



Ship maneuverability
as a consideration
in the design process

How much maneuverability?



Humans Onboard



Vessel inherent and piloted maneuverability



Many design features to consider?



Bridge design and mariner tools



“When ships get too big for their ditches” - Gray

- IMO has for years had guidance criteria for the maneuverability of large ships at full speed in open water
- Only guidelines
- Many ships do not comply
- Guidelines don't help much at slow speed in narrow channels where bank effects and squat are crucial
- ***Something better is needed, and fast.***

Ship Design



SHIP DESIGN

Questions to Address

- What is the current situation?
- What is the desired situation?
- Why is there a difference between the current and the desired situation?
- What are the impediments to change?
- How can these impediments be most effectively addressed?

Can we get
there?



Current Situation?

- Good predictability of ship maneuverability in deep water
- Some ships being built have very poor maneuvering capabilities
- Don't have hard and fast requirements or criteria
- IMO has guidelines not requirements – because of difficulty and cost of predicting and verifying

- Many important elements
 - Squat (trim and sinkage), ability to turn, ability to go straight, ability to recover, ability to stop, ability to go slow or number of engine reversals, etc.
 - Degree of ship crabbing and increased effect on moorings or reserve rudder angle
 - Adequate horsepower for control, rudder size and effectiveness
 - Visibility, etc.
 - Air draft, forces on moorings from passing ships

- Don't have tools capable of assuring controllability to make design tradeoffs
- Ship maneuverability is not really present in the ship design spiral
- Definitive maneuvers and full and model measurements done in deep water and rarely at operating conditions – basis of modeling
- Data from shipbuilders difficult to get
- Reactionary vs planned/designed
- Science of designing for adequate maneuverability is lacking

An accident can spoil your day!



Desired Situation?

- Need hard and fast maneuverability criteria for ship design so will know result
- Would like straight-forward and accurate formulas to easily find answers
- Improved tools and design process so can reliably make tradeoffs and assure an adequately controllable ship
- Knowledge about what ships will be like so port and channel designers know what to design around

- Ports need many answers such as how wide does channel need to be, size of turning basin, air draft
- Ideally, vessel classes indicating vessel's controllability so know what to expect
- Risk analysis of harbor/waterway by segment and ship combination and levels of acceptable safety
- Advancement in practical use of more advanced computational tools – CFD

- All ships instrumented with dual frequency dgps so know where they are vertically and gather useful data for prediction/understanding

Congestion will increase



Why not at desired Situation?

- Ship design is set to meet economic use of vessel
- Cost of studies and improving science is high
- Not enough data and sharing of existing data
 - Existing data not shared due to legal/competitive constraints
 - Systematic model tests not done because of cost
 - Full scale trials not often done as expensive to do accurately

- State of prediction ability in restricted waterways is not sufficient to make decisions
- Technology to measure ship trim and sinkage only recently available and systematic studies are needed to improve science
- Need more developments of predictive tools with full-scale validation
- Owner's lawyers can't permit sharing of data with others and public

Art or Science?



