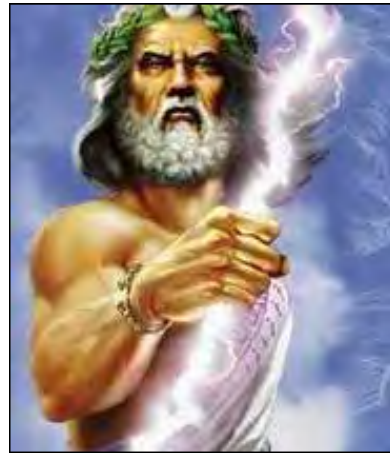


Lessons Learned from Superstorm Sandy

Alex Kripetz, Travelers Ocean Marine
Claudio Crivici, Castle Rock Risk Services
Carroll Robertson, BoatUS

Lessons Learned: Act of God Defense

Our Marina Insureds will be sued by their customers



+



=



Lessons Learned: Dock Coverage

Insureds wanted/needed more components covered than they initially contemplated in their limit



The obvious...



Lessons Learned: Dock Coverage

Insureds wanted/needed more components covered than they initially contemplated in their limit

The not so obvious....



Lessons Learned: Older Docks

Insureds with ACV valuation want to know how to
choose a “good” limit

The Factors:

Kind of old? Really old? Mix of Both?

Coinsurance?

Blanket? Schedule?

Life Expectancy???

(Hint: Life Expectancy=20 more questions and
different for every dock system)

Is the Limit Compressed?

Lessons Learned: Cargo

Flood: How's the location I'm looking at (really)



Before:
Flood Zone

Now:

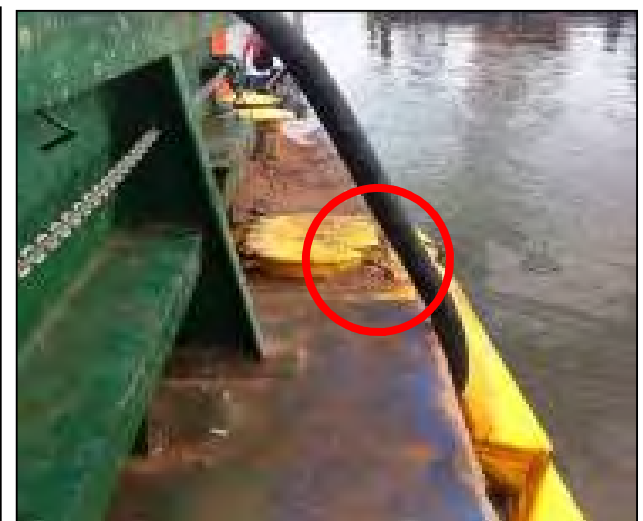
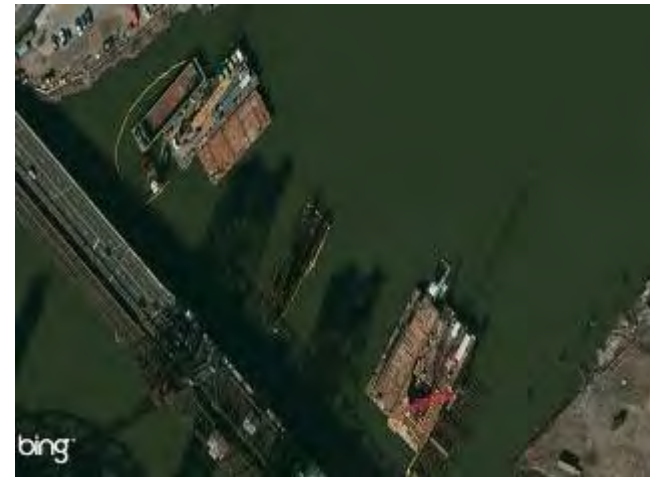
- *Flood Zone*
- *Flood Score*
- *Elevation Variance*

If Higher Hazard:

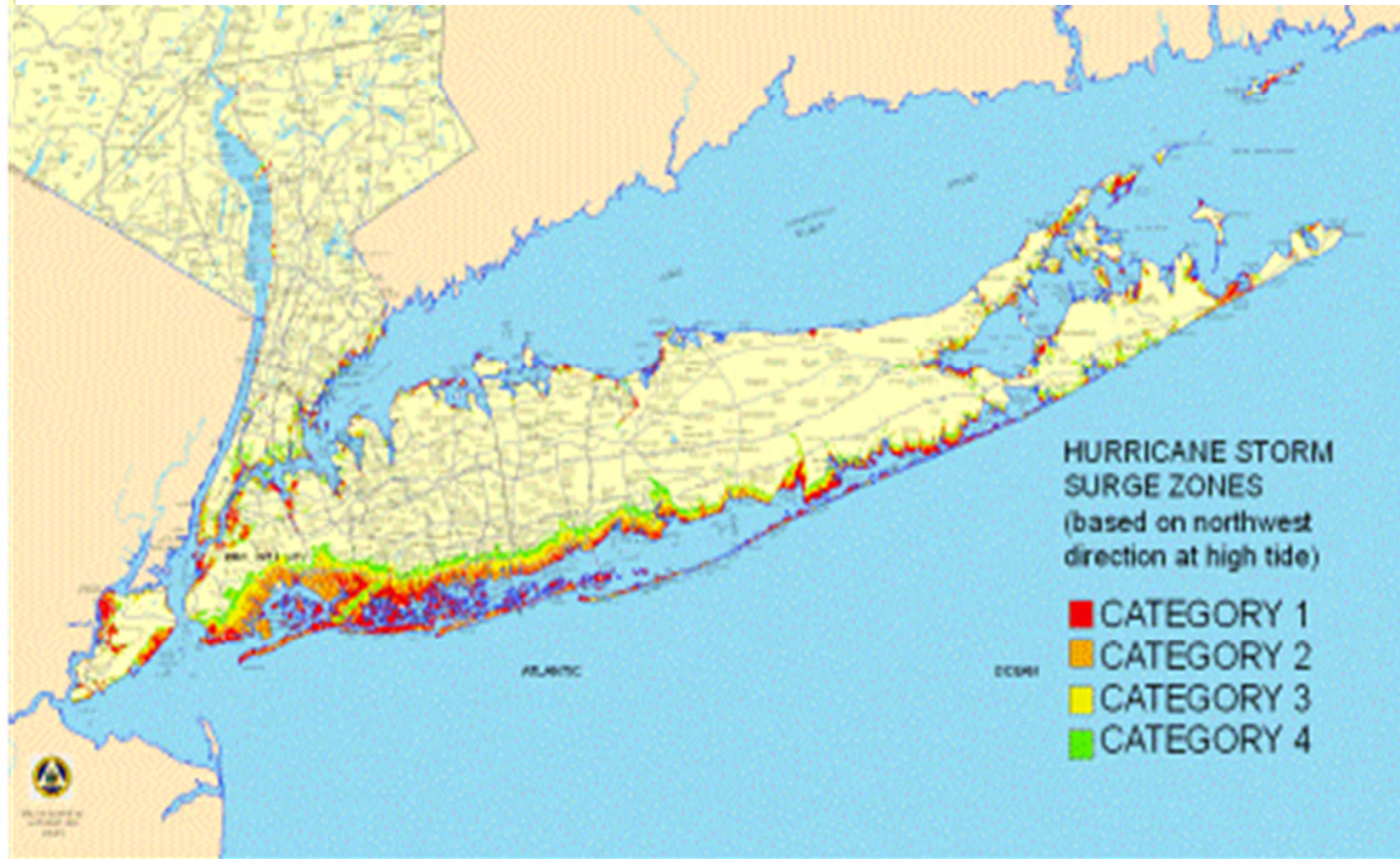
- *Critical Machinery Location*
- *Storm Season Accumulation*
- *Severe Event Plan?*

Lessons Learned: Hull/P&I

Checking Up On The Storm Plan Works



Basing storm contingencies on past experience has proved to be a frequent and tragic mistake.



