

Special Operations Vessel (SOV)



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Capability Gap

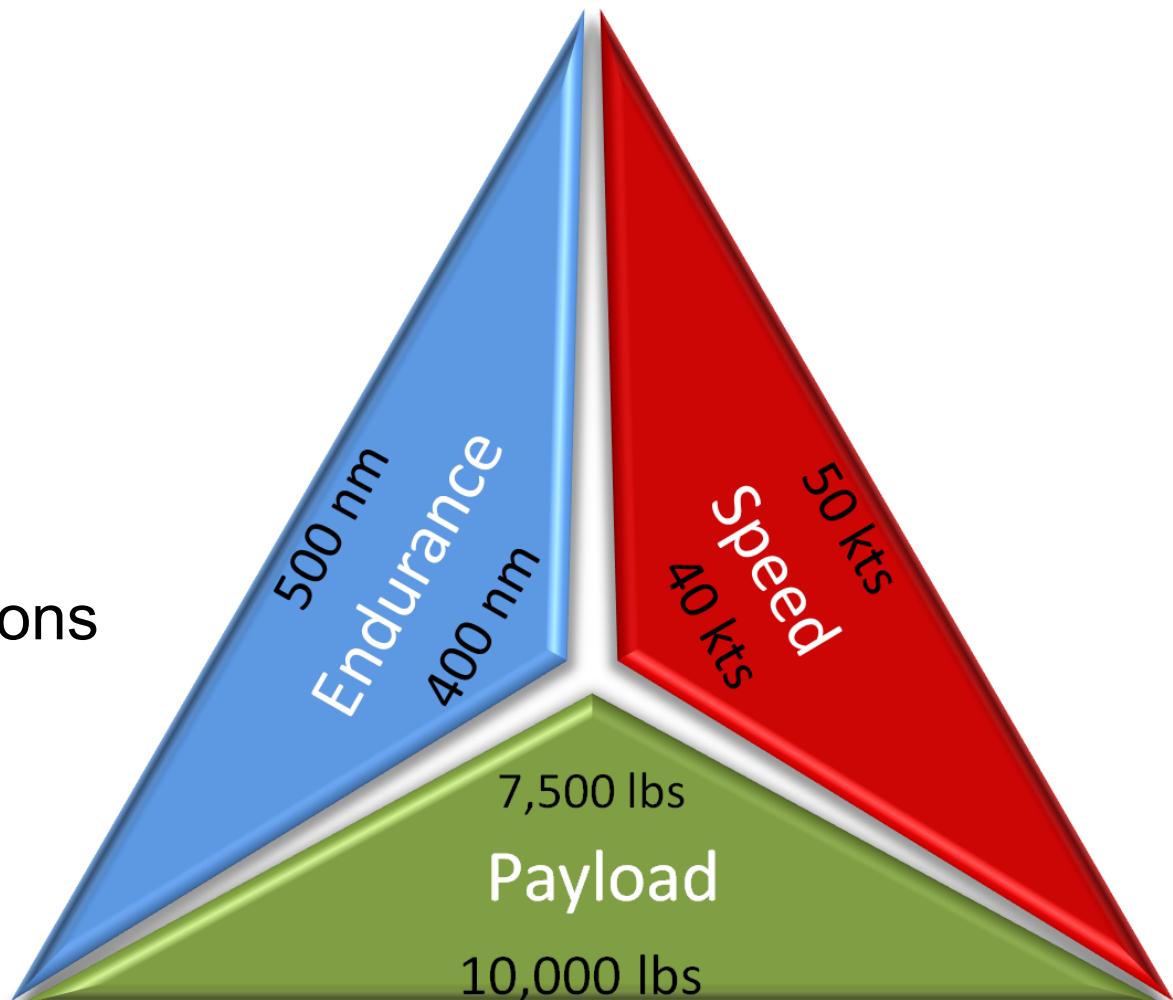
- National Defense Authorization Act of 2012
 - Mk V Special Operations Craft / RIB retirement
 - Delayed inception of CCM
 - Unexpected program delays for follow-on platform
- Gap established for special operations vessel

Our Sponsorship: Designers, Operators, Requirement Setters, and Owners

Mr. Donald Blount	DLBA, Inc.	Naval Architect High Speed Vessel Designer
Mr. Carl Casamassina	NSWCC CCD	Deputy Warrant Holder Combatant Craft
CAPT Travis Schweizer CAPT (ret) Tom Wright	OPNAV	N951
CAPT Chuck Herbert	NAVSEA	PMS 340
CAPT (ret) Tim Kelly	USSOCOM	PEO Maritime Branch Head
CAPT (ret) Tom Carlson	Naval Special Warfare (NSW)	N84 Surface Mobility Programs Lead
CDR Todd Freischlag	NSW Group FOUR	Chief Staff Officer

