

# Damage Control



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# Common Damage Control Scenarios

Flooding: Hull holed at or below the waterline result of...

- Collision with floating or submerged object
- Failed below-the-waterline plumbing (seacock, stuffing box, hose, etc)

- 40% of all underway sinkings are the result of striking submerged object
- 16% are a result of broken prop shaft or strut
- 16% result of damaged or deteriorated below the waterline plumbing, pipe, hoses, clamps etc.



- Spar collapse: Mast falls as a result of metal fatigue or standing rigging failure.
- Rudder failure or loss.



Unfortunately, not every day at sea is like this...



Some are like this...



Others are like this



...or this...

# U.S., U.K. Join Norway in Investigating Viking Sky Engine Failure

March 25, 2019 by gCaptain

0  
SHARES



And still others are like this

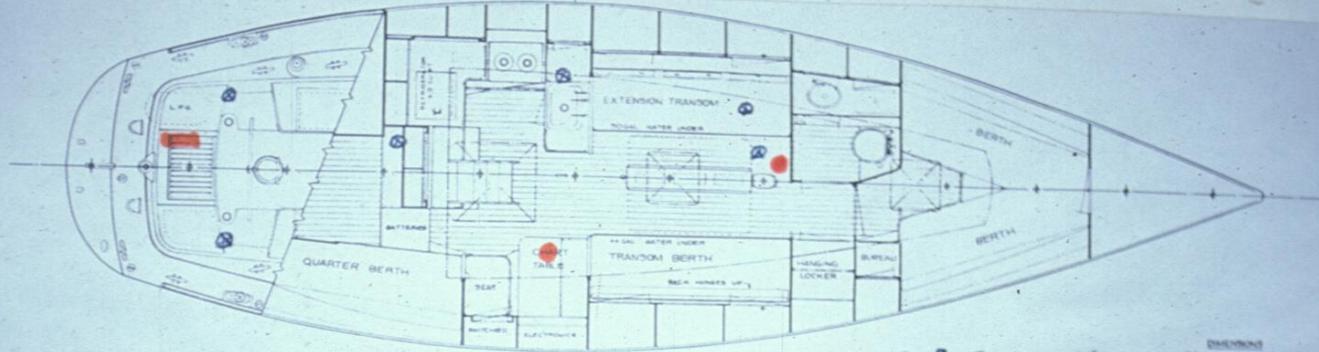


# Dealing With Flooding

- Find and gain access to the flooding; stop the water flow *first*, then worry about pumping out.
- Shut seacocks, fill or patch the leak.
- Seacocks. Location, location, location.



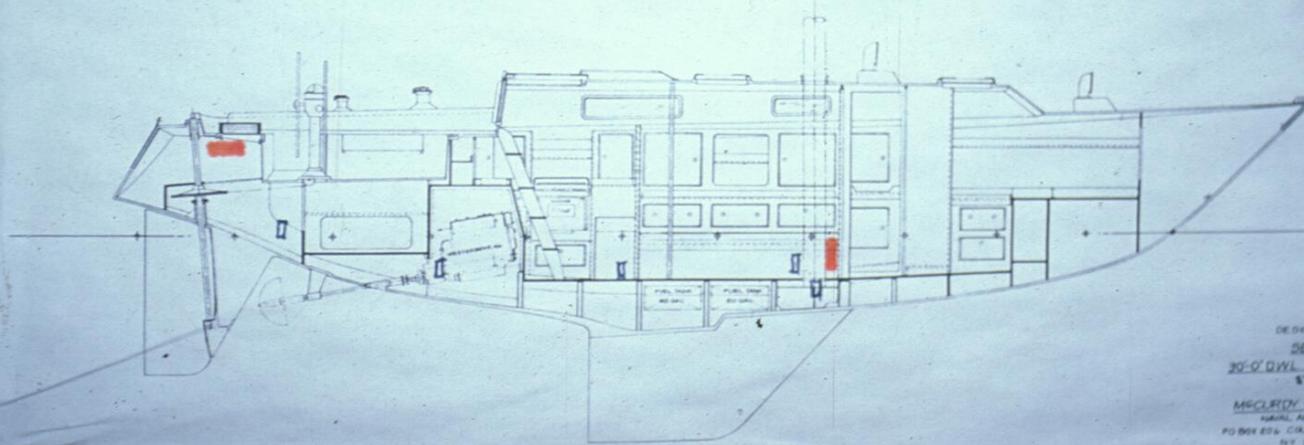
# Post a Seacock Location "Map"



⊗ □ SEACOCK

● ■ FIRE EXTINGUISHERS

DIMENSIONS	
L.O.A.	36'-0"
BEAM	11'-0"
DEPT.	5'-0"
DRAFT	2'-0"



DESIGN NO. 84  
SELKIE  
20'-0" DWL. F.R.P. CUTTER  
8'-11" H  
MCGURDY & RHODES, INC.  
NAVAL ARCHITECTS  
PO BOX 874, COLD SPRING HARBOR  
NY 11724

# Flood Rates

- A 1" hole 1 foot below the waterline = **1200** gallons per hour
- A 2" hole 2 feet below the water line = **6660** GPH or **111GPM** (USN Salvor's Handbook)



# Bilge Pumps

- *Larger electric bilge pumps are typically in the 1500-2000 GPH range, under ideal conditions.*
- *Actual is often half rated capacity*



Rule of thumb: 100 gallons/hour for every foot of boat length

For max capacity submersibles only

Don't forget the alarm



This one is too high...

