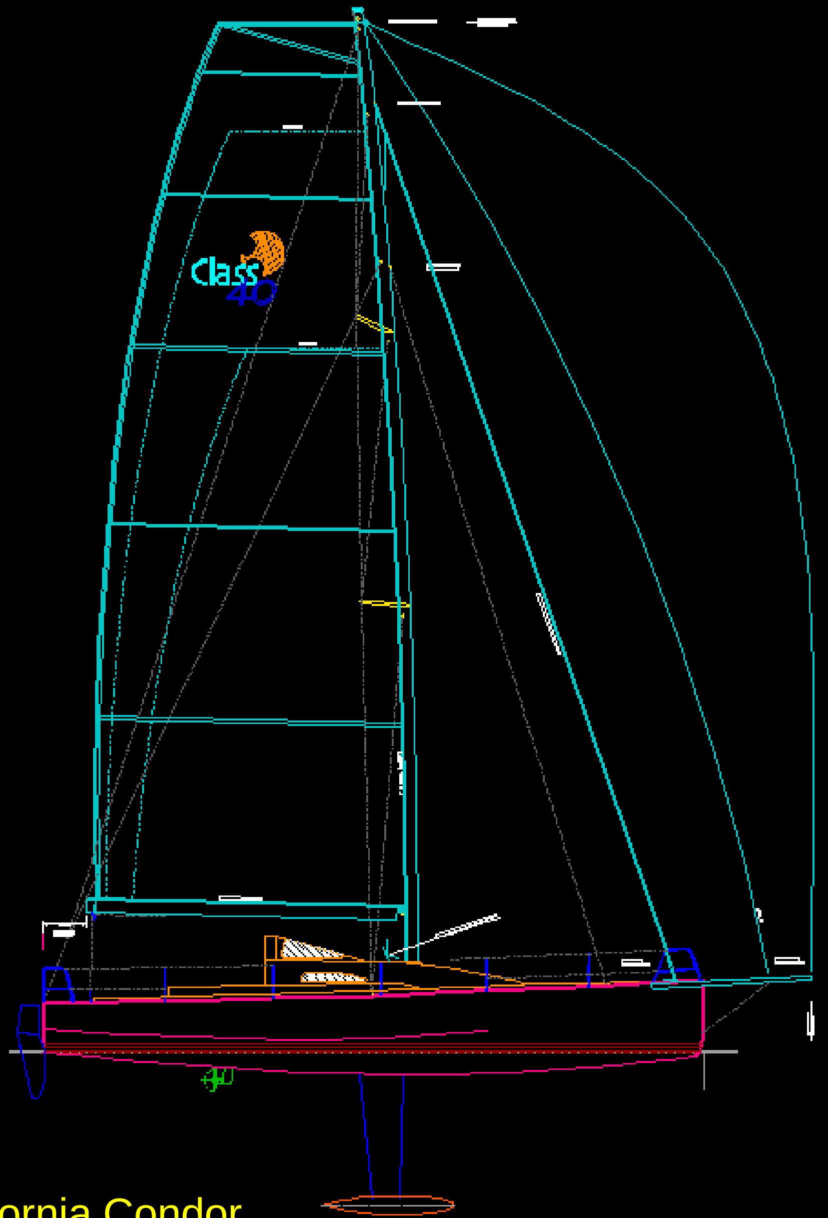
- floats or amas, as in multihulls
- wide beam monohull

2. And by moving weight to weather

- crew on rail or trapeze
- low Center of Gravity (bulb keel, light rig, light deck)
- water ballast
- canting keel