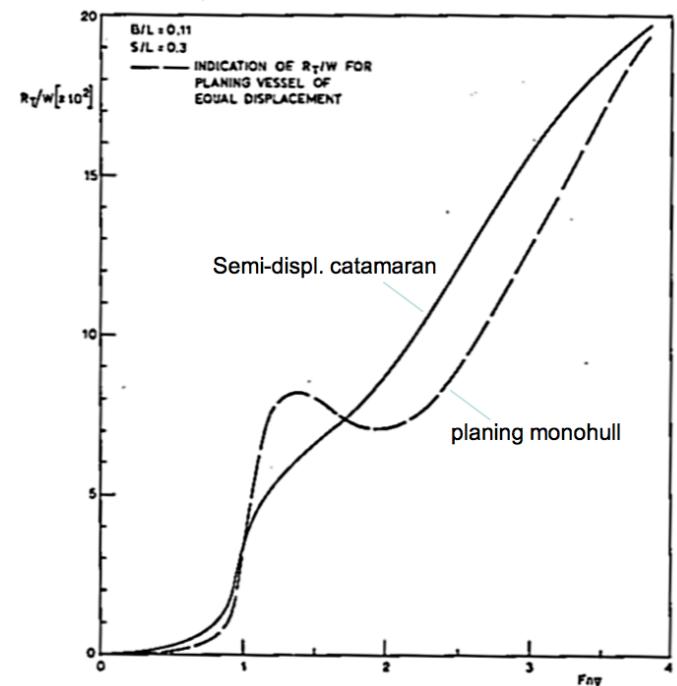
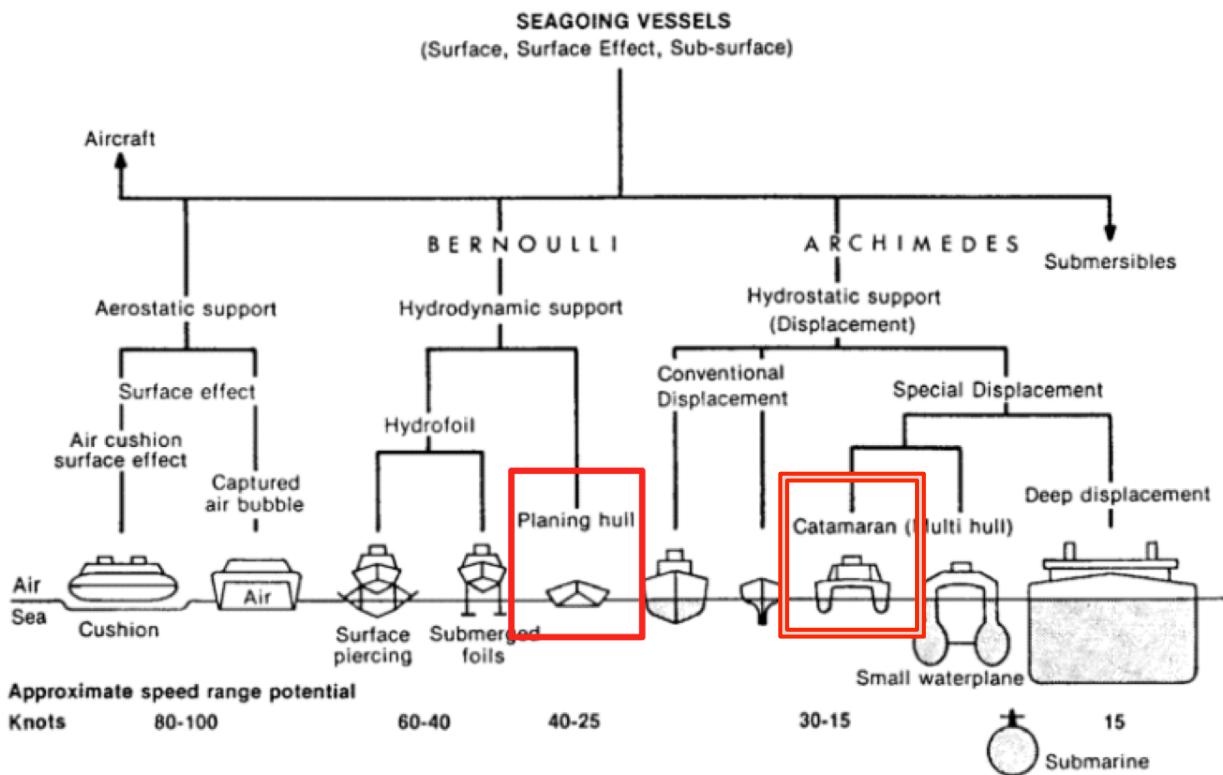
Requirements

- Iron Triangle
 - cruise speed
 - payload
 - range
- Ride Quality
 - vertical accelerations

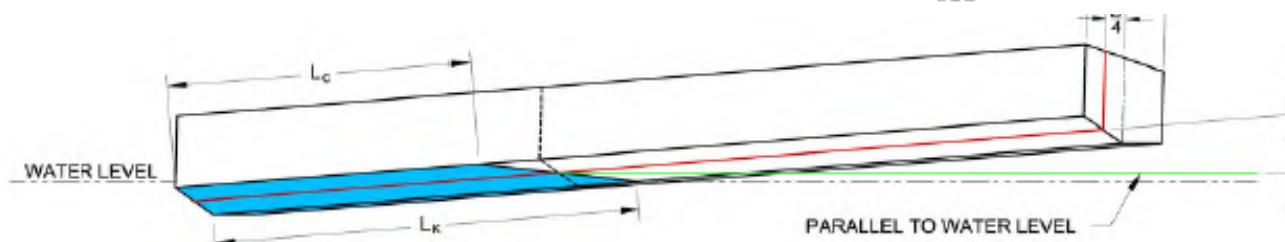
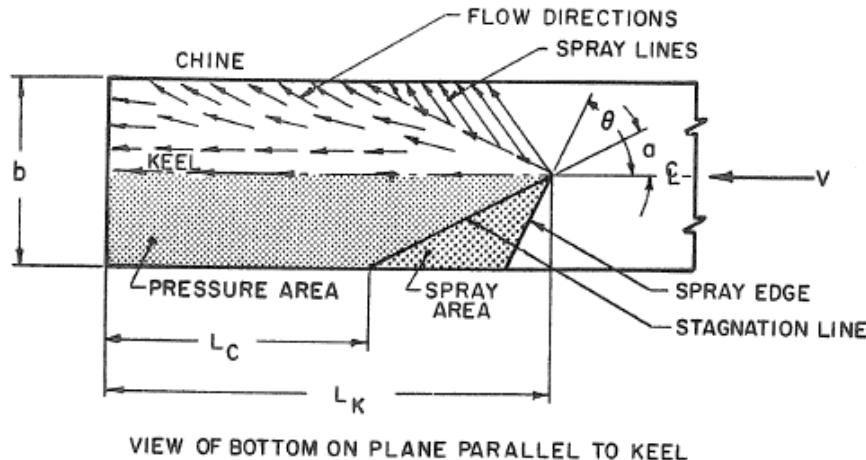


Types of Craft Considered

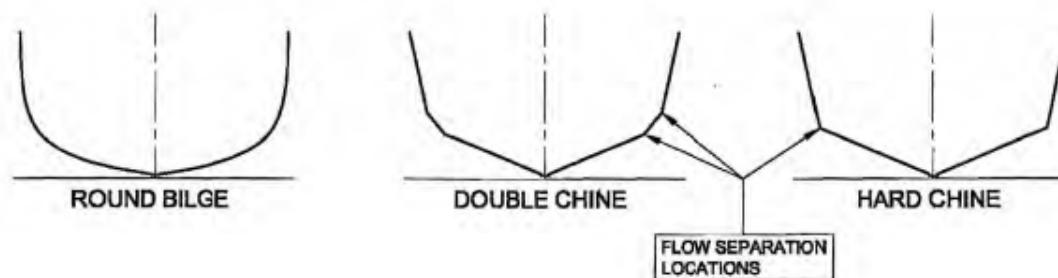
- Narrowed to two hull forms
 - planing catamaran
 - planing monohull