Clean bilges are more than good housekeeping  
Bilge debris is your pump's worst enemy



# “Electric Bilge Pump Systems Debunked and Done Right”

Professional Boat Builder Magazine  
January/February 2014

E mail

[katie@stevedmarine.com](mailto:katie@stevedmarine.com)

for a link if you'd like a copy.



## Plumbing the Depths

Electric bilge pump systems debunked and done right.

**Text and photographs  
by Steve D'Antonio**

In my 25 years in the marine industry I've frequently encountered misconceptions about bilge pumps and their capacity to operate as damage-control devices. Many people believe that a bilge pump labeled "2000" can be relied on to pump 2,000 gallons (7,571 liters) of water per hour from a leaking boat. Nothing could be further from the truth. The majority of bilge pump systems are hamstrung by design and installation faults that diminish a pump's output by as much as 75%, so even under ideal circumstances it is incapable of keeping up with an influx of seawater from a minor hull breach, much less catastrophic flooding.

**Above**—A standard 2,000-gph (7,571-lph) centrifugal electric bilge pump and its float switch pulled from the bilge for repairs. As this image illustrates, access to pumps for service is critically important. The most significant thing for a builder or repairer to keep in mind is that even in the best possible situation, this pump is unlikely to actually remove 2,000 gallons of water from the bilge in one hour.

Below is an excerpt from a letter from a client whose boat was nearly lost because of a small leak caused by a failed  $\frac{3}{8}$ " (9.5mm) stuffing-box injection hose, and the bilge pump's

inability to keep up with this comparatively minor ingress of seawater.

The sound of the engine changed slightly, which made me glance at the instruments. The tachometer needle rested at the zero mark, and the voltmeter showed about 11 volts. I slowed to an idle, banded the helm to a shipmate, and went below to check the engine. When I opened the compartment it was as humid and foggy as a London street, and a faint smell of burning electrical components permeated the air. There was obviously a leak. I could see that water had risen to the level of the engine's crankshaft pulley and flywheel and was being slung everywhere, including onto the alternator, apparently killing its charge capability and the tachometer output along with it. I suppose it's a good thing the tach died, otherwise I