Rapid Transit



California Condor

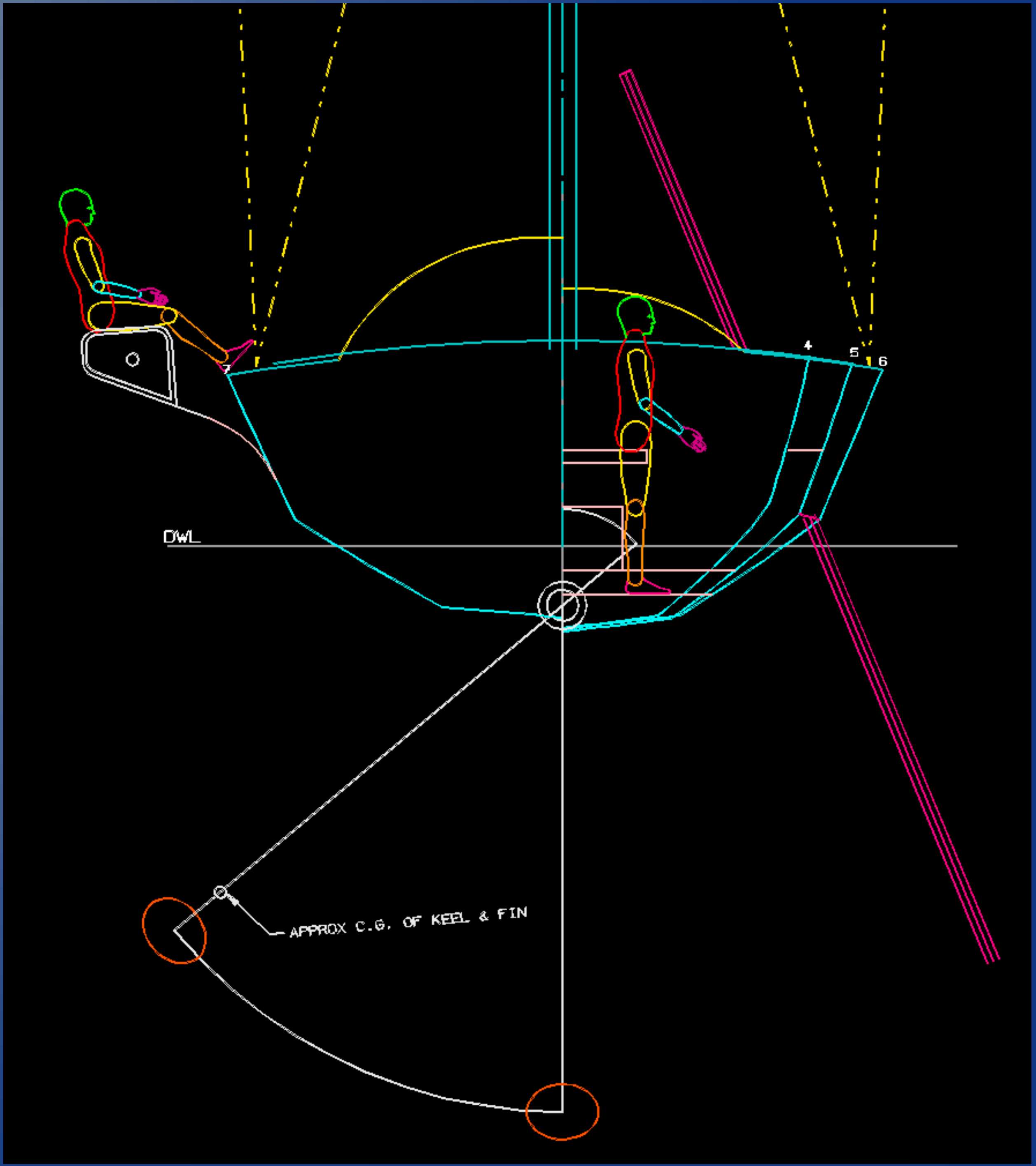
Design 95, Rapid Transit
Early concept sketch

Water ballast tank hiking seats
- good RM without fin drag
- leeward buoyancy well placed during knock down
- phenomenal cockpit

Bilgeboards
- fast
- more complication for crew

50 deg keel swing/side
- 12.33' draft
- (eventually reduced to 11.22')

Initial hull computer model was Design 90 “XL” scaled
- After VPP studies went to more powerful hull shape,
- “narrow” beam/length ration

