

Rudders

- As important as standing rigging and mast!
- Know 'em, Service 'em, Respect 'em

Know' em

1. Designated expert and back up with extensive knowledge of steering system
2. Don't assume a factory or after market installation is reliable
 - Check it
 - The story of the Autohelm 2011

Know' em

3. Be familiar with primary steering gear, control cables (or gear system), linkages, and pulleys or sheaves
4. Ensure **emergency tiller** for rudder actually works
 - Tight fit (no play)
 - Try it under load

Service 'em

1. Prior to race service and inspect all components

- No worn or fatigued parts
- If SS consider drop rudder to inspect at lower bearing just above rudder (ultrasound test?)
- Upper and lower bearings not worn
- Lubrication

Service 'em

2. Plan for spares (e.g.; cable/kevlar line, linkages)
 - On Safety Equipment Chart
 - Take required tools

Service 'em

3. Before race:

- At crew meetings discuss scenarios
- Reinforce role of Person in Charge and rest of crew in case of incident
- Practice inspections in high seas

4. Regular inspection while racing

Respect 'em

1. Good seamanship
 - Sail balance
2. It's a long way—don't overstress rudder
3. Don't overstress you—risk is not high if well prepared

Emergency Rudders

- When You Need 'em They Better Work
- Must steer boat with or without wind, whether or not yacht's rudder is still in place
- Test under high seas and wind before race
- Don't leave to the last month

Design Considerations

1. Type of failure of primary rudder (clean break, bent)
2. Ease of steering - it has to work
3. Mission changes, not racing
4. Anticipate long distance to go and high sea state
5. Attachment method to the hull--how will you install the rudder while at sea
6. Stowage – safe storage of emergency rudder when you're (hopefully) not using it
7. Know the forces
8. Blade size (underwater surface area)

FORCE ON THE BLADE

$$F = A * C_l * 1/2 * \rho * V^2$$

F = force (lb)

A = area below transom (ft²)

C_l = Coeff. of lift (use 3.0 to allow for pumping transients)

ρ = density of water (1.9905 slugs/ft³)

V = design speed (ft/sec)

(1 knot = 1.6878 ft/sec)

$$F = 8.5 * A * V^2$$

F = force (lb)

A = area below transom (ft²)

V = design speed (knots)

Example: 1 ft. x 4 ft. blade, 7 knots: F = 1,666 lb

Cautions

1. Saving money in the design and construction could be expensive.
2. Need to be robust and durable
3. Don't leave home without your emergency rudder!

SOS Rudder



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SOS Rudder



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SOS Rudder

Quote from Scanmar!

“The SOS Rudder is an emergency steering system designed to get you to the nearest port in case of rudder failure. DO NOT ATTEMPT TO CONTINUE TO RACE, OR TO CARRY A HEAVY PRESS OF SAIL”