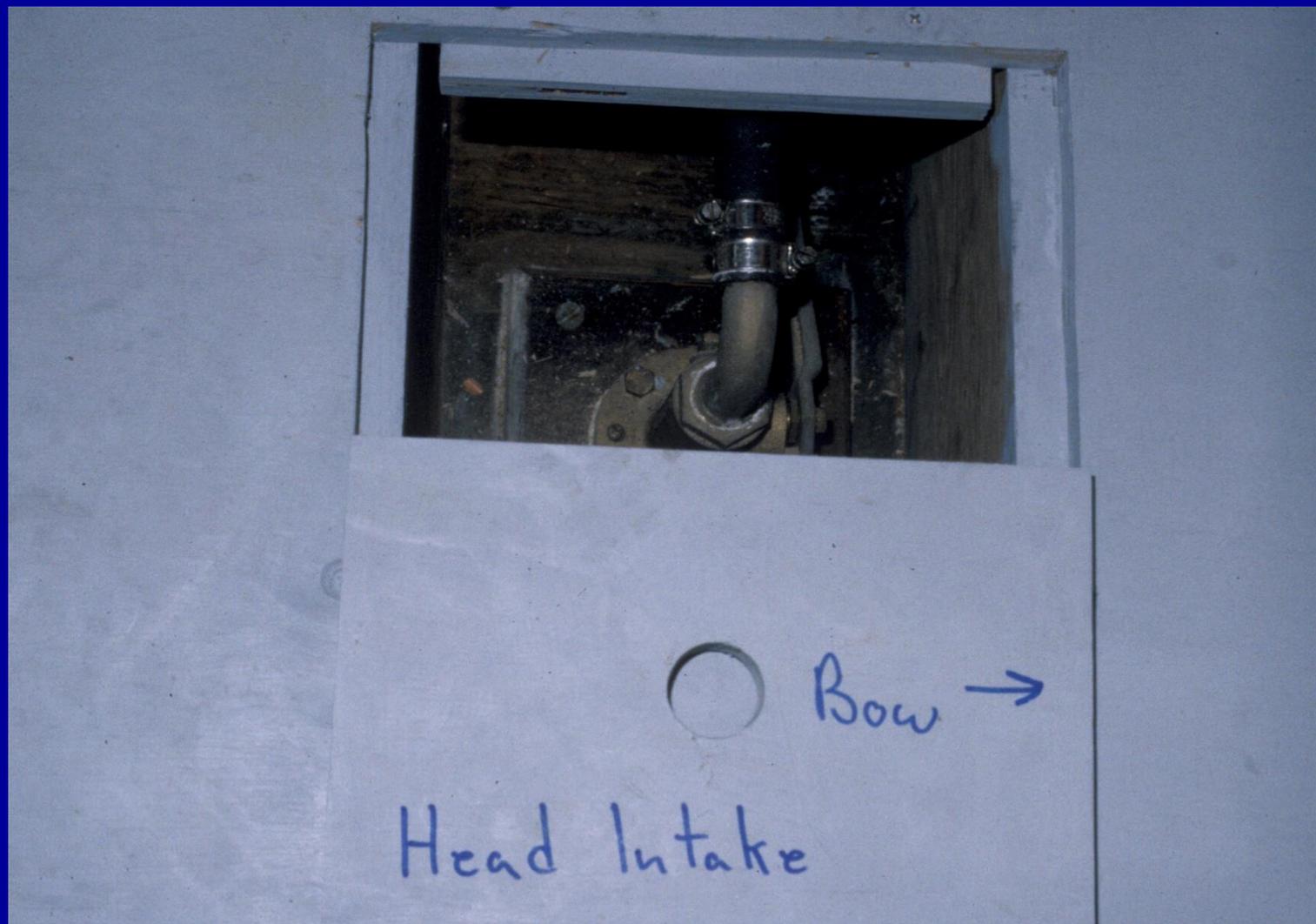
# Avoid the “hidden seacock” syndrome

You should be able to  
find and access every  
seacock aboard your  
vessel, *in total  
darkness...*

...without the aid of  
tools.



If it's not obvious there's a seacock in there, label it.



○ Bow →

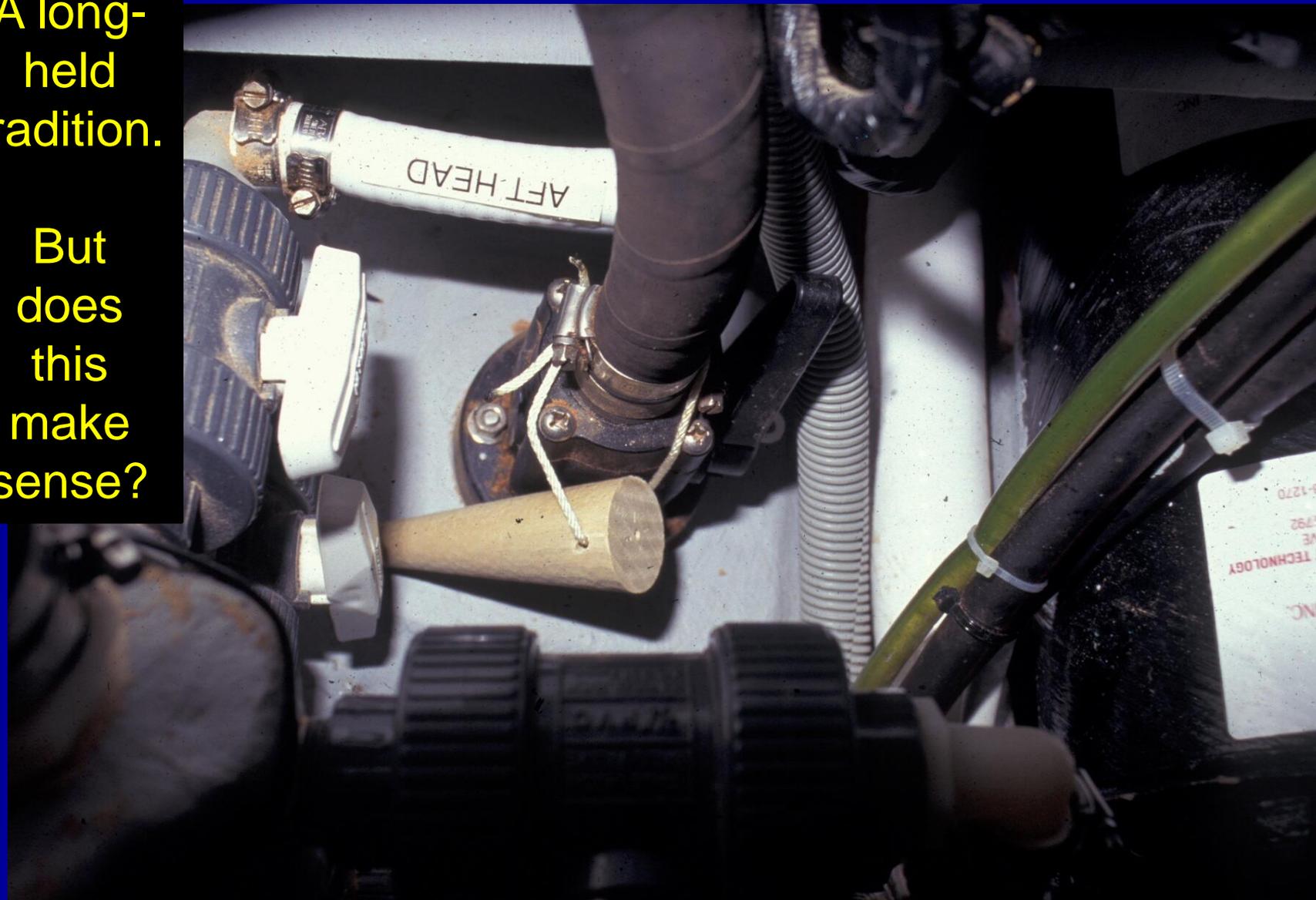
Head Intake

# Cedar/soft wood plug assortment



A long-held tradition.