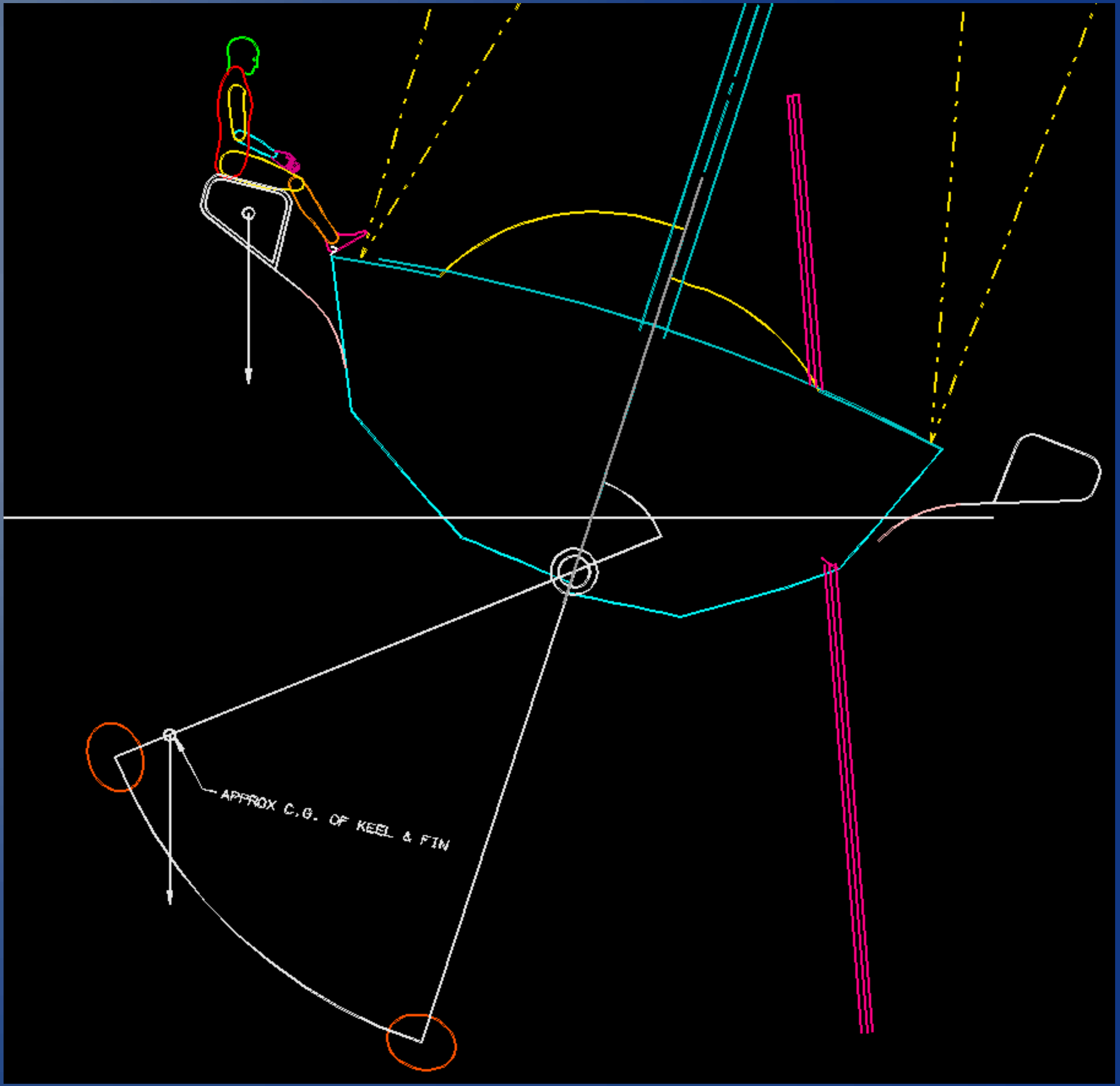


How thinking changes

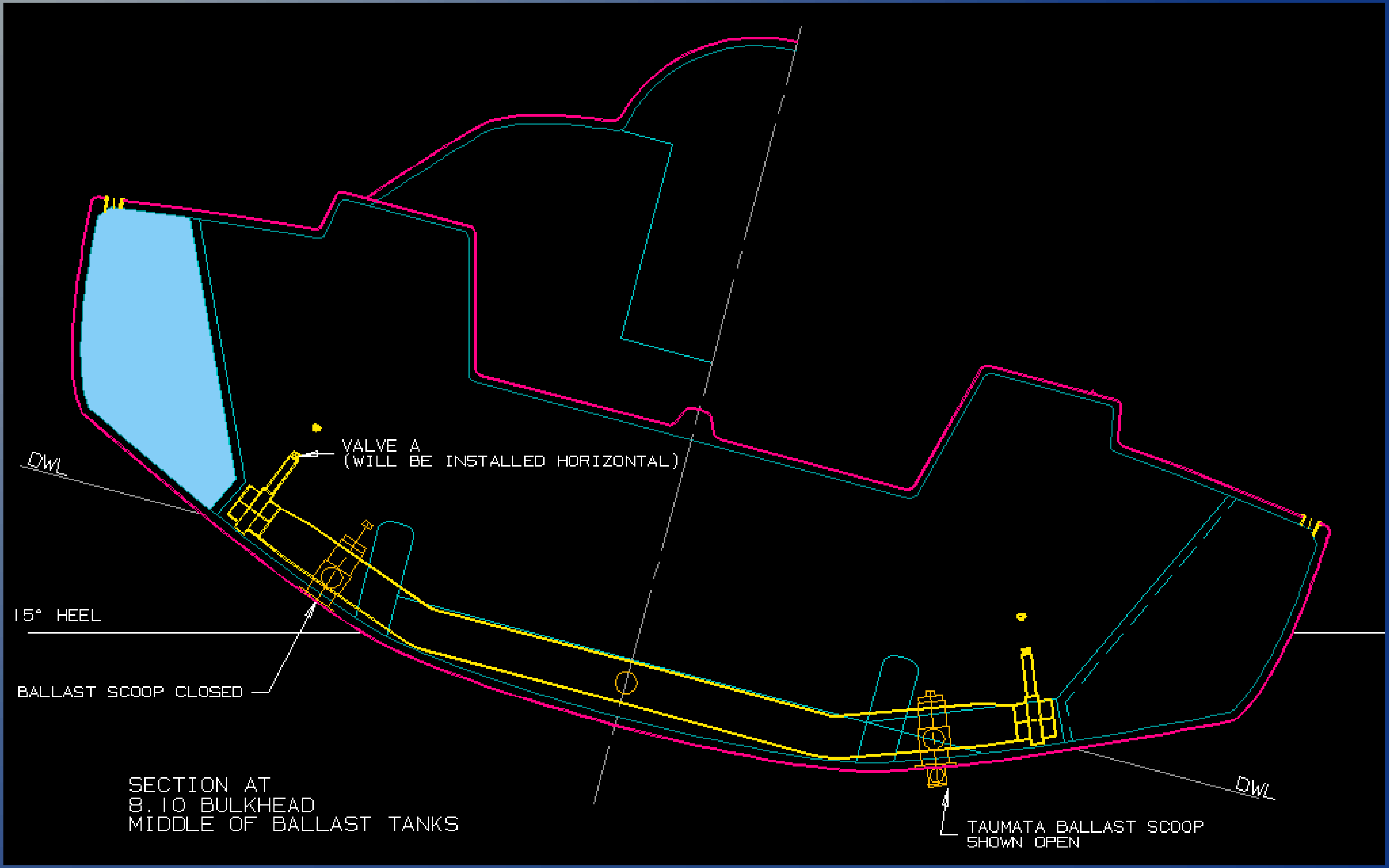
Ballast tank/crew don't get weight nearly as far outboard as canting keel.