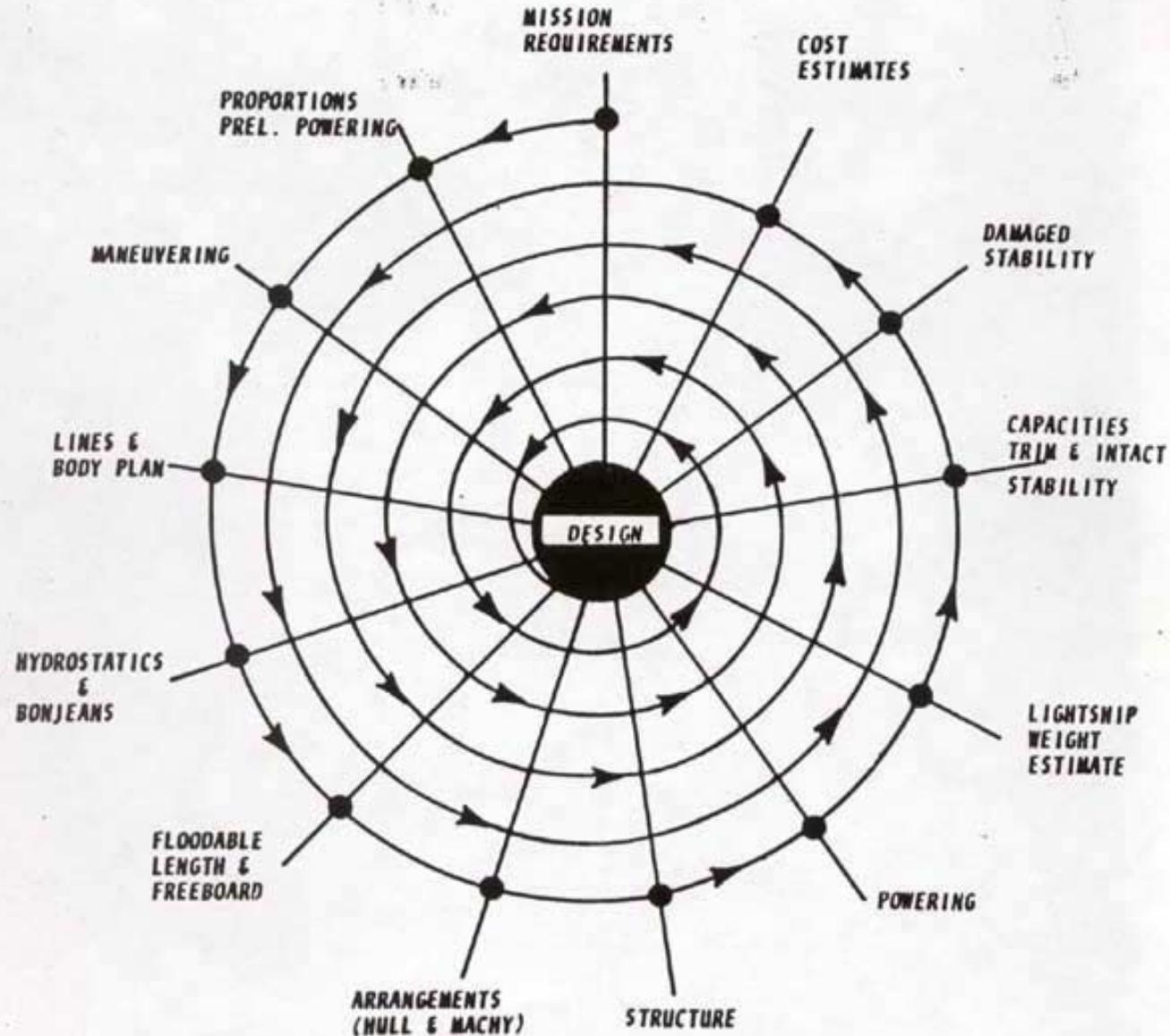
Impediments to change?

- Cost of acquiring needed data
- Company legal/competitive risks of sharing data
- Need more developments in predictive tools and expensive
- Accurately measuring in full scale to build and validate models very difficult until recently
- Lack of major accident from flagrant controllability problem – classic method to make improvements in ship safety

How to address impediments?

- Work out difficulties so organizations can cooperate and share data
- Collect more data
- Set up systems so data collected systematically
- Pilots collect and share data on ships
- Increase ship maneuverability design awareness

Ship design spiral



- Houston ship channel studies - Panel H-10 continue to develop slow speed criteria and performance indices together with Houston ship pilots Design ships and harbors together
- Ports must set minimum standards function – classification of ports
- Need shared liability/responsibility/authority

- “Fast track” improvements
 - Work to have local port stakeholders get together and work issues
 - Work out long term solutions re waterways and improvements
 - Determine level of safety desired
 - What type ships port would accept and reject



Conclusion

Have some
directions but
still need
IDEAS on
how to make
it happen?