Planing Craft

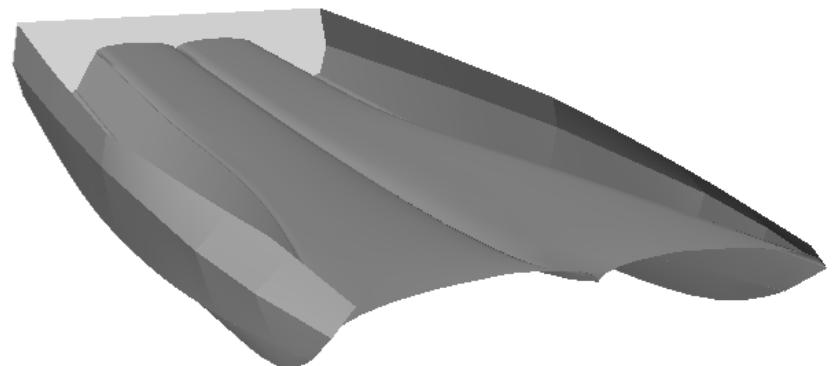
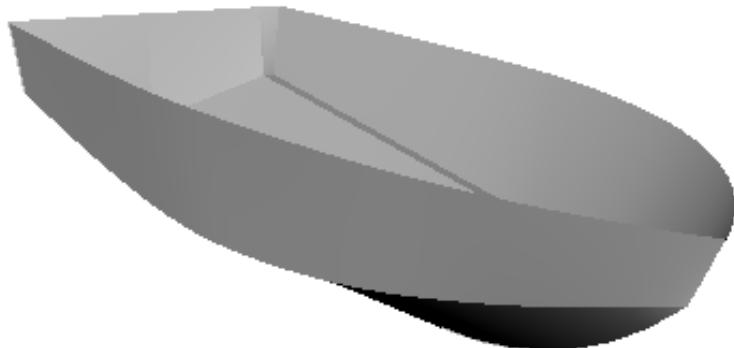