Hard to keep leeward flare out of the waves

In out of control situation (broach) canting keel has MUCH better capsize recovery (if it is on the right side)



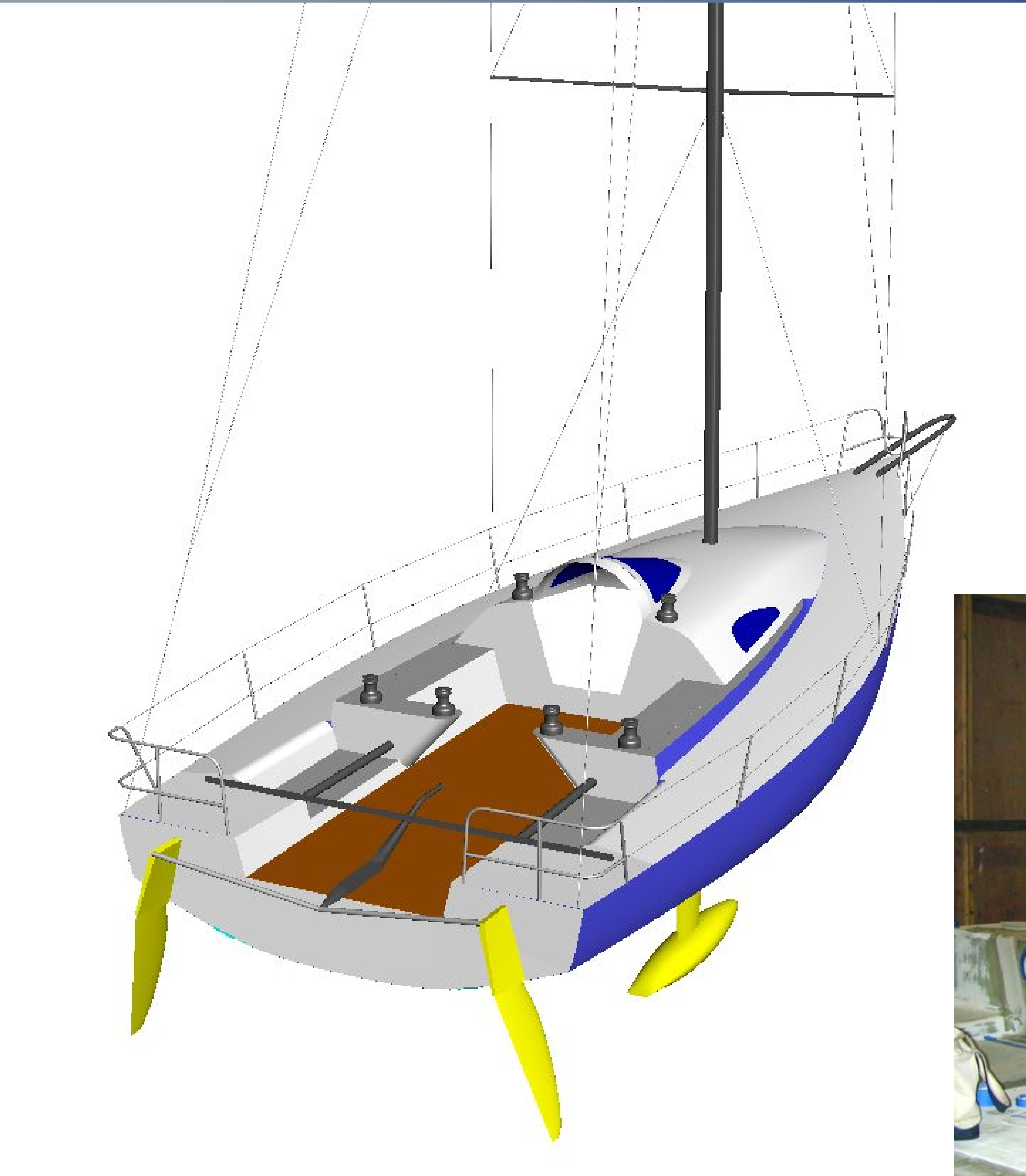
The water ballast solution



Wide hull puts water ballast well to weather
Center of buoyancy of hull well to leeward

Yippee Kai Yay, launch day (sistership to California Condor)

This is typical sailing attitude.
Note buoyancy will be well to leeward.
Leeward rudder pintle is vertical.
Flattish planing surface to leeward.
Water ballast way out to weather.
Unique forefoot chine sheds water.
It's all about increasing power while decreasing drag.