Three Point Framework to Hold Pintels and Gudgeons



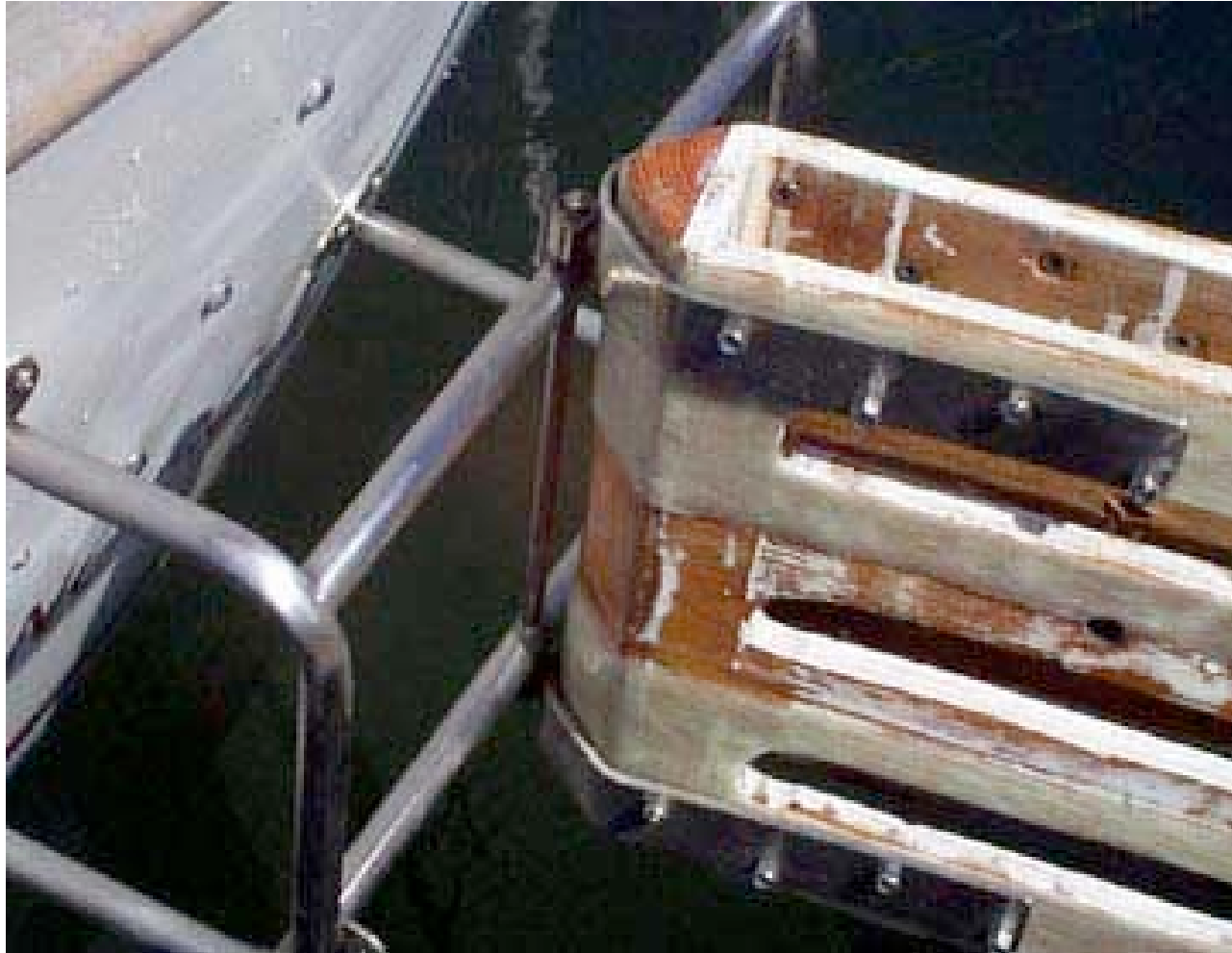
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Three Point Framework to Hold Pintels and Gudgeons