Sandy Surge - up to 12.5'. Surge was comparable to a strong CAT 2 hurricane— what if Sandy had Cat 2 Winds?
Comparable wind force up to 250% greater.



Sandy Lesson Learned
Often inadequate Preparation for
Wind & Wave & Surge



350 Slip Marina – 72 hours Post Sandy.

Lesson Learned – Is exposure on each risk known?
Are PML estimates accurate?





Policies – Blanket schedules often with inadequate values.
Coinurance – Often with unclear language.
Actual Cash Valuation: Method of calculation must be defined in policy



Dock Values are Unique to Each Location



LEARNING FROM SANDY

Sandy Overview:

American Institute of Marine Underwriters

May 8, 2013

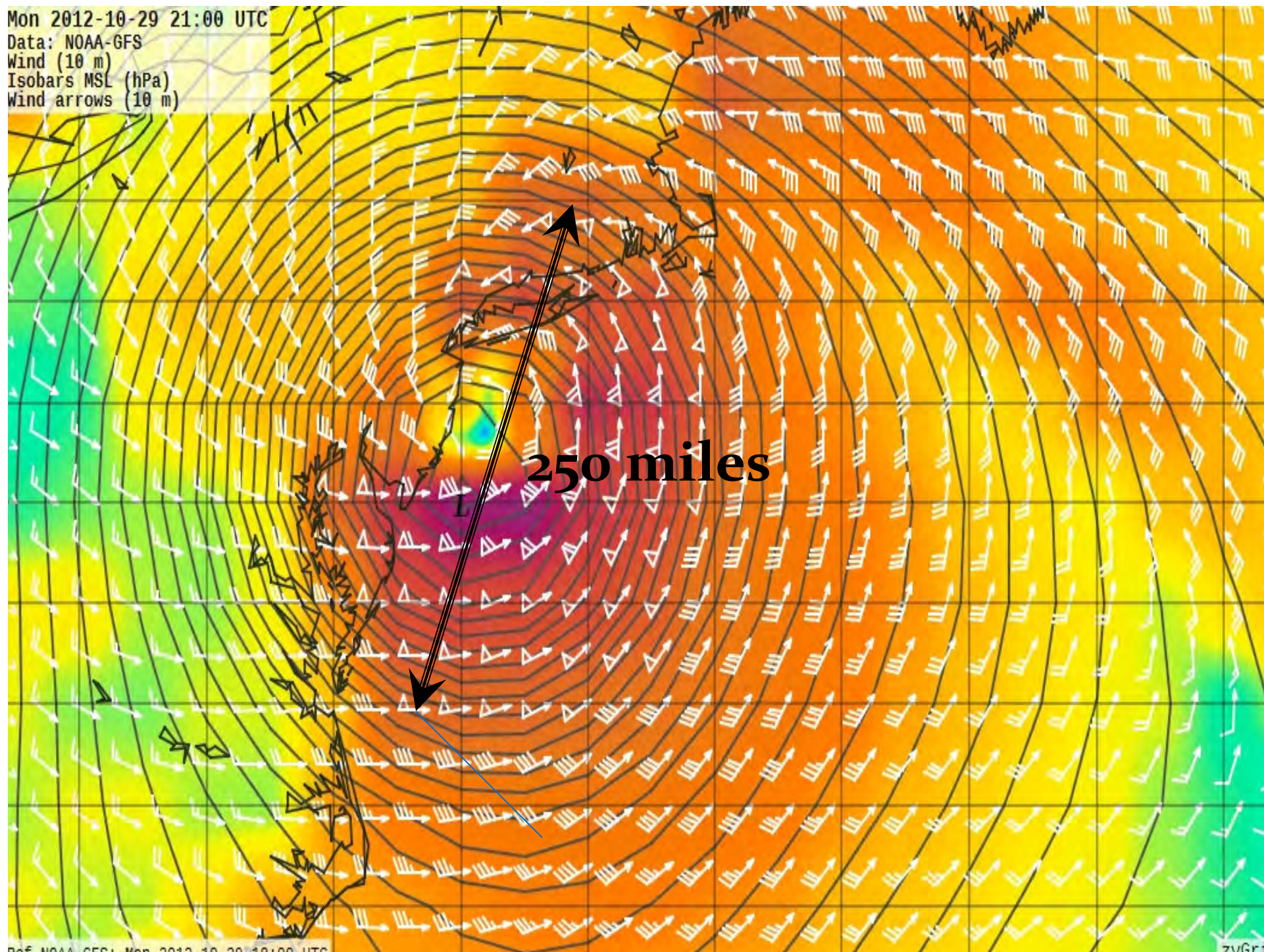
Carroll Robertson

SVP Claims

BoatU.S.



Mon 2012-10-29 21:00 UTC
Data: NOAA-GFS
Wind (10 m)
Isobars MSL (hPa)
Wind arrows (10 m)



BoatU.S. Catastrophe (CAT) Teams

- First deployed after Hurricane Alicia hit Houston in 1983

- Team of experienced surveyors, salvors, and claims adjustors

- On the ground after every major weather event where large numbers of boats were destroyed for the past 30 years

- Debrief after the fact to develop hurricane preparation best practices

- First members reached marinas in NY and NJ less than 24 hours after Sandy made landfall; CAT Teams in the field through Christmas

- Past two months debriefing to determine what we can learn from this storm



The objective

To share lessons coming out of Sandy that will help marine facilities in storm-damaged areas rebuild smarter and those in other areas prepare better for future storms

We will focus on:

1. Why were so many boats and so much marina infrastructure destroyed DESPITE good forecasting and days of preparation based on industry “best practices?”
2. How did the various methods of securing boats fare in Sandy’s high surge?
3. What are the key lessons learned for marine facilities?