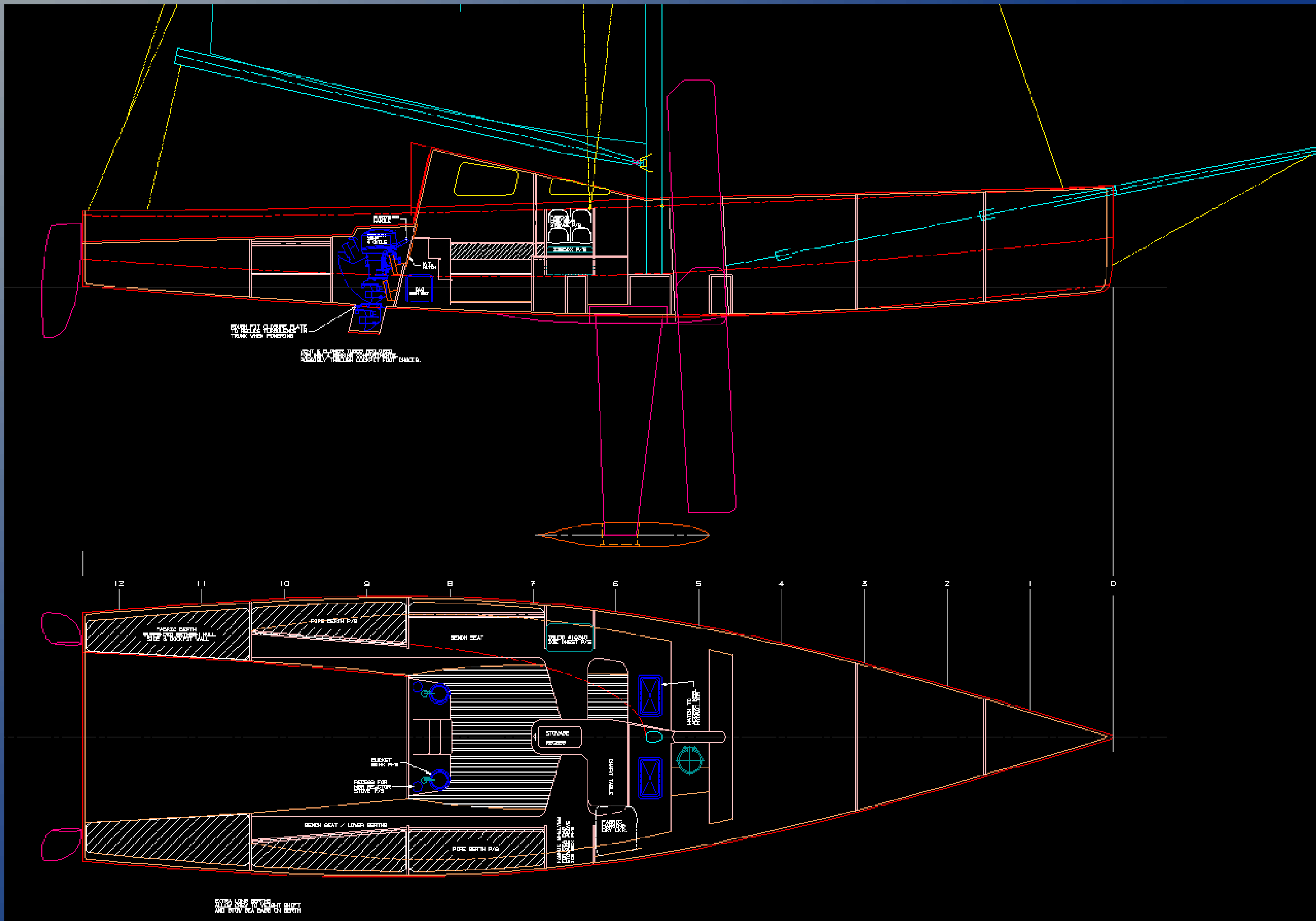


Design 99

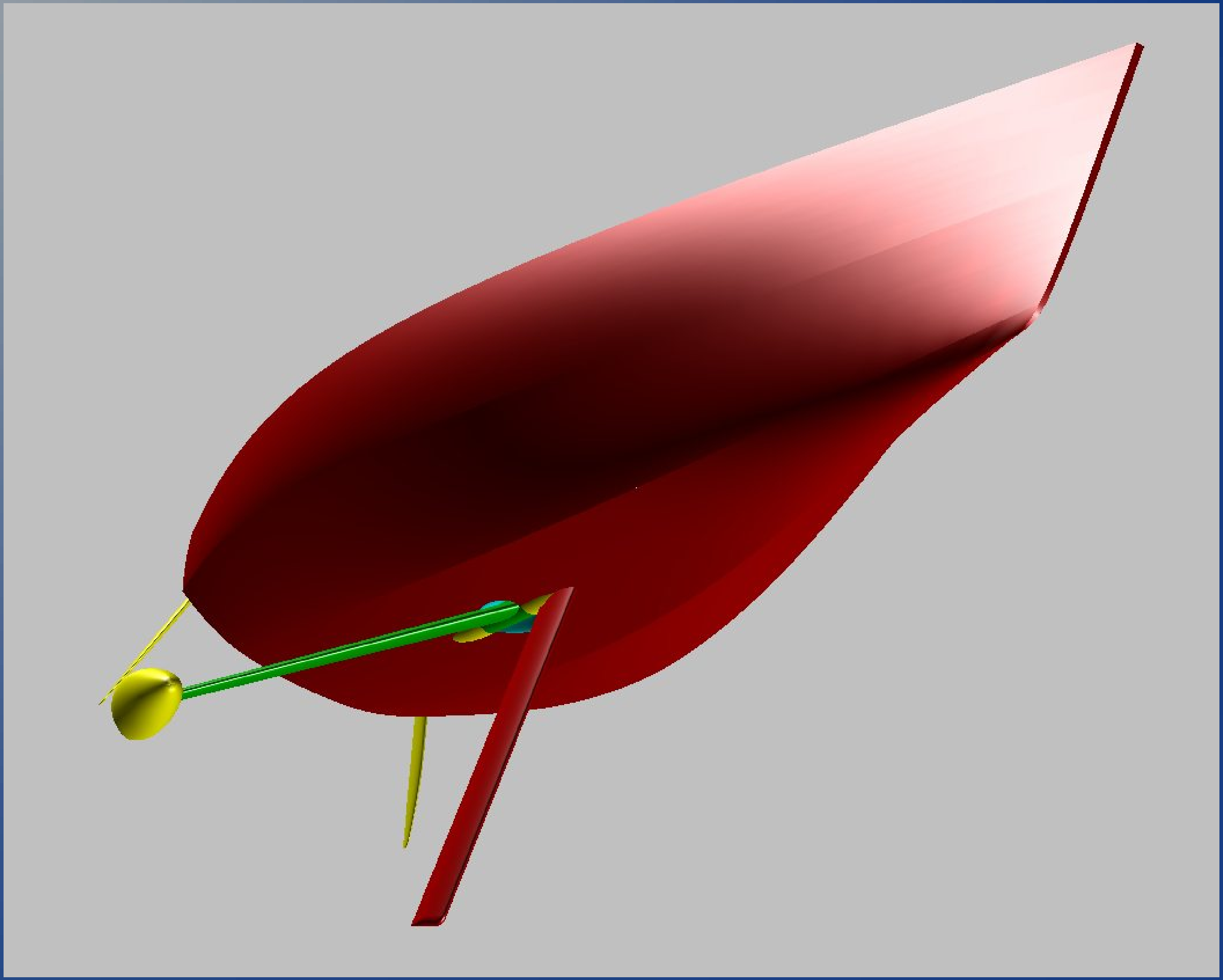
California Condor

Taking shape

Rapid Transit – Preliminary Accommodation



Computer model   Design 95   *Rapid Transit*