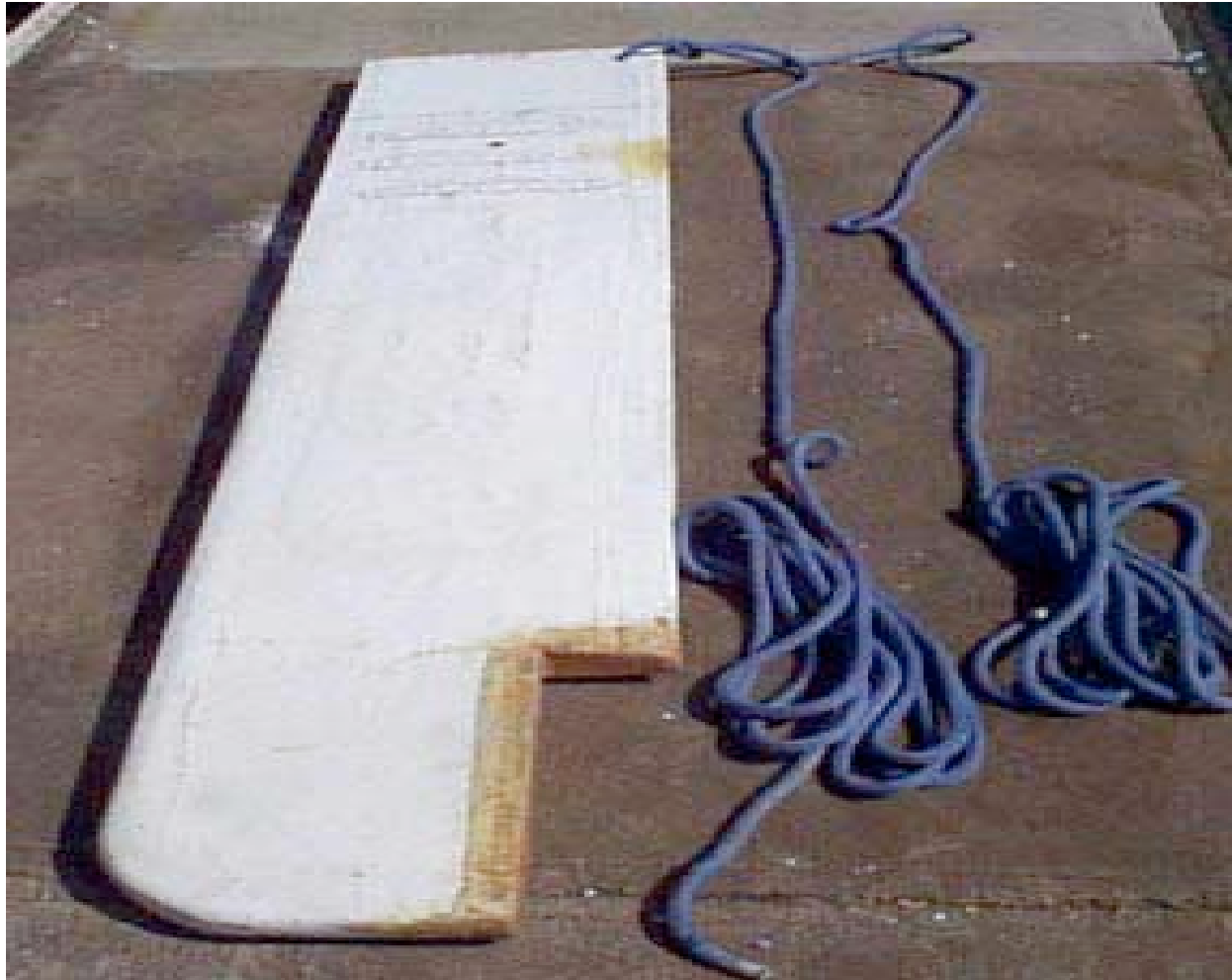
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Rudder in a Cassette System



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Rudder for Cassette



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Rudder in Cassette



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Hydrovane



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Hydrovane: After 750 miles. Not!



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No No's

- Windvane likely too small but...
- Spinnaker pole – definite no no
“2' x 4' x 3/4" ply clamped u-bolts. Pole lashed vertically over transom to stern cleats, supported from dropping by rolling hitches to pushpit rail. Line on either side, clove hitched around pole, below water level, and led to winches”