But does this make sense?



# Avoid leveraging your seacocks



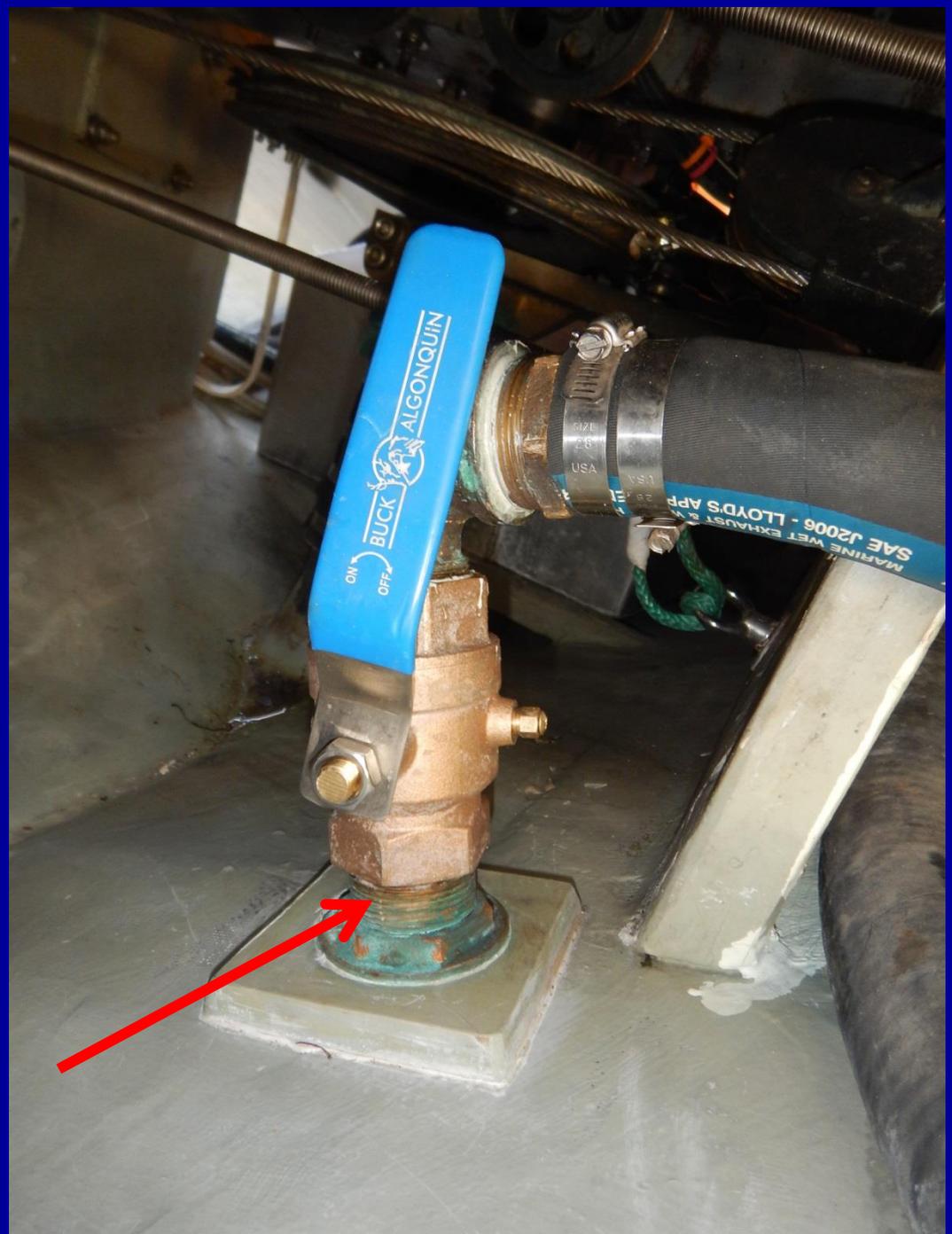
Looks good but...