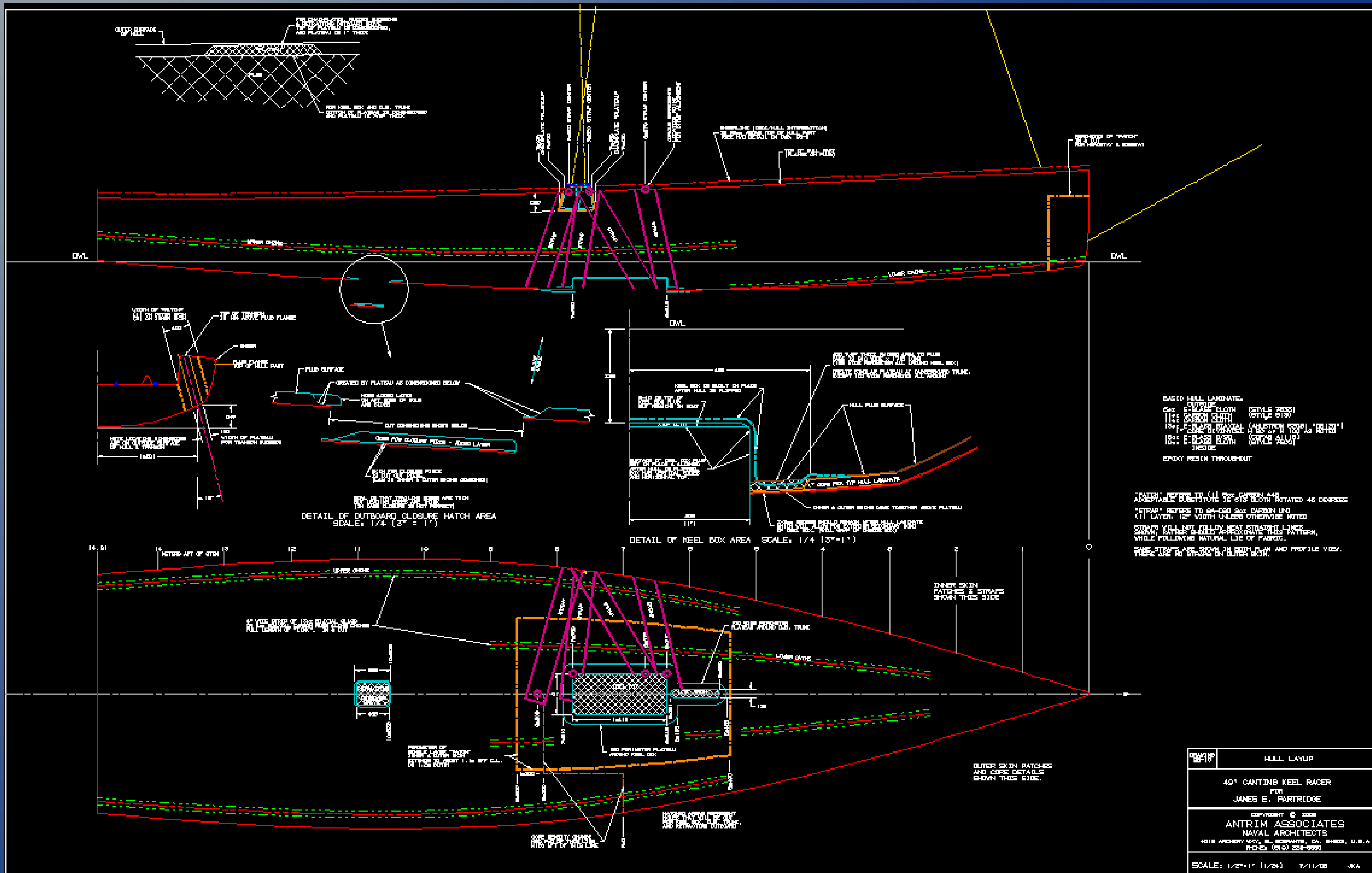


The days of hand lofting are over!   *Rapid Transit* construction starts!
Computer files of hull frames go by email to John Palmer in Grass Valley