Stuyvesant YC
Betsy Haggerty



Mansion Marina,
Staten Island



Crescent Beach,
Staten Island



Goals of hurricane preparation

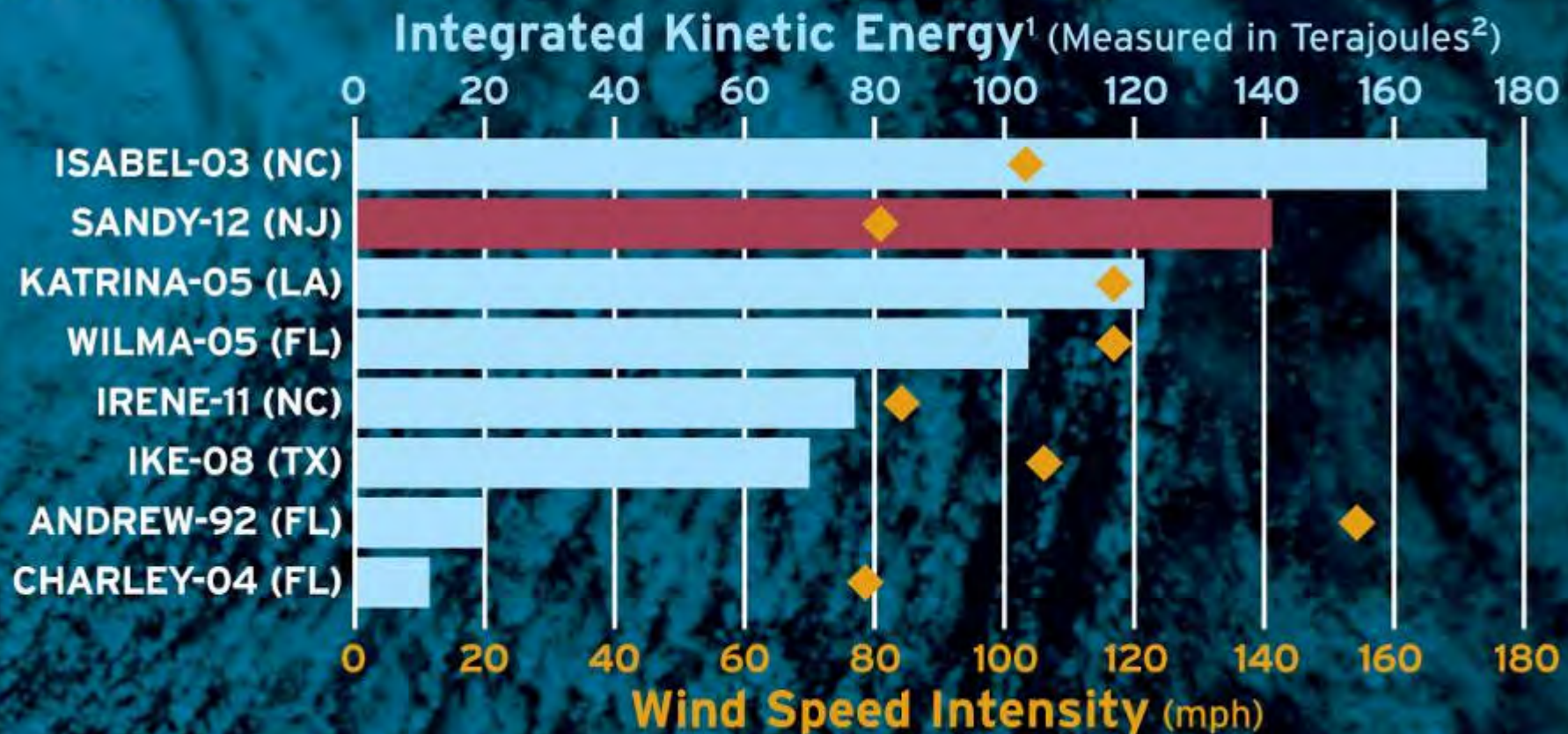
- Prevent loss of life
- Limit damage to boats
- Limit damage to marina infrastructure
- Limit damage to other infrastructure
- Limit damage to the environment

Stuyvesant YC
Betsy Haggerty



OVERALL STORM POWER AT LANDFALL

The most powerful storms are not necessarily the windiest. The energy in Sandy was equivalent to the power used by 40,594 U.S. homes in one month.



¹Energy of storm based on extent of tropical storm force winds

²One terajoule = 277,777 kW = energy used by 290 U.S. homes in one month

Source: Washington Post

A DEADLY STORM SURGE



Why was this storm so devastating?

Storm Dynamics:

- Power of a hurricane with the size and duration of a nor'easter
- Largest storm ever in the Atlantic basin
- Confluence of easterly wind direction and Long Island geography
- Intensity, extent, and duration of winds
- Arrival with lunar tide and duration across multiple high tides

Coastal Configuration:

- High population and marina density
- Many marinas only a few feet above MHW levels
- Prevalence of older marina infrastructure not designed to withstand surge in excess of 6 feet

East Quogue, NY
Long Island



Great Kills Harbor,
Staten Island





Croton YC
Hudson Valley, NY

Atlantic Highlands, NJ



Staten Island



Additional Sandy challenges

Not a dozen damaged marinas, but hundreds across 400 miles of coastline

Challenging logistics for almost three weeks: gas rationing, no electricity, no hotel rooms, traffic jams, blocked roads

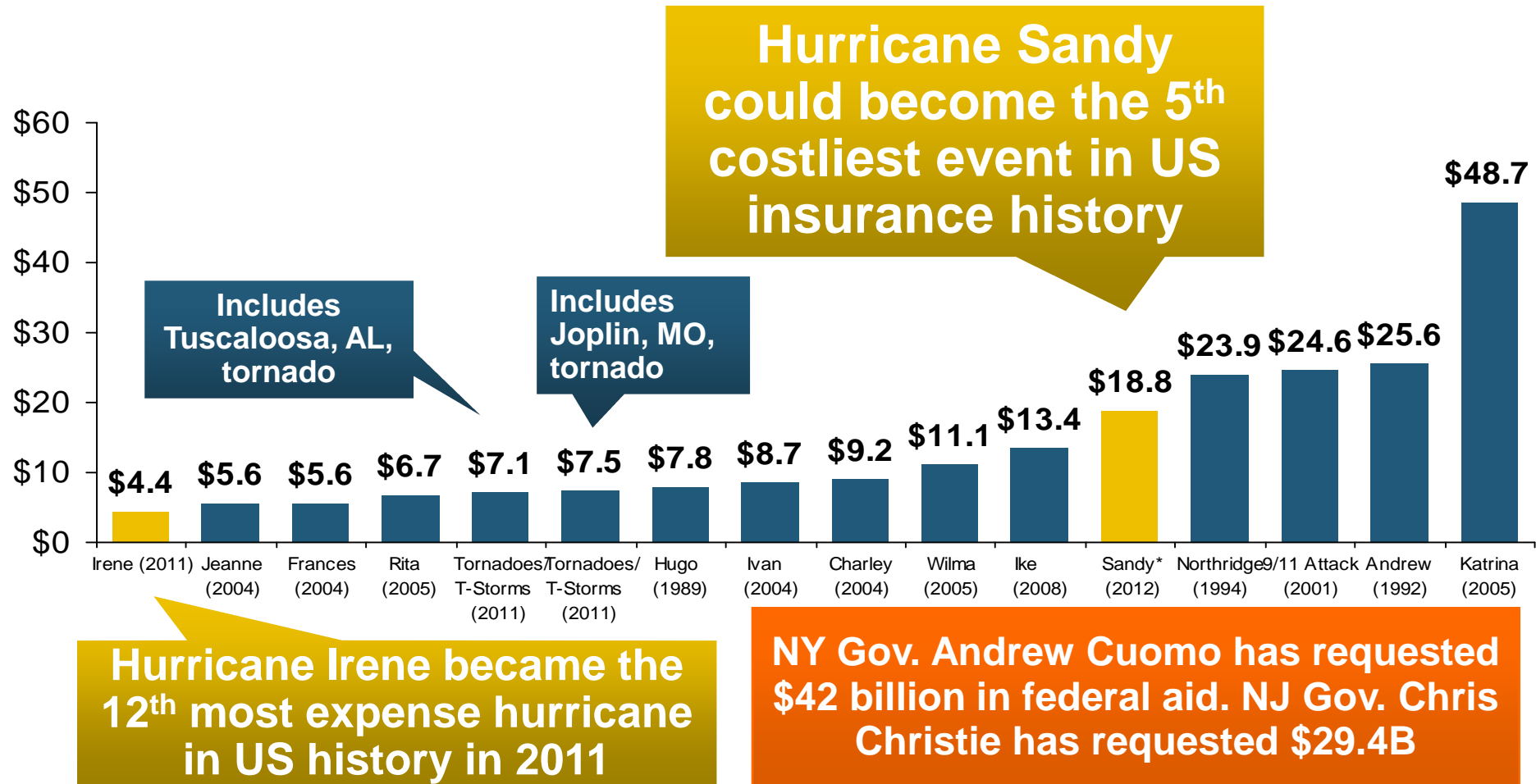
Second Nor'easter ten days after Sandy brought freezing temperatures to devastated region