Not really a  
seacock

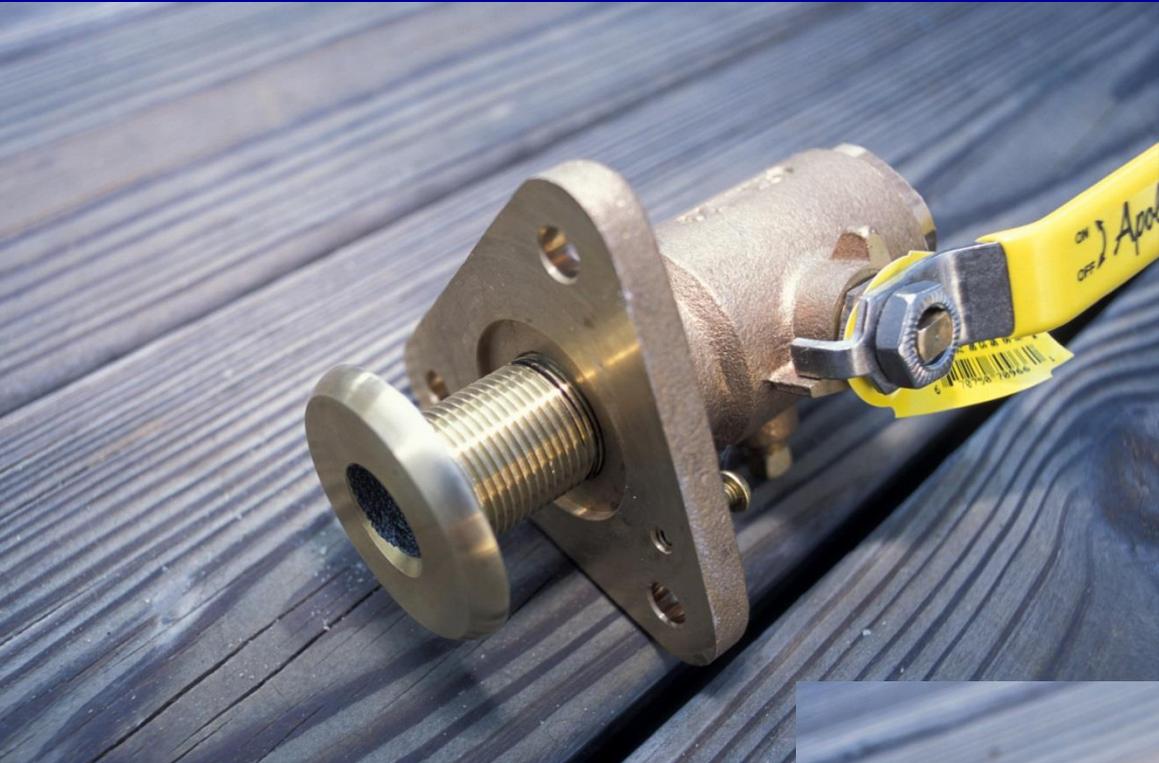
Why?

Incompatible  
threads

Lack of a load-  
distributing flange







Avoid PVC for  
BTW  
applications...



# Seacock Durability and Strength

The ABYC 500  
lb -30 Second  
Rule.

Do yours  
measure up?

The 'stand on it'  
rule



# The “Liner” Hull Dilemma



**Access, access,  
access.**

Options for  
improving access to  
the *interior* of the  
hull in the event of  
damage...



# Plan B



**Cordless  
reciprocating saw  
and drill**



**Spare  
batteries**



**Hole-  
saws**



**Spare high quality  
blades**



**Kindling hatchet**

**Drill and  
sheetrock  
screws (not  
for thick FRP)**



**Thin plywood  
patches**



**Sealant**

**For FRP/Fiberglass**

**Self Tapping  
Screws**



**Phillips Drive**

**“Cutting Point”  
or PK Screws**



**Square or Robertson  
Drive**

# Adhesives, Sealants and Cleaners



# If You Can't Access The Damage From The Inside...



# Running The Rigging Failure Gauntlet

- Assess damage to the hull quickly.
- Cast off the rig as quickly as possible.
- Save what you can, particularly the boom, for use as a jury rig.



## The Jury Rig

It doesn't have to be pretty...