A True Story

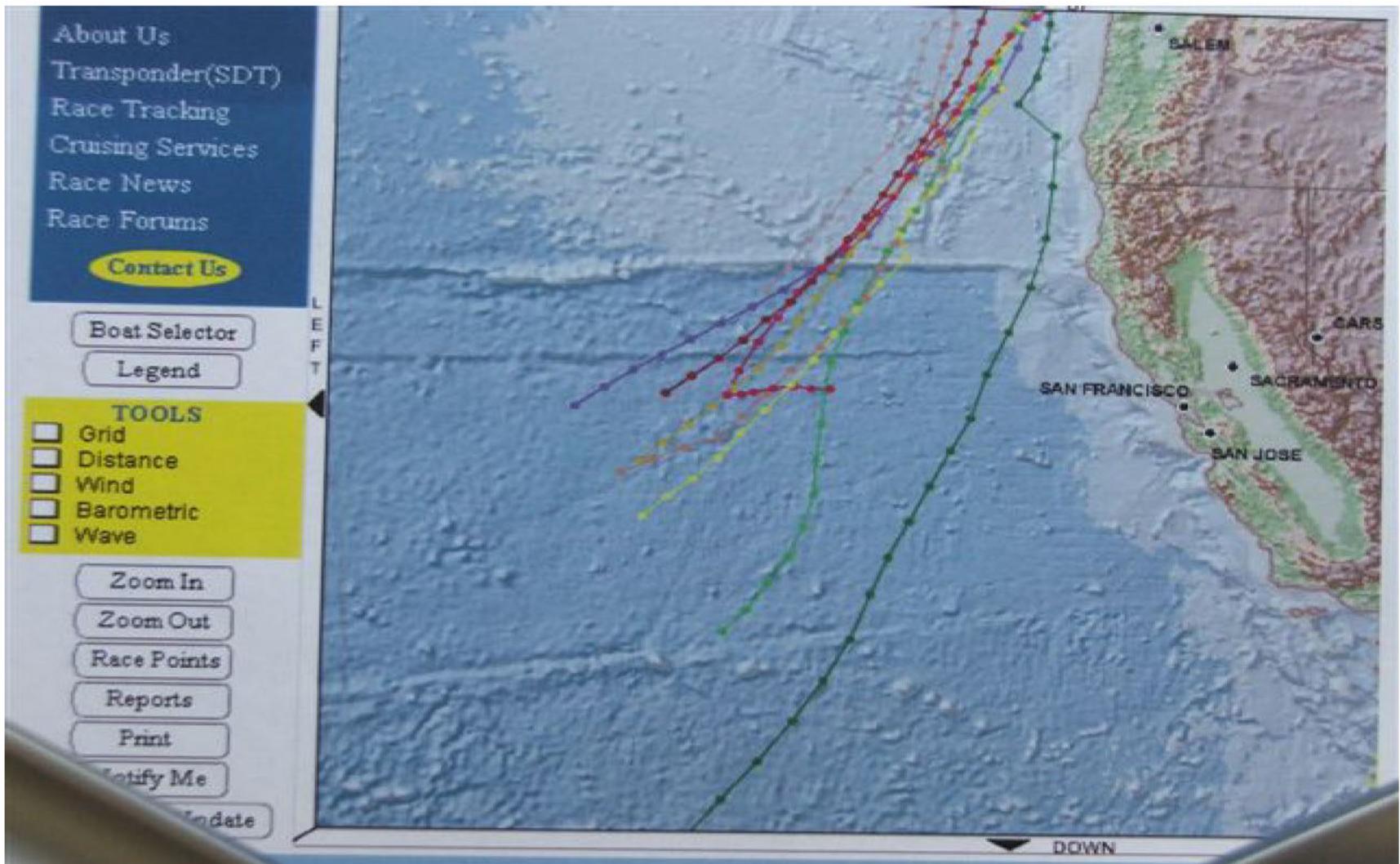
- It only happens to Ajax, Rocket J Squirrel, Foxfire (1992), and a few others