GENERIC HULL FORMS

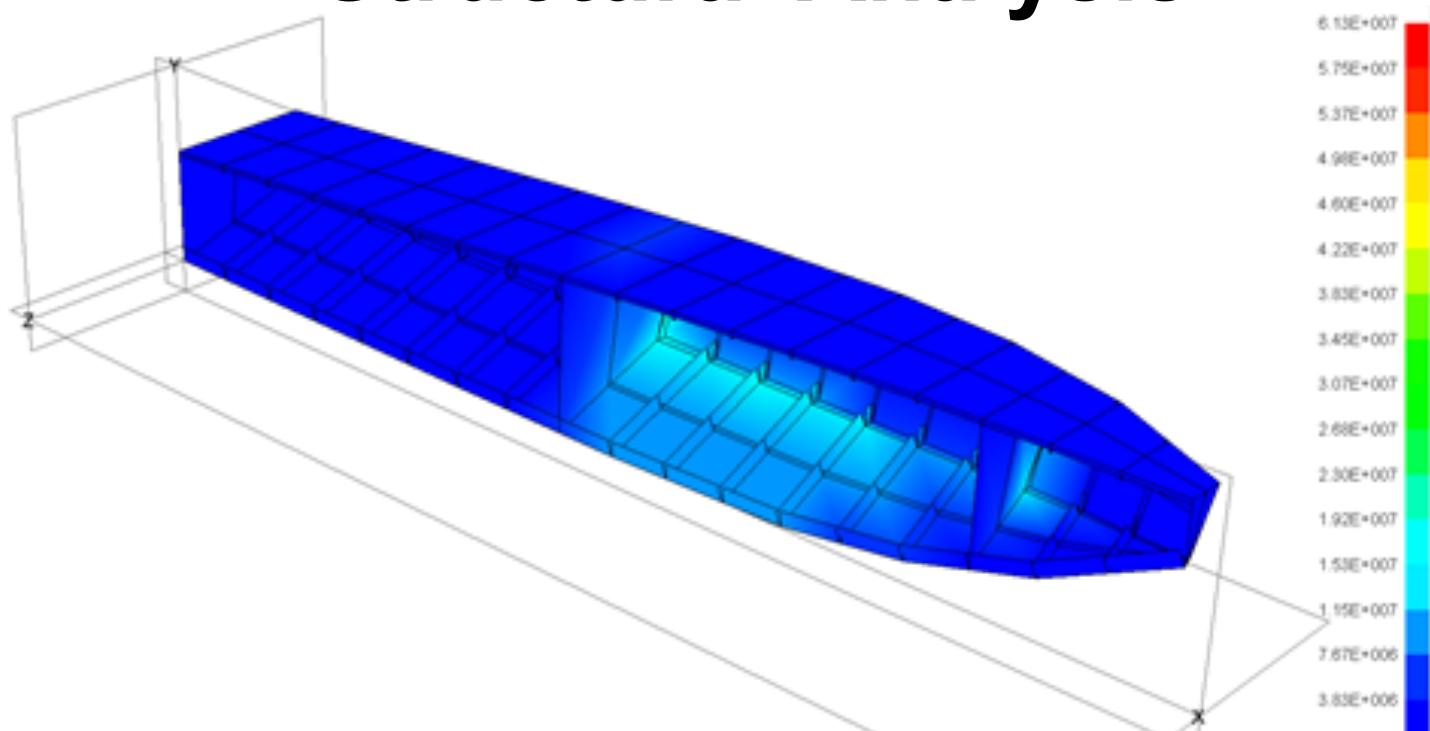


Hull Selection: Catamaran vs Monohull

- Parametric variant generation tool
- Two Concurrent Spirals



Structural Analysis

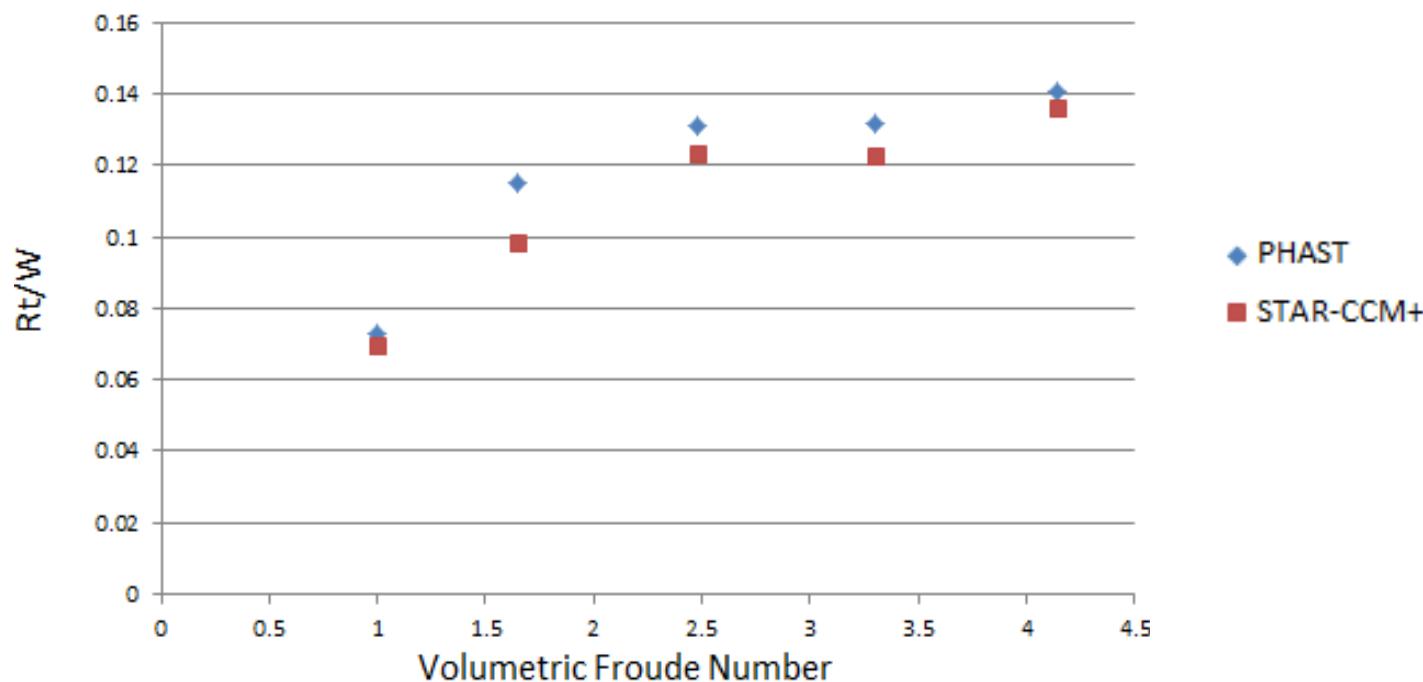


<u>Structural Analysis Step</u>	<u>Increased Catamaran Structural Weight</u>	<u>Increased Monohull Structural Weight</u>
Crossdeck Slamming	25.5%	N/A
Hull Slamming	8.5%	26.8%
Forebody Pressure	8.1%	9.3%
Design Sea Pressure	8.1%	-6.5%
Heavy Units Weight (Deck) Pressure	8.1%	-5.8%
Final Weight	8.1%	-5.8%



CFD Validation

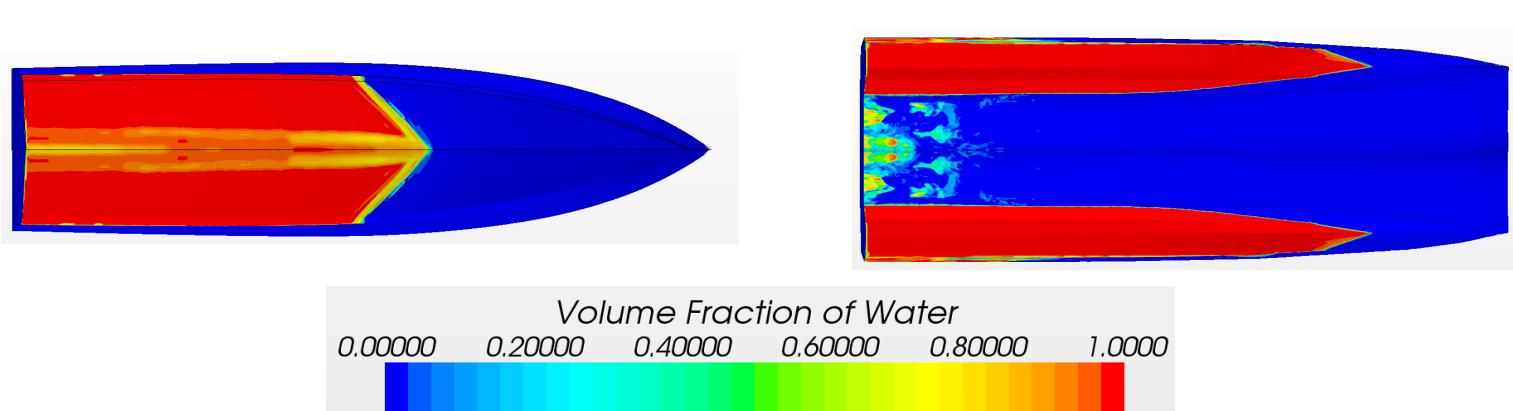
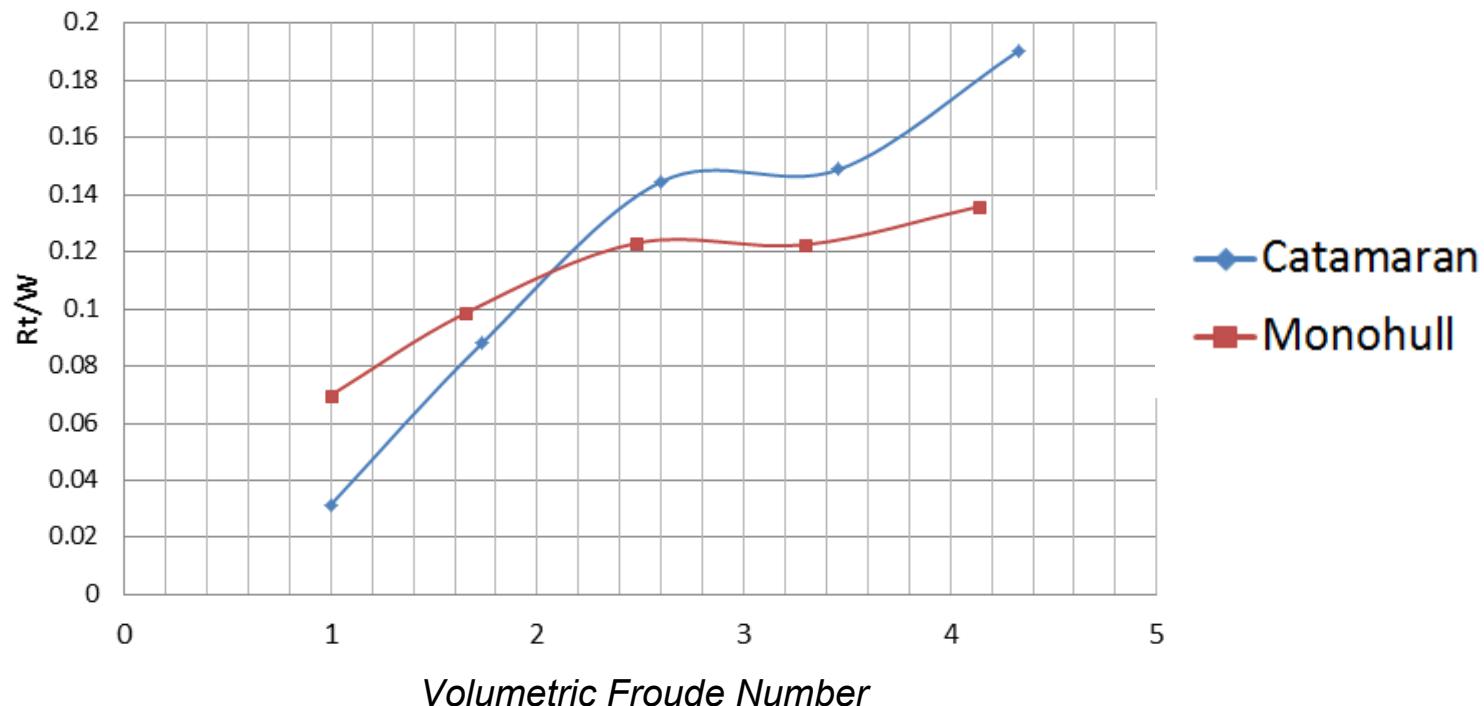
*Non-Dimensional Resistance vs.
Speed*