- Many boats not yet winterized
- Many engines not pickled

First access to parts of the barrier islands didn't occur until three weeks after Sandy

Top 16 Most Costly Disasters in U.S. History

(Insured Losses, 2012 Dollars, \$ Billions)



*Estimate as of 12/09/12 based on average of range midpoints from AIR, RMS and Eqecat..

Sources: PCS; Insurance Information Institute inflation adjustments.

What we've learned

- Why was this storm so devastating?
- **Securing boats: What worked... and what didn't?**
- What has Sandy taught us?

Things that could not be changed...

- Height of hardstand area above sea level
- Height of fixed pilings holding floating docks
- Age and condition of fixed and floating docks
- Condition of neighboring marinas' infrastructure
- Number of boats in dry stack storage whose owners no longer have trailers

What worked... and what didn't

- Hauling boats
- Securing on floating docks
- Securing on fixed docks
- Moorings

Nelson's Marine Basin
Tom's River, NJ



Atlantic Highlands Municipal Marina
Atlantic Highlands, NJ



Patsy's Bay, Stony Point NY
Larry Wilson



Mansion Marina,
Staten Island



Hardstand stowage

- Surge carried boats off anywhere hardstand stowage was within a few feet of MHW and surge exceeded ~6 feet.

Staten Island



Mansion Marina,
Staten Island



Good Luck Point Marina,
Baysville, NJ



Mansion Marina,
Staten Island



Hardstand stowage

- Surge lifted boats off jackstands where hardstand stowage was within a few feet of MHW and surge exceeded ~8 feet.
- **Confined areas with multiple surge events suffered the greatest damage – “boat stew” at bulkhead consisting of boats, docks, marina equipment, and other debris.**

Nelson's Marine Basin
Tom's River, NJ



Nelson's Marine Basin
Tom's River, NJ



Hardstand stowage

- Surge lifted boats off jackstands where hardstand stowage was within a few feet of MHW and surge exceeded ~8 feet.
- Confined areas with multiple surge events suffered the greatest damage – “boat stew” at bulkhead consisting of boats, docks, marina equipment, and other debris.
- **Where boats did not go over the bulkhead, recovery was far easier than from the water and boats were much more likely to survive.**

Outcomes in a high-surge storm

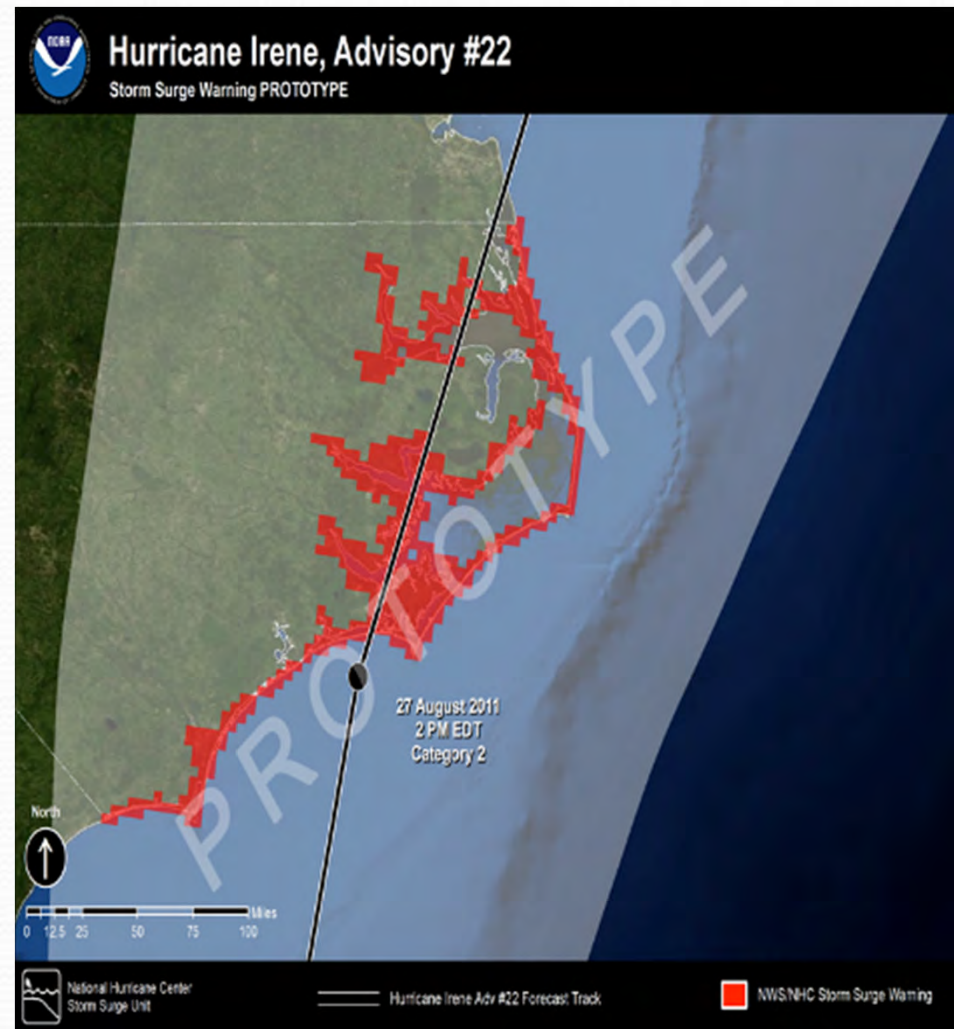
- **Hauling boats wasn't wrong, but it didn't work as well as in high-wind storms.**

Securing boats on land

- Assessing wind and surge risk
- Methods and techniques for securing boats on the hard
- Would any of this have worked in Sandy?