The Dream 2008



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We Are Something Wicked

“It” Can Happen



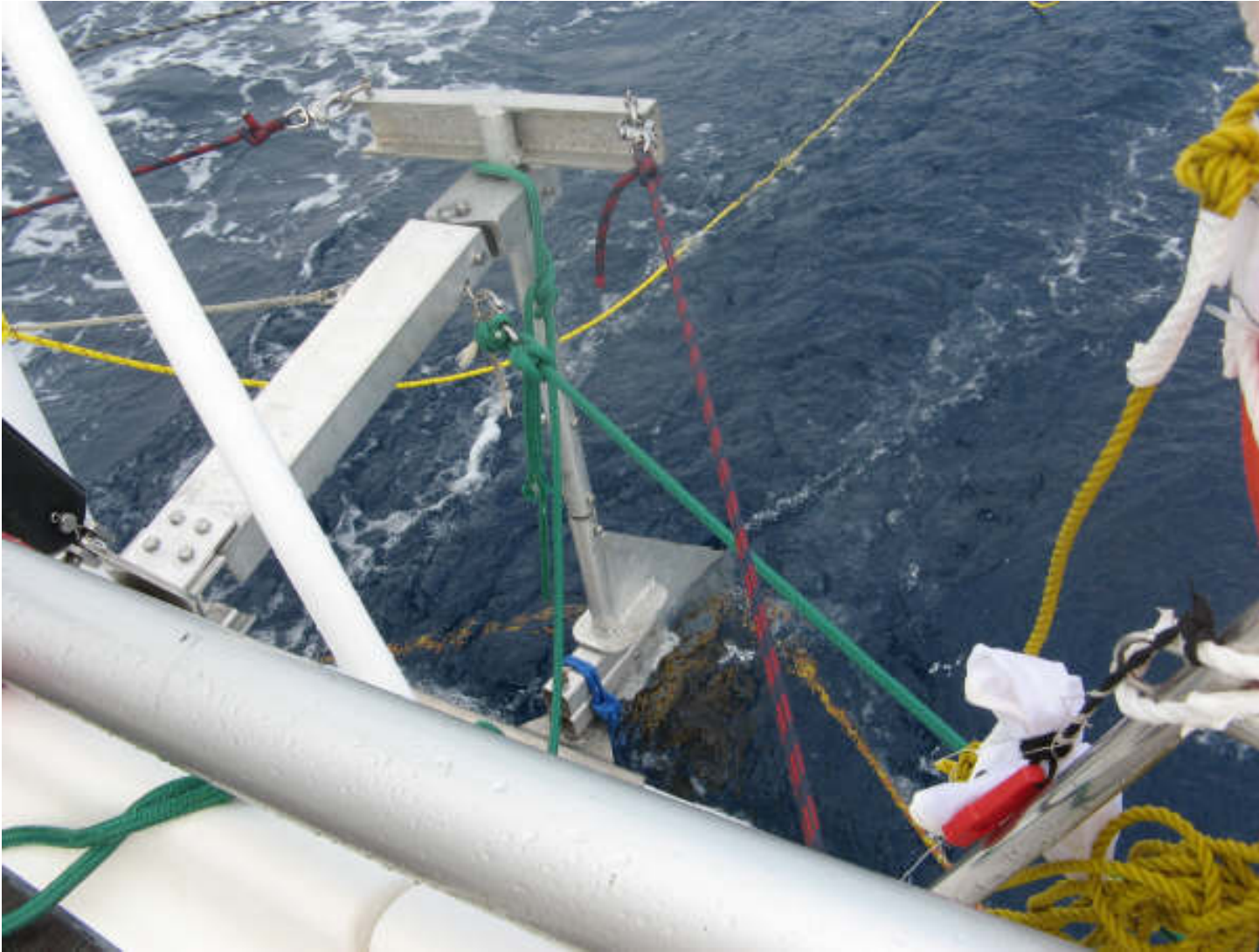
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Something Wicked, Beneteau 40.7