Calm Seas; F_{nv} 1 & 20, 30, 40, and 50 knots

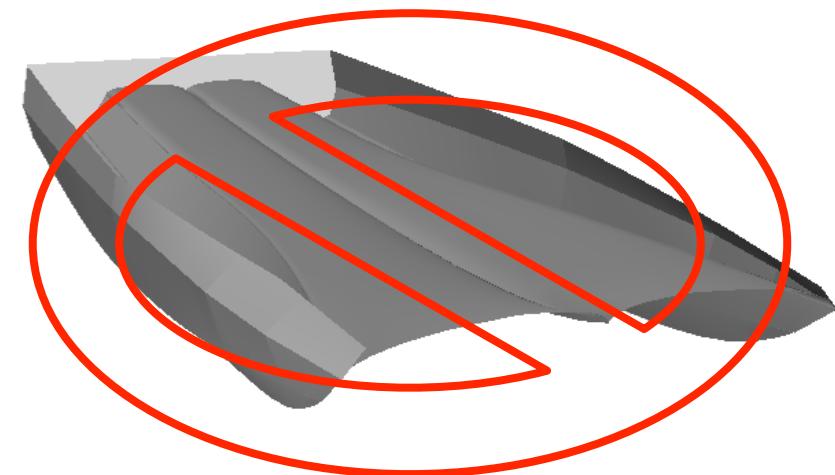
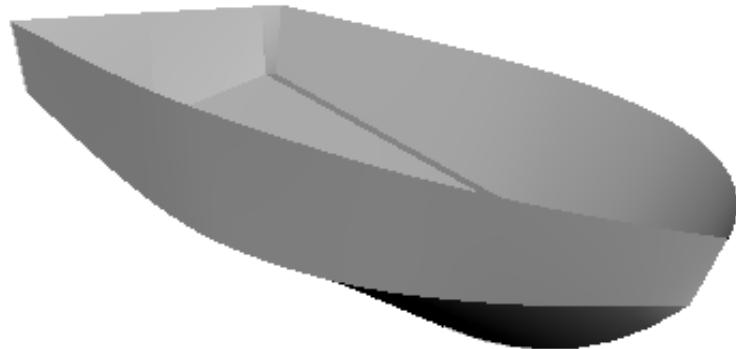
CFD Results

Hull Comparison



Hull Type Selection: Monohull

- Structural weight -> Payload capacity
- Slamming pressures
- CFD resistance
- Catamaran tunnel closure
- Sponsor input



Propulsion and Generator Selection

Considered Gas Turbines(6) and Diesel Engines (8)

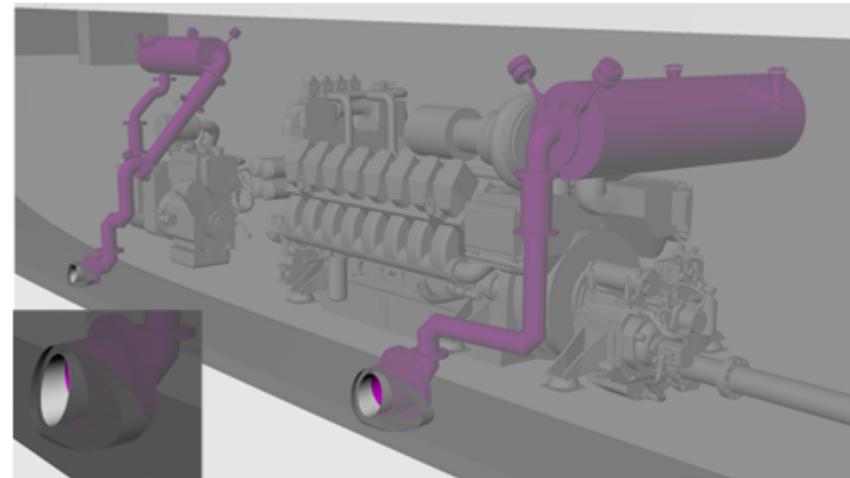
Prime Mover: MTU 16V4000 M90

Generator: 2x Kohler 32 EOZD Generator

Propulsor: HamiltonJet HM-811

Considerations

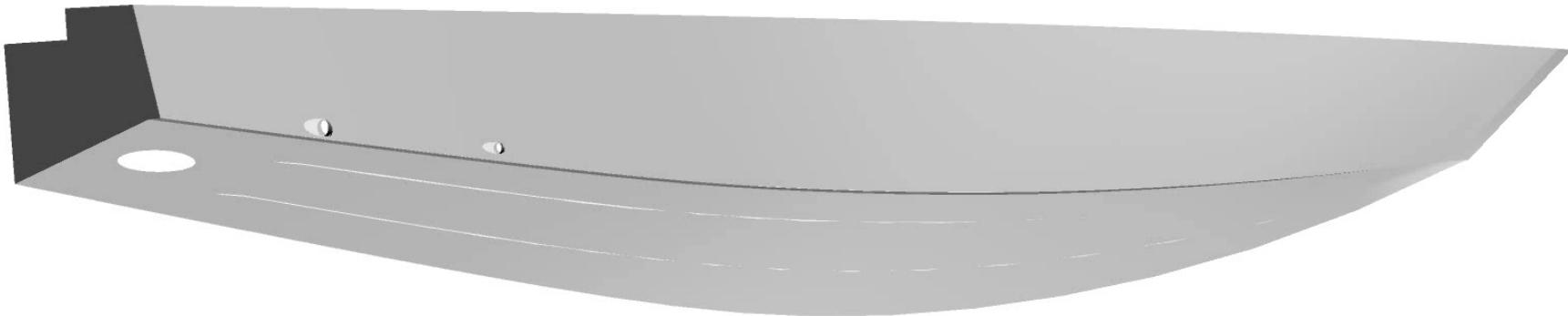
Iron Triangle, SFC, Power
Weight, Size, Detectability