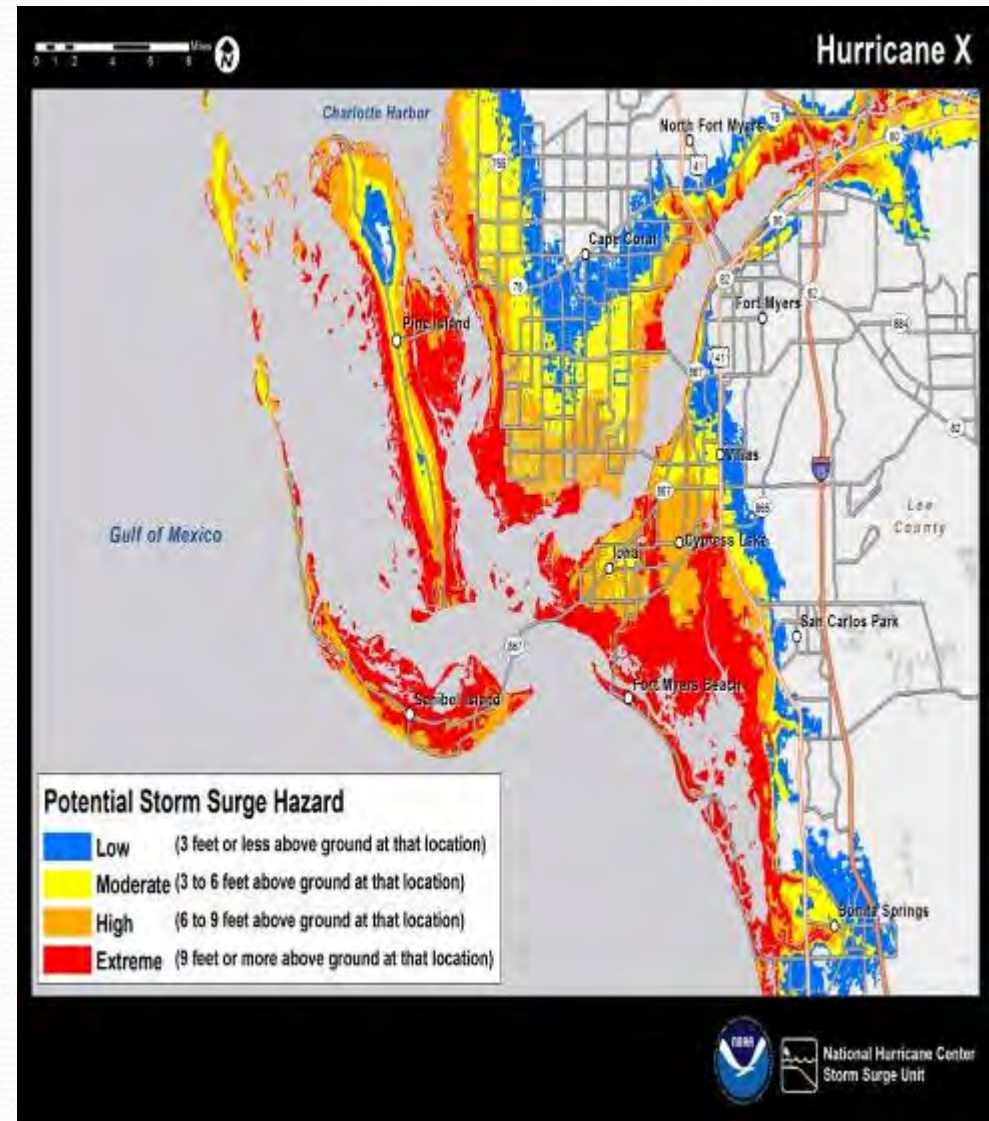
Storm Surge Watch and Warning

- Current tropical watches and warnings are mainly issued for winds
- NWS is developing a collaborative process between the National Hurricane Center and Weather Forecast Offices to **issue tropical cyclone storm surge watches and warnings**, separately from (tropical) wind watches and warnings.
- Experimental tropical cyclone storm surge watches and warnings for public by 2015
- Future work: Expand to include extra-tropical storms.



Storm Surge Inundation Graphic

- Work is well underway with the development of a tropical cyclone inundation graphic which incorporates uncertainty
- Experimental in 2013 or 2014
- Future work: Expand to include extra-tropical storms.



Goals of hurricane preparation

- Prevent loss of life
- Limit damage to boats
- Limit damage to marina infrastructure
- Limit damage to other infrastructure
- Limit damage to the environment



PRIORITIES

Keep the boats on land:

- (1) From going over the bulkhead
- (2) On the premises
- (3) Upright
- (4) Watertight







+ ?? feet

~3 feet



Tying down boats: Sailboats

- Keeps them from being knocked over in high wind events (impressive and proven results through Category 3)
- Keeps them from getting carried away in high surge events
- To flood the boat, surge has to exceed height of keel and topsides above the hardstand area – in excess of 10 feet. BUT forces on the tie downs?



Tying down boats: Powerboats

- Helps prevent them from being toppled off jackstands in hurricane-force winds, but not as critical as for sailboats
- Height of keel and topsides above the hardstand area significantly lower than for sailboats – would take much less surge to flood the boat
- In high-surge events like Sandy, it may be better to “restrain” smaller (>30 feet) powerboats rather than strap them down completely

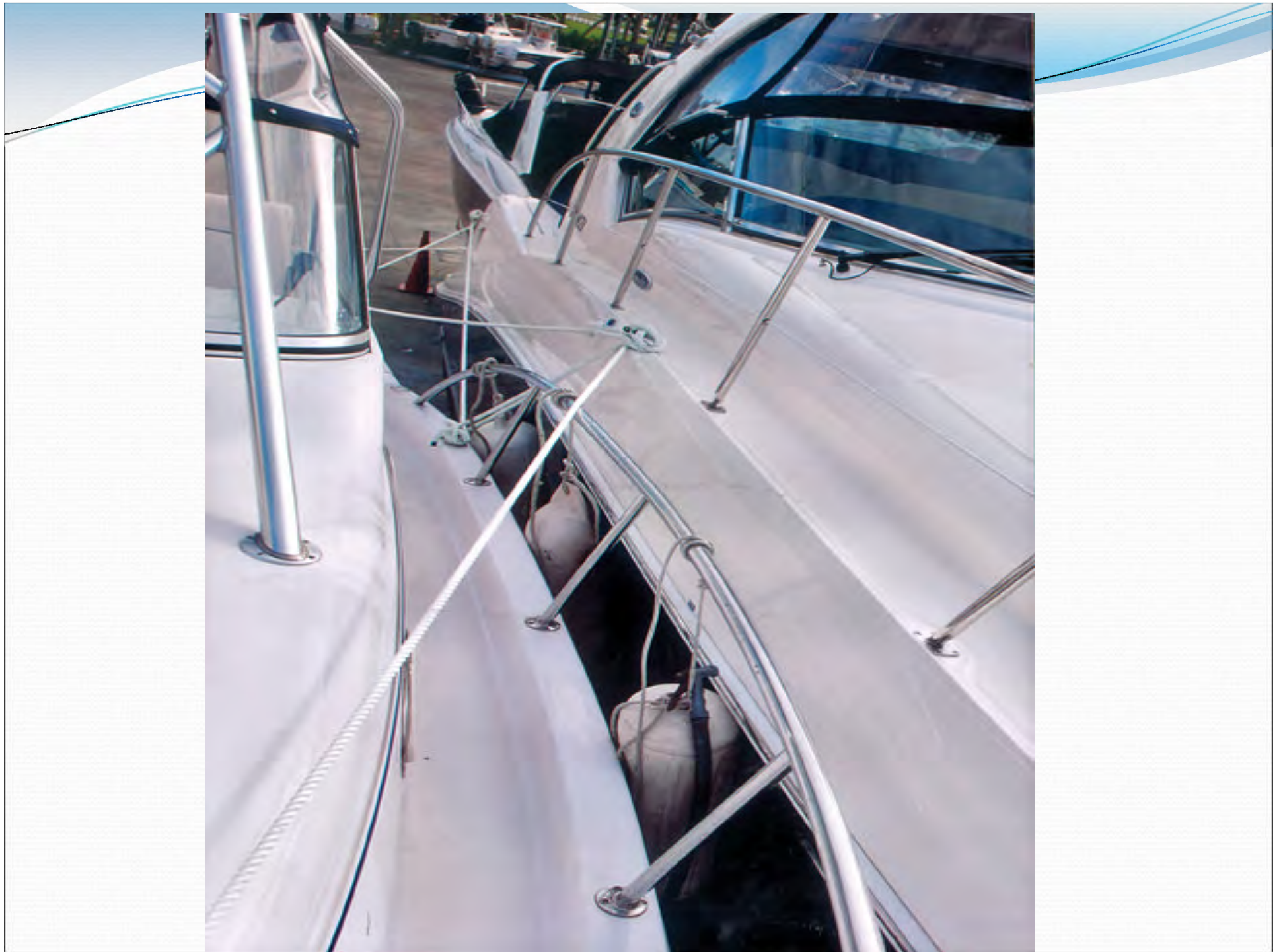
Sebastian River Marina and Boat Club, Sebastian, FL