CNC router cuts them out
Cree picks up the plywood frames - tax day 2008
Put slot A into notch B

Voila!

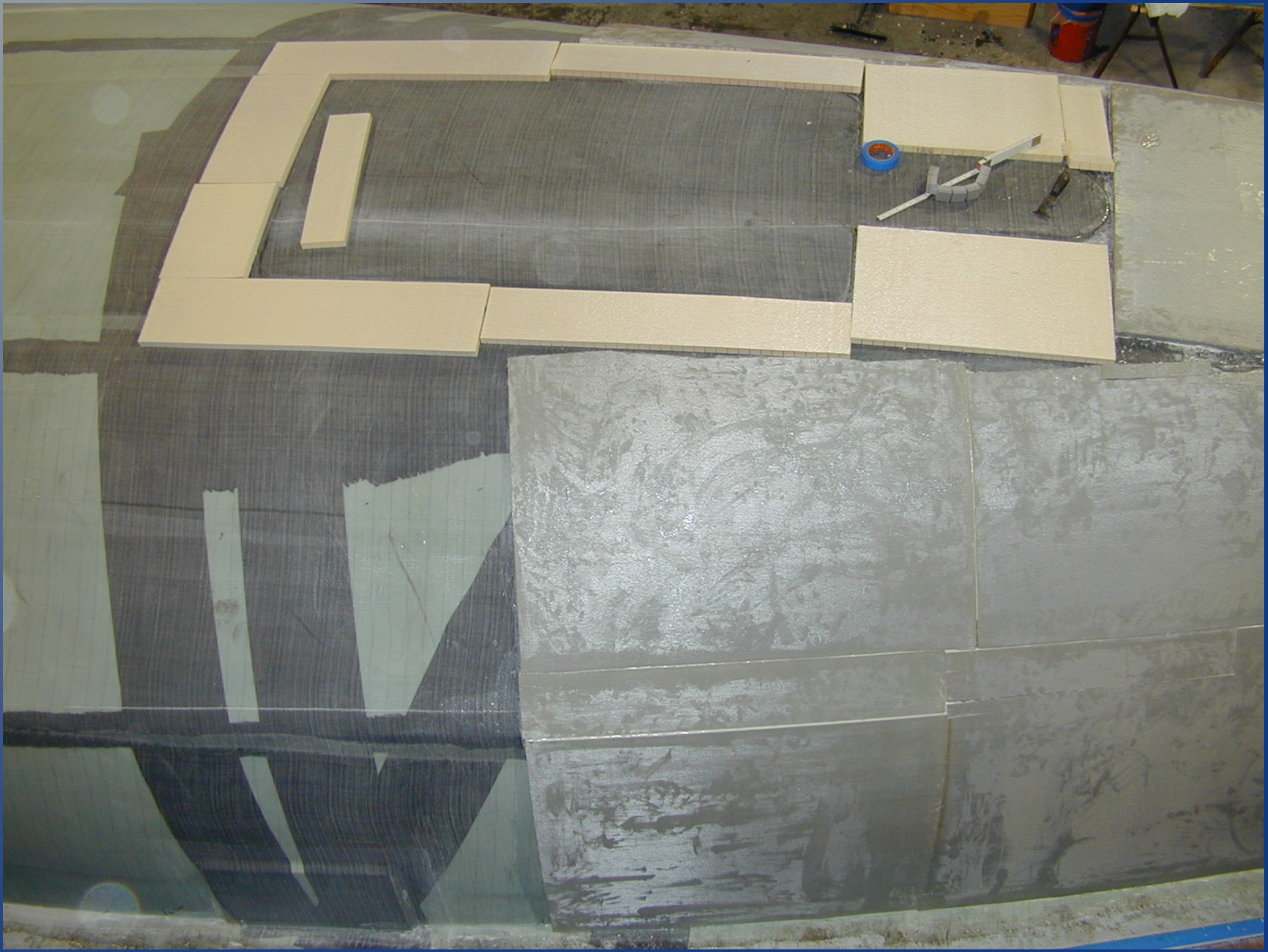
Rapid Transit Construction Plan

(one drawing of many!)