Rolls-Royce

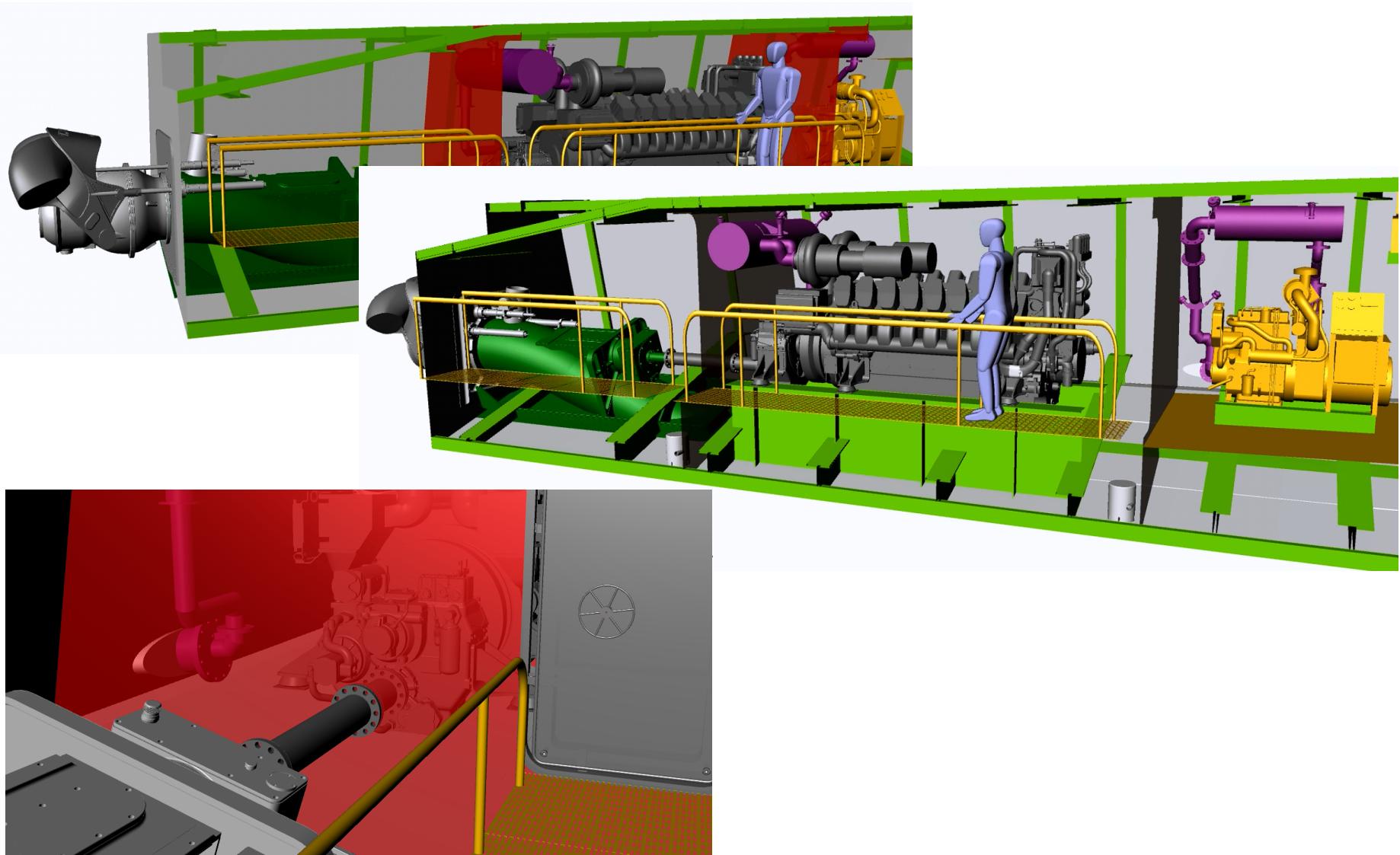


General Arrangements

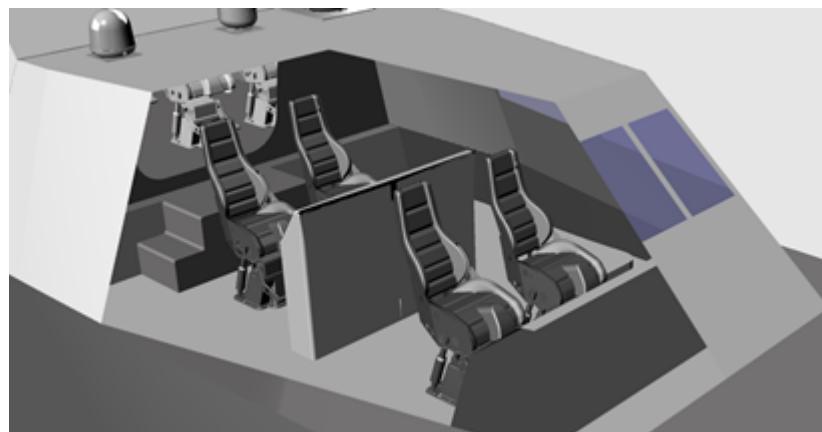
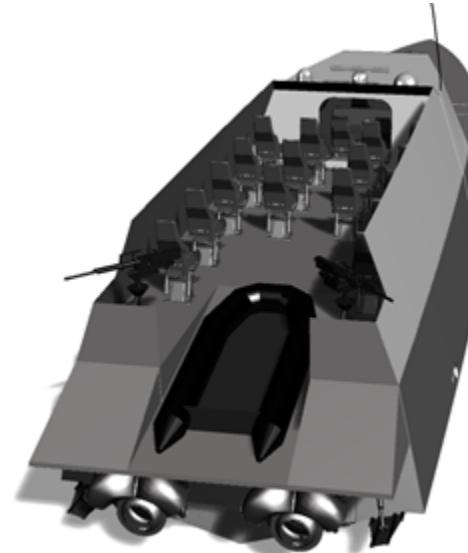
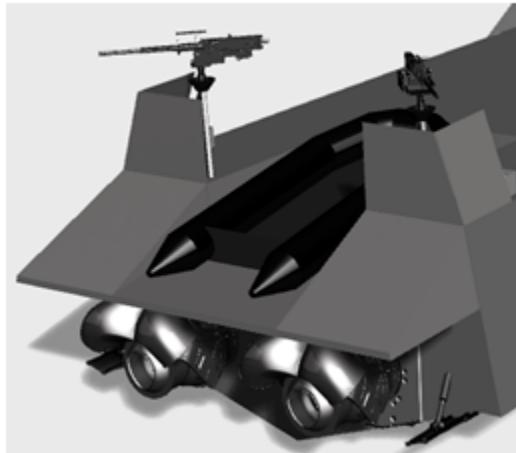