Hinckley Yacht Services, Stuart , FL facility





Techniques and lessons learned

Plywood under jackstands to keep them from sinking
Jackstands should be chained together to keep them from shifting

Tying boats together can help to hold them in place

Fendering between boats to minimize damage

Special equipment may be required to pack boats in

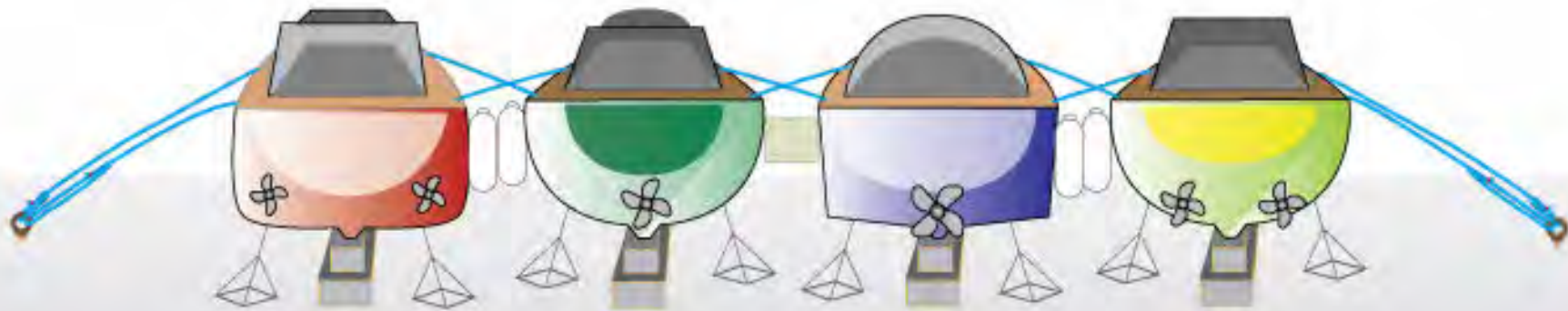
Can charge for preparing boats for hurricanes

If tying down for surge that might reach higher than the waterline, would want to close all seacocks and seal the exhaust

Securing boats

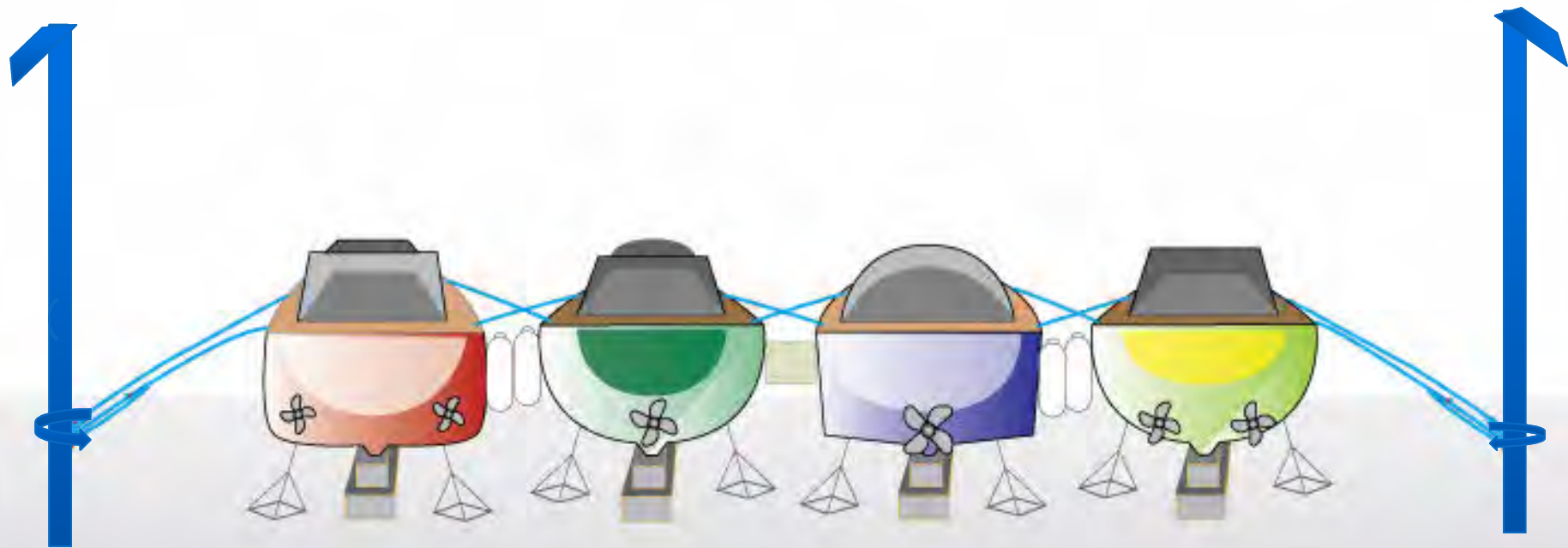
- Secure row of boats to strong points
- Use stretchy nylon line
- Allow boats to rise with the surge
- Held in the area by lines
- When they come down, may not come down well
- Even if damaged, still on premises, at least some will be upright and watertight

Securing smaller boats for large surge



- DRAIN PLUGS IN
- BILGE PUMPS ON
- BATTERIES TOPPED UP

Securing smaller boats for large surge



- DRAIN PLUGS IN
- BILGE PUMPS ON
- BATTERIES TOPPED UP



Courtesy Gary Lucas



Gary Lucas Case Study

- Raised stands higher and added more concrete blocks under the hull
- Four screw anchors four feet long each rated for 6,000 lbs.
- Nylon straps ran over the top of the boat (not to cleats)
- Ratchets to crank down on the straps
- Straps and anchors were obtained from McMaster Carr at a cost of less than \$100



Courtesy Gary Lucas

Would any of this have worked in Sandy?