Clean Break



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Design Flaw



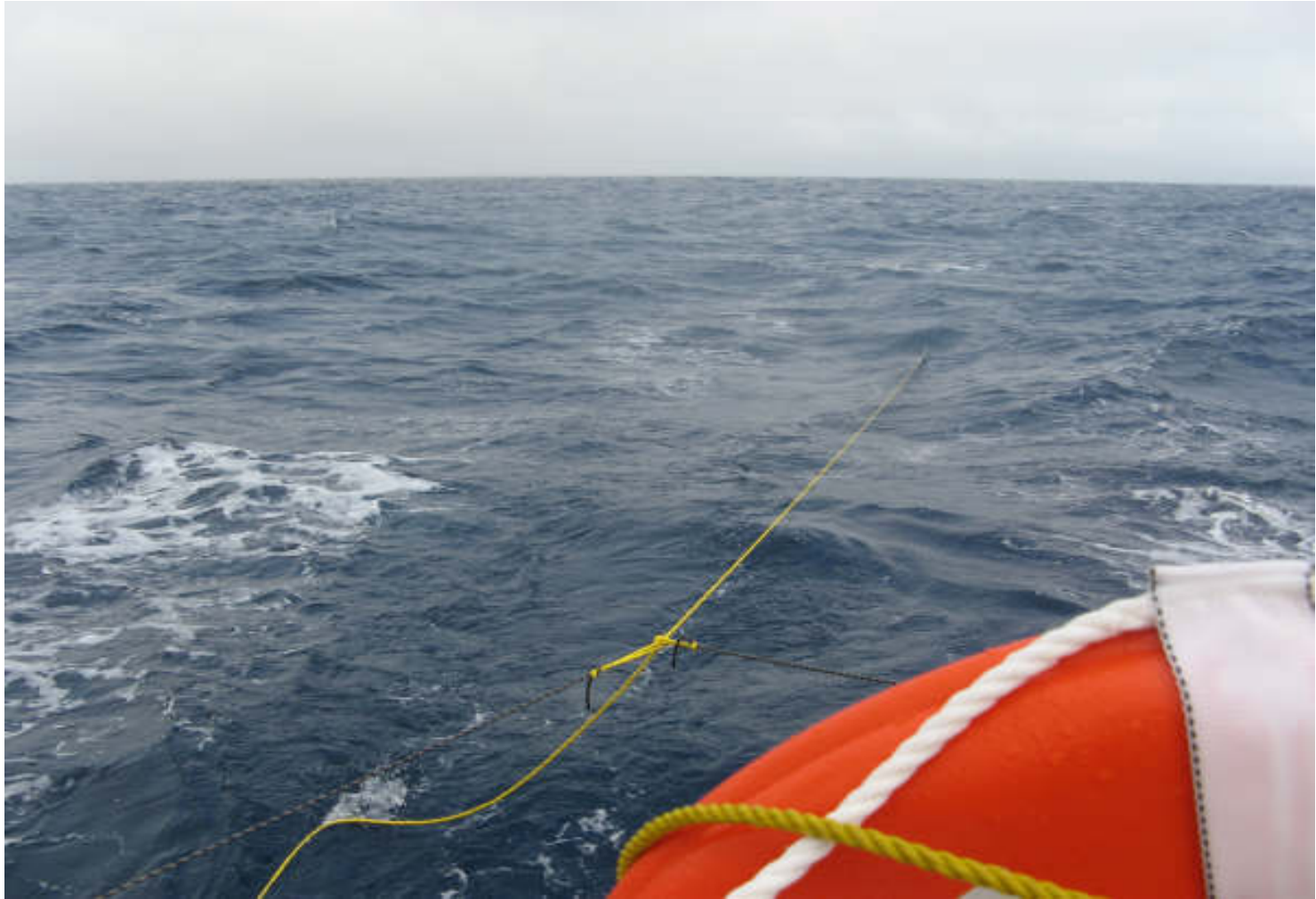
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Recovery



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To Starboard



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To Port



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Multipurpose Spinnaker Pole



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Oops – not Red!



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More Oops



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San Francisco



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Lessons Learned

1. Don't underestimate the forces
2. Emergency rudder always works at the dock - test it under adverse conditions
3. Plan how you will install it -- who will do what AND practice at sea
4. Assume it'll happen in the worst conditions
5. If it happens stay calm
6. You can make it home safely on your own
7. Crew experience, passport numbers, and safety equipment written on a sheet in navigation table
8. Take a drogue appropriately sized
9. Use a spinnaker net



Swiftsure International Yacht Race, May 26 – 28
Vern Burkhardt, Chair