UNREGISTERED VERSION
Gadwin ScreenRecorder

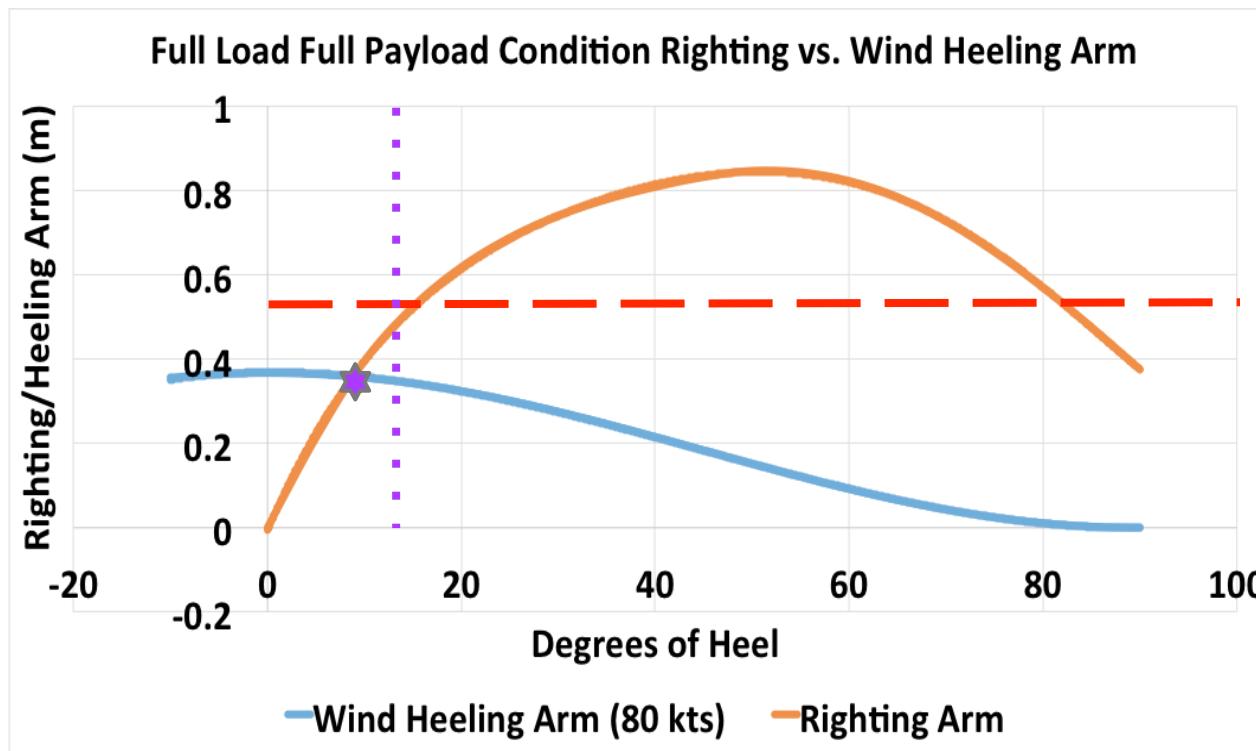
Engine/Aux Room GA



Topside GA



Intact Stability



— — — max wind heeling arm ······ max intersection heel angle

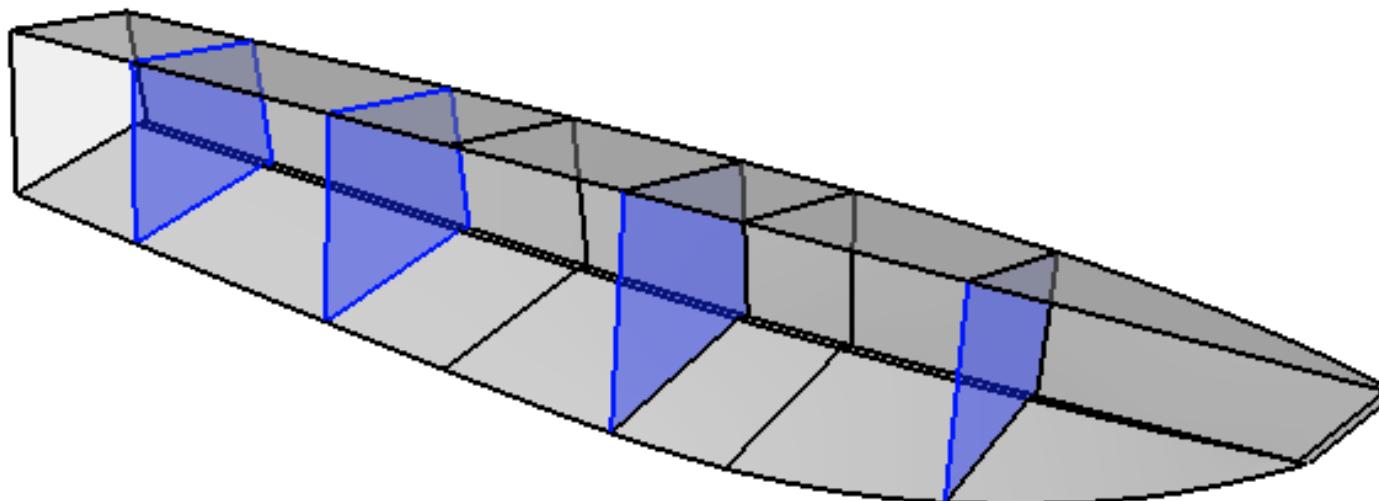
Minimum 140% area ratio required; SOV > 1000%

Range of the GZ curve > 70°

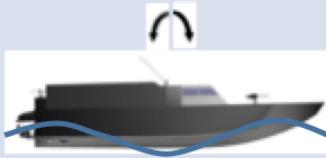
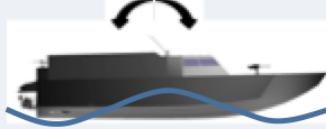
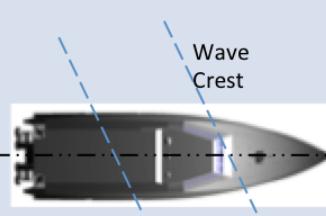
GZ-curve positive over the complete range