Think ahead about the parts you might need to make one



# An Ounce of Prevention...

Conduct regular rig inspections

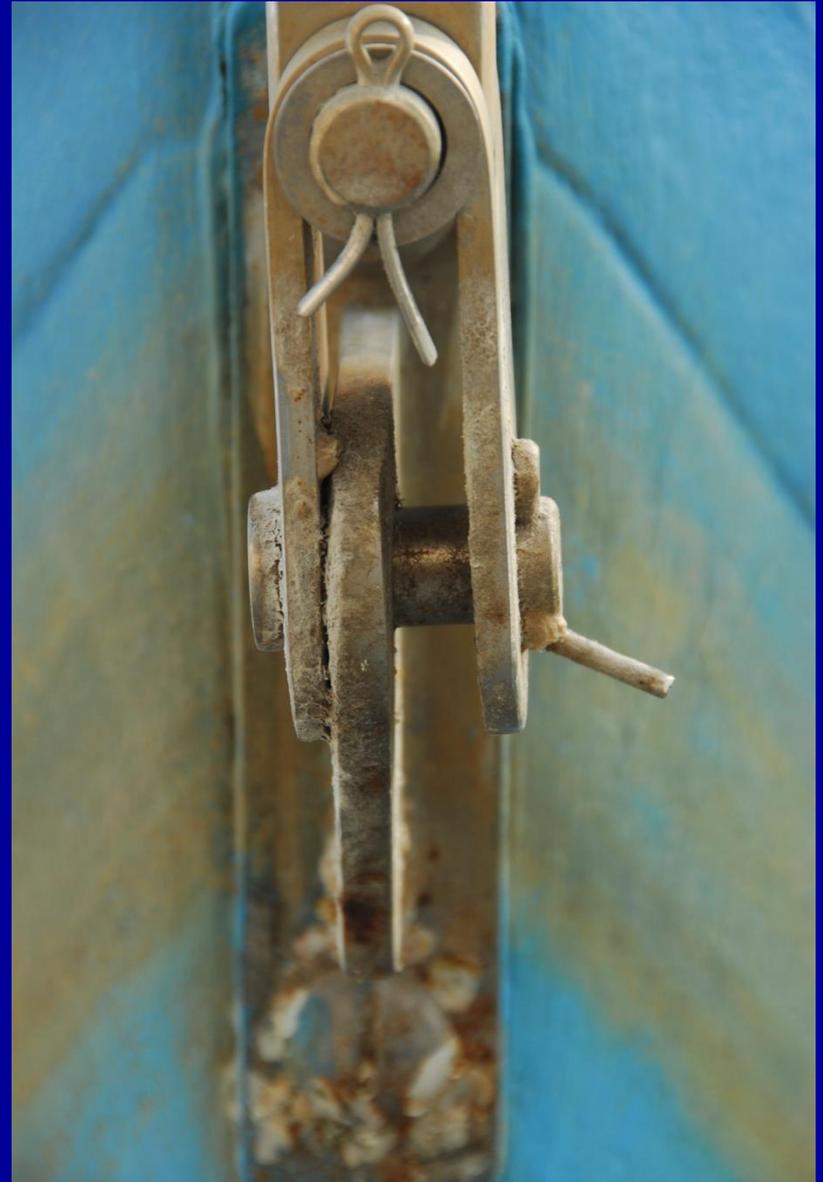
Go up there

Remove tape and chafe gear

Un-step every 5 yrs/new to you rigs



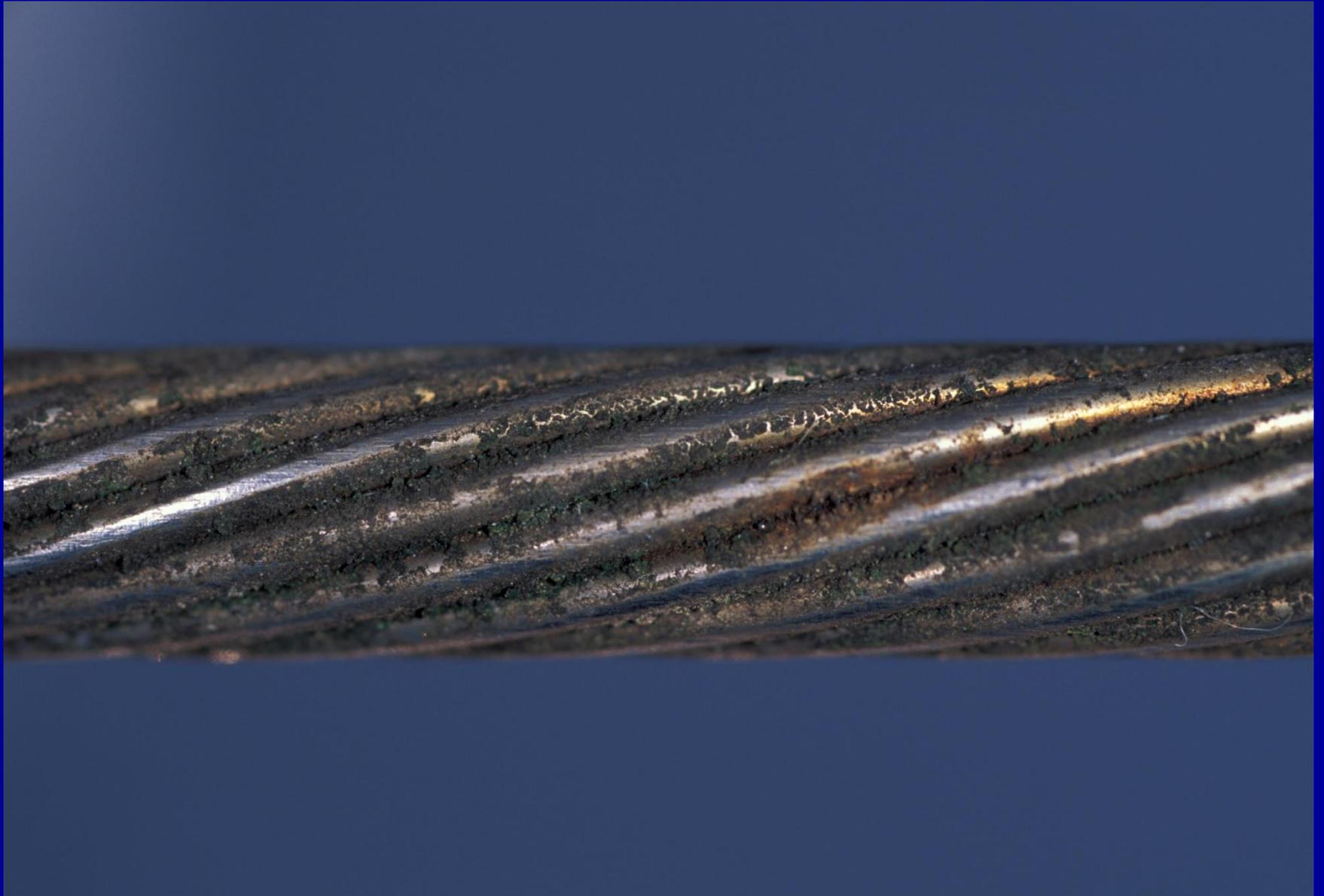
Inspect it even if it works...