Note carbon straps following chines & from chainplate to keel and mast step area

Carbon straps shown in last slide
This is inner skin. Foam core being fit



What do Jim & Cree have in common?

Jim, can you design a ....

Cree, what do you think about building a ....

Answer:

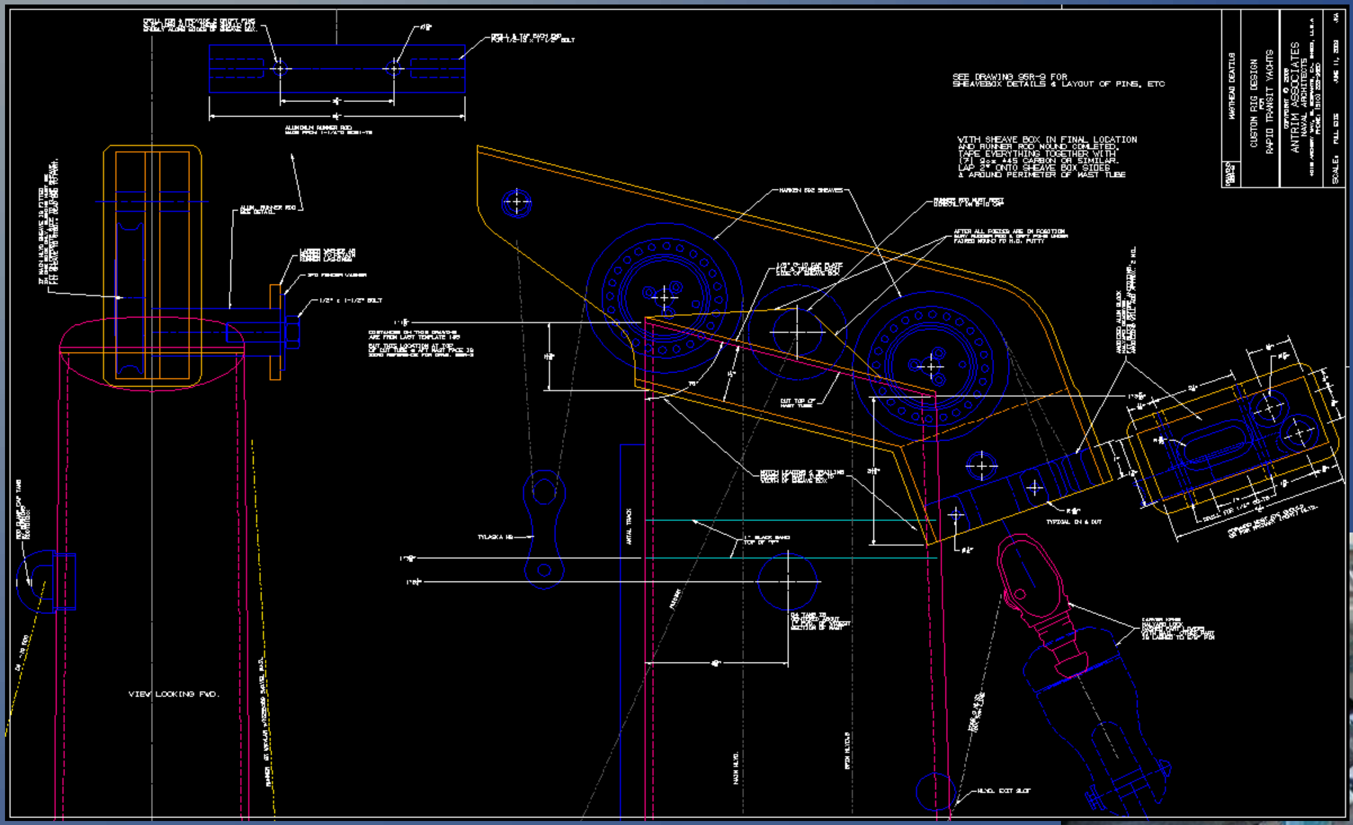
SURE!

Carbon masts are expensive... Gosh, let's *build it ourselves!*

Especially helpful when the boat owner is president of a materials testing company!

Masthead detail

All mast and bowsprit details were custom design & custom build



Foils

CNC cut keel fin molds
Rudder blades in background

Daggerboard half under construction

Custom parts: It's not mass production!

Carbon chainplates above
Installed below

Custom gudgeon

4200# keel bulb

It's so hard to find enough crew