Damaged Stability

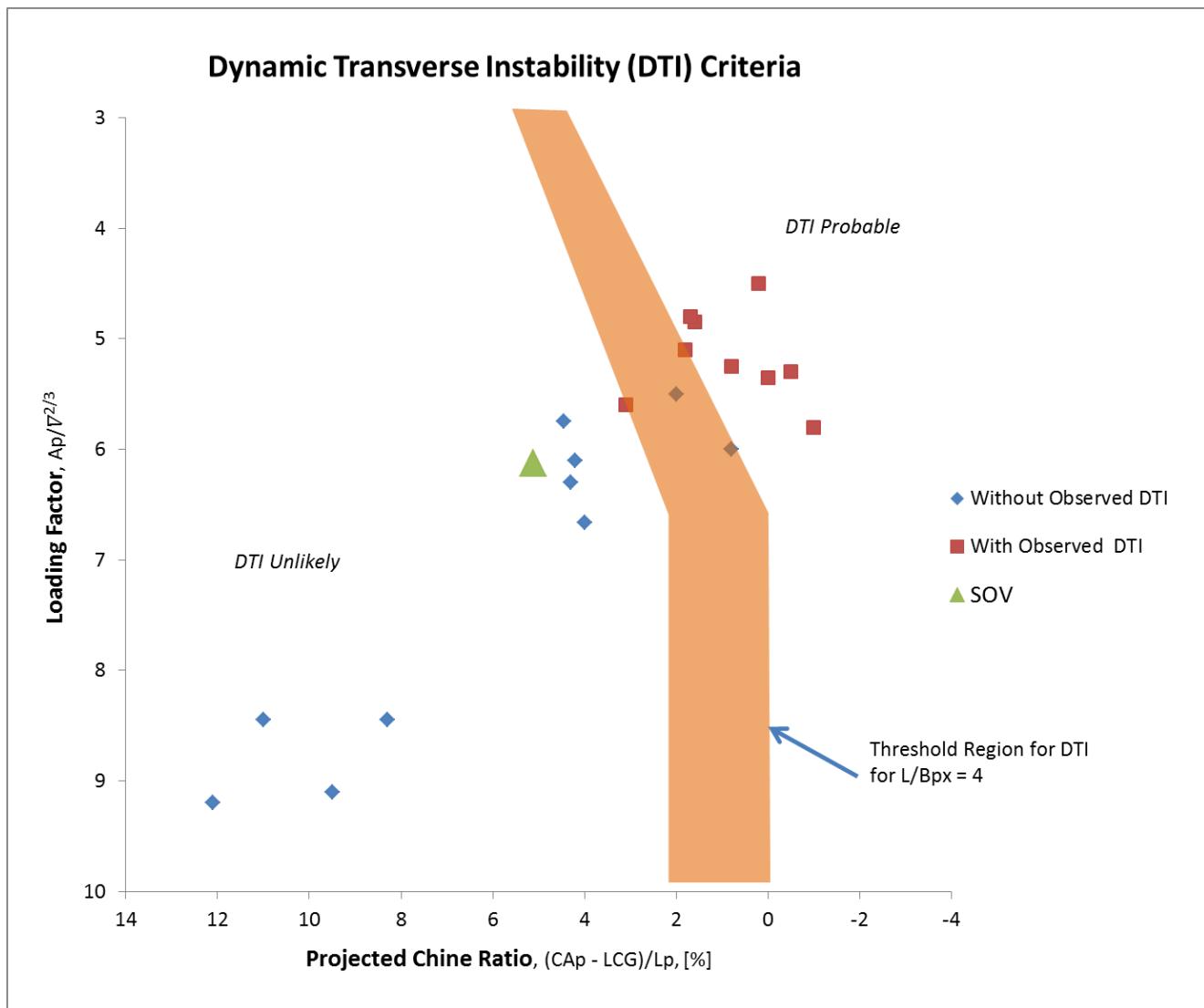
- **DNV/GL Rules** require minimum of 2 WT bulkheads
 - 1 WT collision bulkhead
 - 1 WT bulkhead FWD of engine room
- Initially failed “1 compartment flooding”
 - only 2 bulkheads due to large engine room and auxiliary room
- Added bulkheads in engine room and auxiliary rooms
- After the additions, all DNV damaged stability requirements met



Dynamic Stability

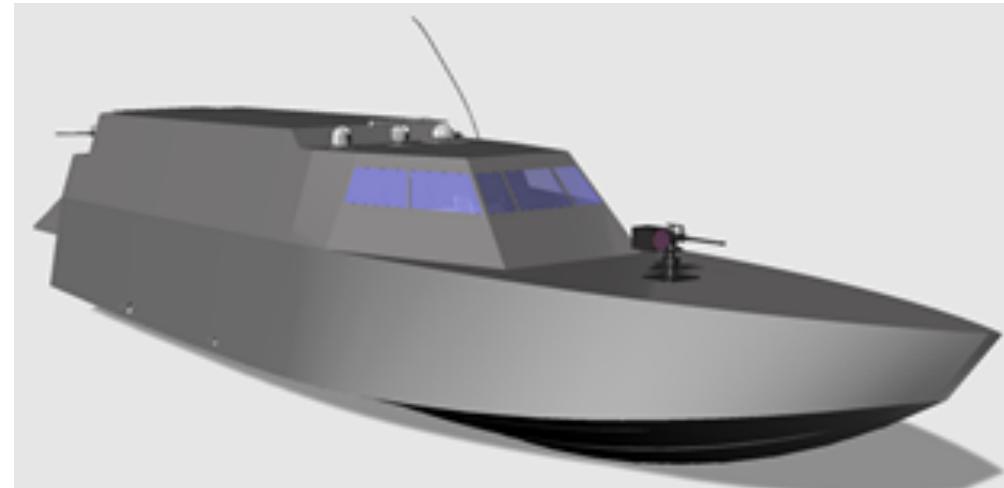
	Hydrostatic	→		Hydrodynamic
	Displacement	Semi-Displacement	Planing	
	Increasing Froude Number →			
Transverse	Transverse Hydrostatics $GM_T \leq 0$	Loss of GM_T Due to Wave Effect 	Roll Instability Non-Zero Heel Non-Oscillatory 	"Chine Walking" Dynamic Roll Oscillation 
Longitudinal	Longitudinal Hydrostatics $GM_L \leq 0$	Loss of GM_L Due to Wave Effect 	Trim Instability Bow Drop Non-Oscillatory 	"Porpoising" Dynamic Pitch-Heave Oscillation 
Combined	Combined $GM_T \leq 0$ $GM_L \leq 0$	Combined Wave Effect 	Broach Non-Oscillatory 	"Corkscrew" Pitch-Yaw-Roll Oscillation 

Dynamic Stability



Final Thoughts

- Lessons Learned
 - inheriting code, modifying code
- Next spin around the spiral
 - deckhouse structure
 - possible downsize
- CFD vertical acceleration analysis
- Design feature analysis:
 - hydrofoil
 - stepped hull



Design Symposium

Special Operations Vessel

30 April 2014

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