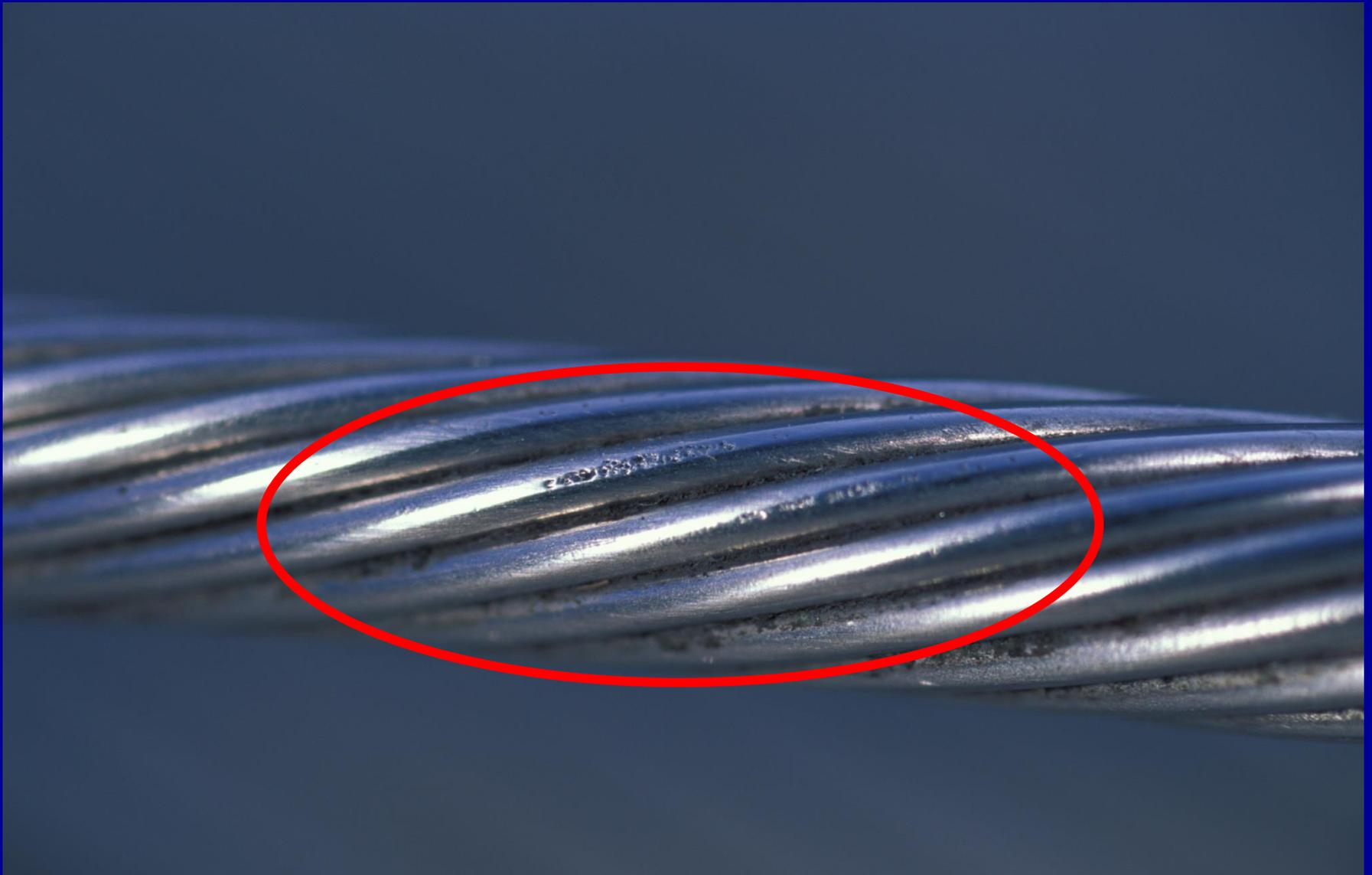
# Crevice corrosion and rust...



# Under Cover Shroud...



The real damage revealed...



# Rudder Damage or Loss



# Rudder Options





Prepare A Back-Up Rudder In Advance



# (Preventing) Keel Loss



Photo US Coast Guard

## Keel Failures 2008 ISAF study 72 cases since 1984, 44% w/ defined causes...

- Welded fin 11
- Grounding/Collision 8
- Internal Structure 8
- Keel Bolt 3
- Canting System 2