- Tying down sailboats would have kept a high percentage in place
- Tying down large powerboats would probably also have been a successful strategy
- Restraining smaller powerboats looks like an approach worth trying in future storms



These strategies did reduce damage to boats, marinas and other property in at least three cases

Reality check

Most people in the path of a hurricane are going to worry about their families, homes, and cars before they worry about their boats

Marina personnel have the same concerns, as well as needing to secure the business before the storm strikes

May get three days of warning that a hurricane is approaching, but exact path, likely wind speeds, and forecast surge height won't be reliable right up to 24 hours or so before it strikes

Hurricane plan must be realistic about how many boats you can haul and prepare in three days – what will you do with the rest?

Would recommend having an Ultimate Storm Plan that can be implemented in the last 24 hours



What worked... and what didn't

- Hauling boats
- **Securing on floating docks**
- Securing on fixed docks
- Moorings

Staten Island



Staten Island



Staten Island



Floating docks

- Where pilings were not high enough (and most of them weren't), the outcome was as bad or worse than being on the hard.

Staten Island Yacht Sales
Staten Island



Floating docks

- Where pilings were not high enough (and most of them weren't), the outcome was as bad or worse than being on the hard.
- **The only place where a meaningful number of boats survived unscathed was on floating docks with pilings high enough to accommodate the surge.**



Floating docks – other issues

- A half dozen marinas/yacht clubs we know of where the docks were within one foot of the top of the pilings
- Forces on the entire docking system at that water level much higher than normal; if not designed for those forces or if docks are old or not in good repair, can easily destroy pilings
- If Sandy's winds had been Cat 3 or higher, the docks that survived might have failed
- Some boats and floating docks were damaged when debris from other marinas came down on them

Floating docks

- Where pilings were not high enough (and most of them weren't), the outcome was as bad or worse than being on the hard.
- The only place where a meaningful number of boats survived unscathed was on floating docks with pilings high enough to accommodate the surge.
- **BUT... some luck involved even then – debris from other marinas damaged docks, dock age/engineering, wind speed and total forces.**

Outcomes in a high-surge storm

- Hauling boats wasn't wrong, but it didn't work as well as in high-wind storms.
- Floating docks with sufficiently high pilings were the only place where large numbers of boats survived Sandy unscathed, but in more than a few cases luck played a significant role.
- **A higher percentage of boats survived on fixed docks than in high-wind storms, but where they didn't they were often wrecked completely and recovery was harder than from hardstand areas.**

Mooring advantages

- Boats ride bow to the wind and waves, can adjust as conditions change
- With adequate scope, will ride up and down with the surge
- New technology for moorings, lines, and chafe protection have made mooring systems more reliable

Nyack Boat Club
Larry Wilson



Courtesy Warren Frerichs
Nyack Boat Club



Courtesy Warren Frerichs
Nyack Boat Club



Mooring System

- Mooring
- Lower Chain
- Swivel
- Shackles
- Upper Chain
- Mooring Pendant
- Point of Attachment to Boat



The mooring is
only so good as
its weakest link

Outcomes in a high-surge storm

Hauling boats wasn't wrong, but it didn't work as well as in high-wind storms.

Floating docks with sufficiently high pilings were the only place where large numbers of boats survived Sandy unscathed, but in more than a few cases luck played a significant role.

A higher percentage of boats survived on fixed docks than in high-wind storms, but where they didn't they were often wrecked completely.

Moorings offer a viable alternative for keeping boats safe in high-surge storms, but only if ALL moorings in the basin are properly constructed, maintained, and prepared for the actual conditions.

What we've learned

- Why was this storm so devastating?
- Securing boats: What worked... and what didn't?
- What has Sandy taught us?

Surge matters

- NOAA and NWS are working on new surge forecasting to accompany Saffir-Simpson Scale when hurricanes are forecast
- Tools for assessing YOUR location's surge risk can provide guidelines for rebuilding