Cheeki  
Rafiki

# Interior Inspection



## Keel Fasteners Look For:

- Corrosion
- Engagement
- Load Distribution



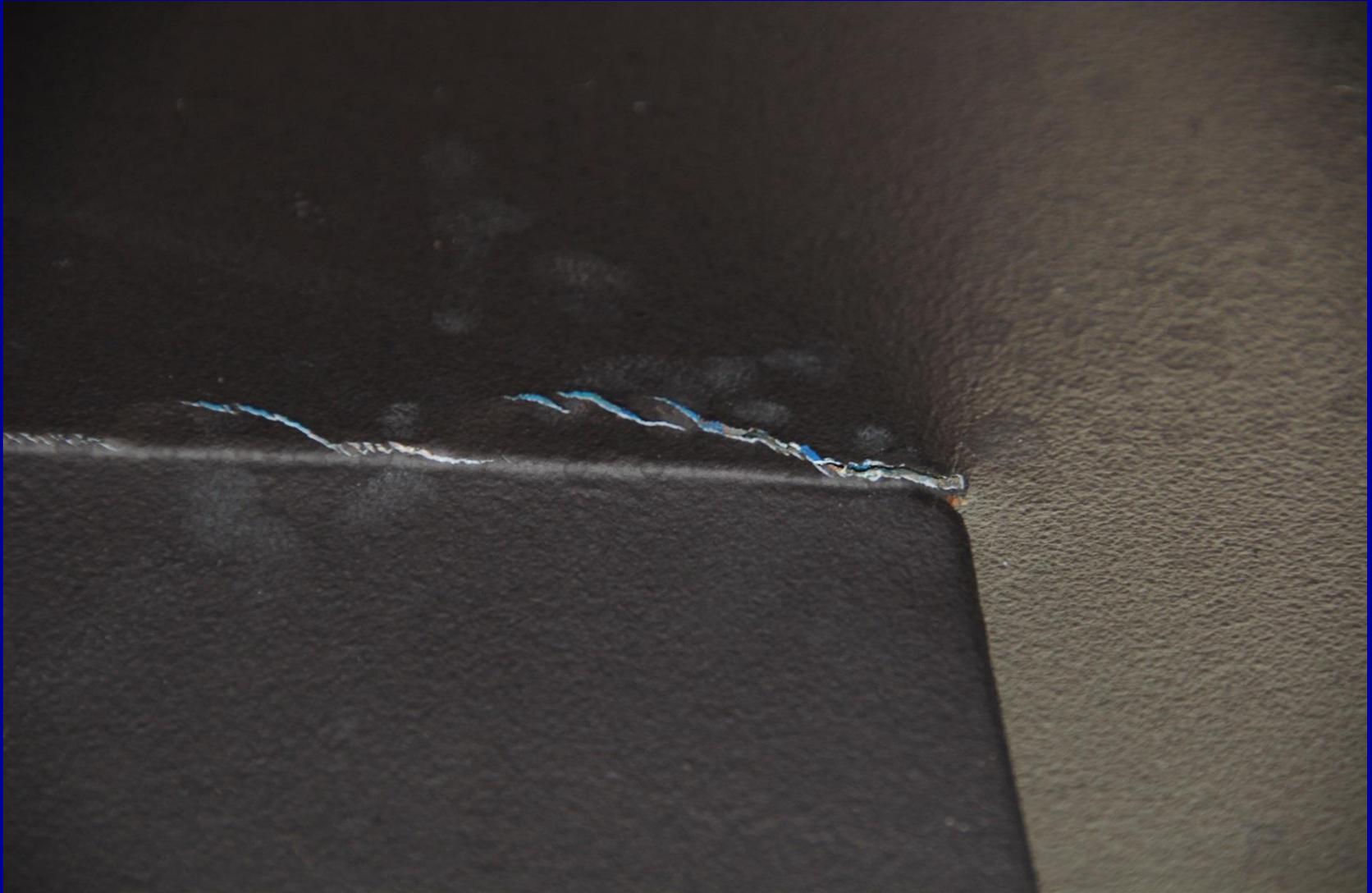




When to drop'em.....



# Exterior Inspection Signs of movement



# Staining from corrosion



## More staining examples



## Stainless Steel's Nemesis...

Stagnant water and the  
crevice corrosion it  
causes.





Home > Feature Article > Stainless Steel – Miracle Metal?

## Stainless Steel – Miracle Metal?

Feature Article

Marine Systems Excellence Ezine

Sep 3, 2011



[katie@stevedmarine.com](mailto:katie@stevedmarine.com)

For a link to two detailed articles about stainless steel corrosion, e mail...

## Cheeki Rafiki MAIB Findings...

"...a combined effect of previous groundings and subsequent repairs to its keel and matrix (or lining) had possibly weakened the vessel's structure where the keel was attached to the hull."



"It is also possible that one or more keel bolts had deteriorated"

"A consequential loss of strength may have allowed movement of the keel, which would have been exacerbated by increased transverse loading through sailing in worsening sea conditions."



# Damage Control Summary

- Find the leak and fix it without delay.  
Keep the pumps clear.



- Don't succumb to the shock of losing your rig or rudder, or you may succumb to the shock of losing your boat.
- Act quickly and calmly to prevent the rig from damaging your (life) boat.



Read about it...

## “The Ethos of Damage Control”

Email [katie@stevedmarine.com](mailto:katie@stevedmarine.com) for a link.

### The Ethos of Damage Control

Every cruiser, at one time or another, faces a damage control scenario, wherein a piece gear fails, sometimes benignly, sometimes catastrophically. The “gear” could be anything from a failed raw water hose to a breached hull. If it hasn’t happened to you yet, you’ve been fortunate, but that doesn’t mean you shouldn’t prepare.

Story by Steve D’Antonio

All photos © 2019 Steve D’Antonio Marine Consulting, Inc.

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# Thank You



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