Associated Press

Staten Island

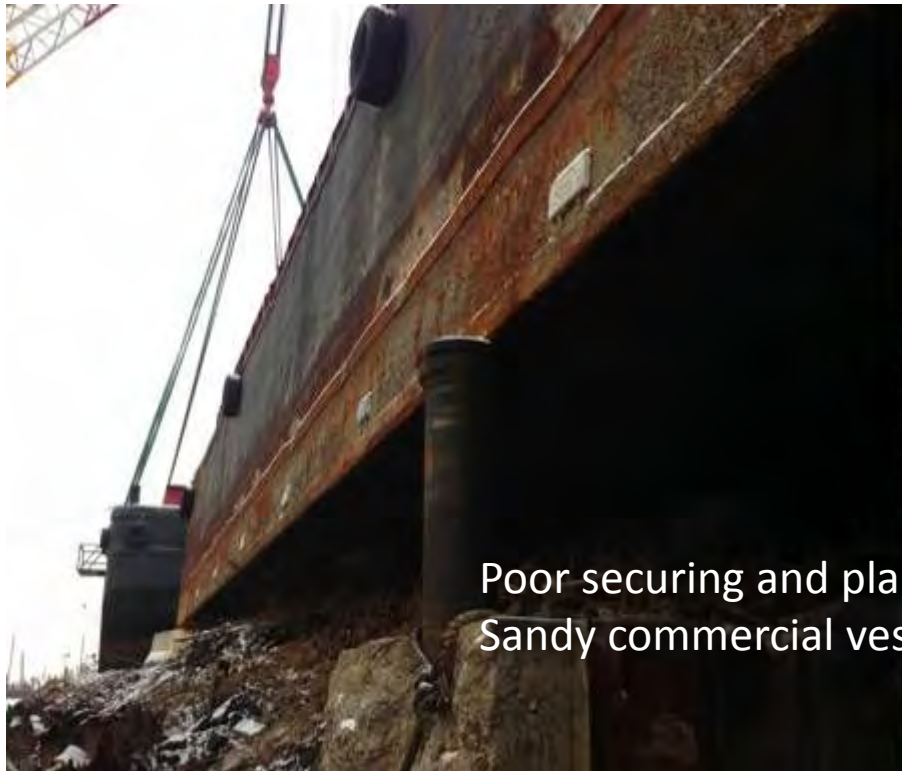


Four take aways

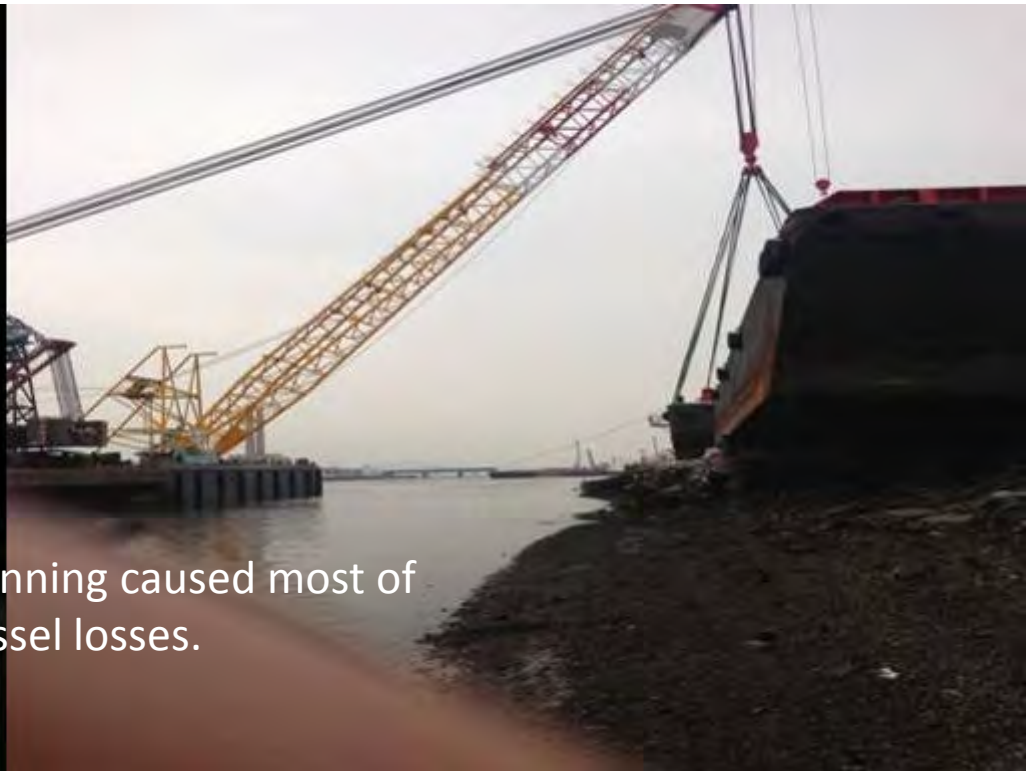
1. Surge matters.
2. Preparations matter... but we have to prepare for the real risks.
3. Hurricane planning needs to become more marina and storm specific.
4. Lessons from Florida marinas and new ideas coming out of Sandy could have reduced the damage in this storm.


Many commercial operators moved their assets to safe harbor and tended their equipment during the storm and had no vessel losses.





Poor securing and planning caused most of Sandy commercial vessel losses.

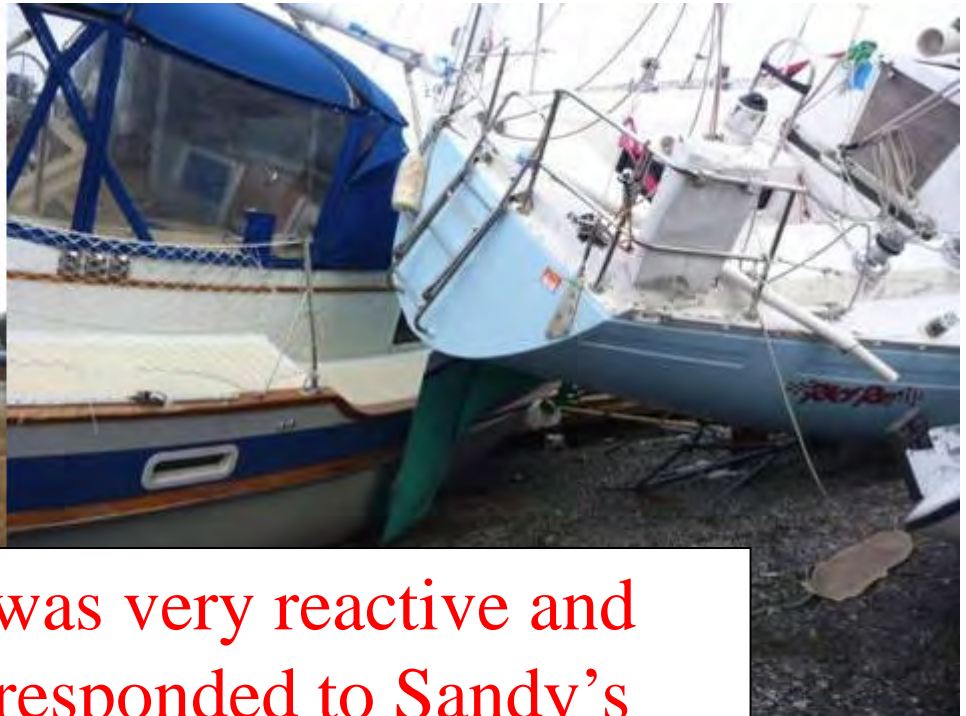




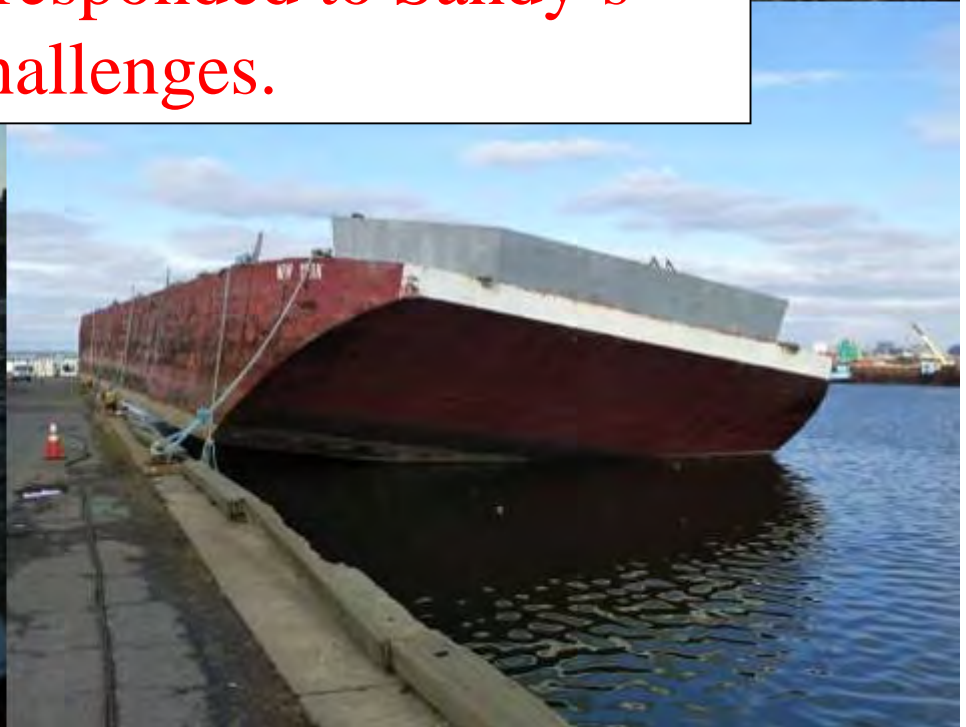
Buoyancy at 64 #'s per cubic foot of displacement is a force that should not be secured against. Vertical lift must be allowed for. Most mooring point failures during Sandy were due to inadequate allowance for vertical rise while at same time restraining horizontal motion.

By far- the most costly commercial marine claims were onshore storage type losses





The Industry was very reactive and impressively responded to Sandy's challenges.



Post Sandy - Major Marina Fire - 5 months later.

Infrastructure has many untested systems or
improperly repaired systems post Sandy



Risk Engineering needs to be improved. To use Sandy as a benchmark is a mistake. It was a unique event that would have truly been Catastrophic with elevated winds. A majority of the facilities are being repaired with no additional improvements to mitigate a similar event. There is no simple one fits all solution.

