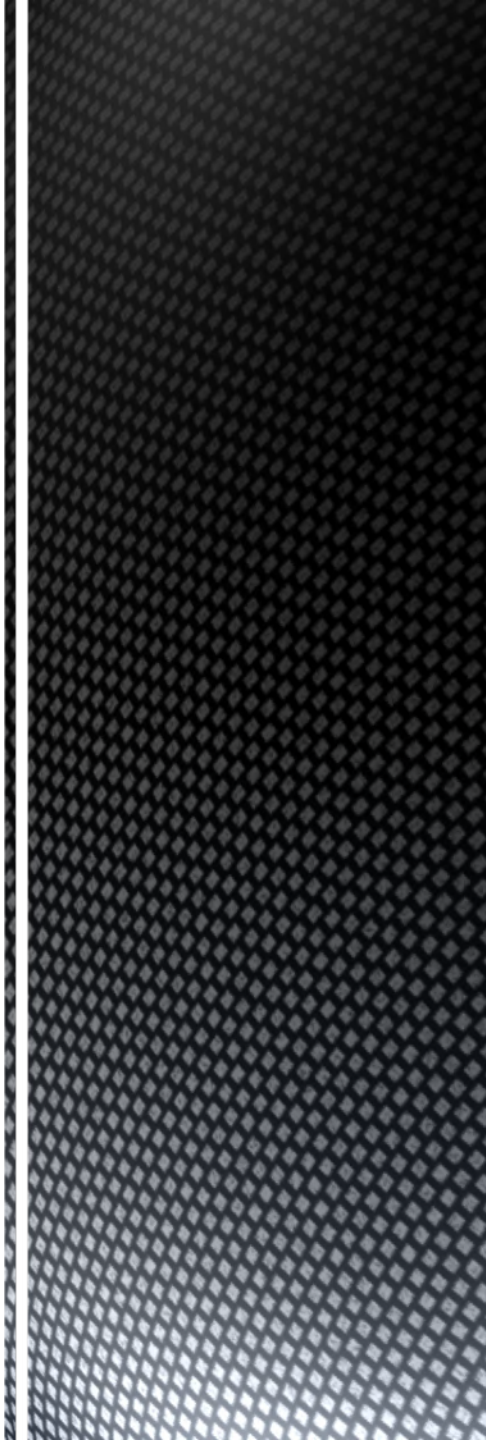
Optimizing High Speed Hulls



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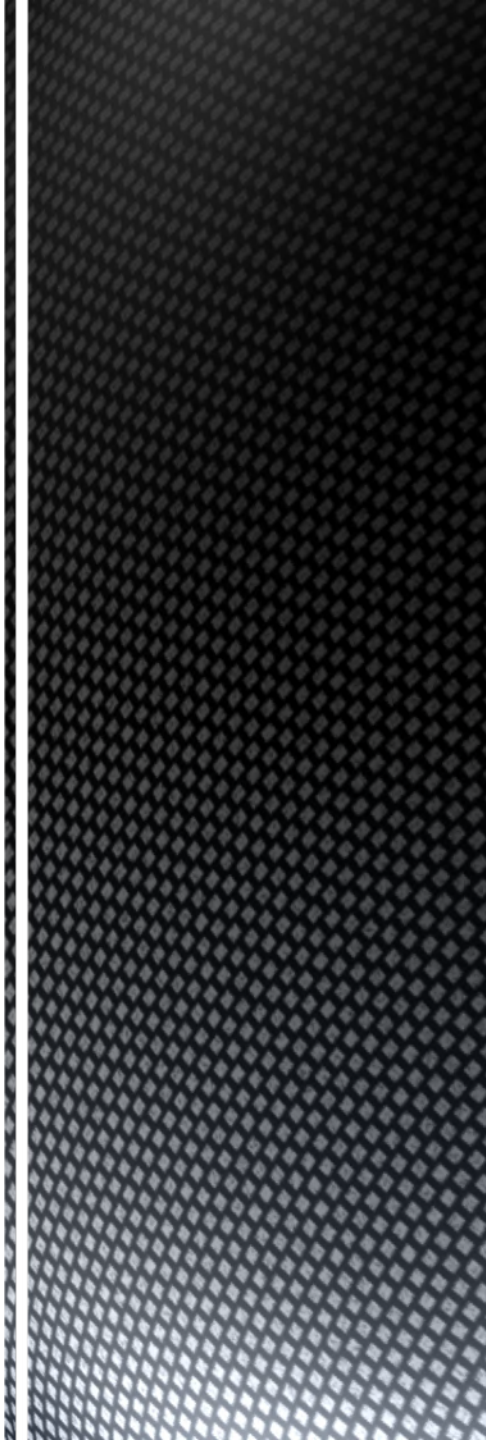


Introduction

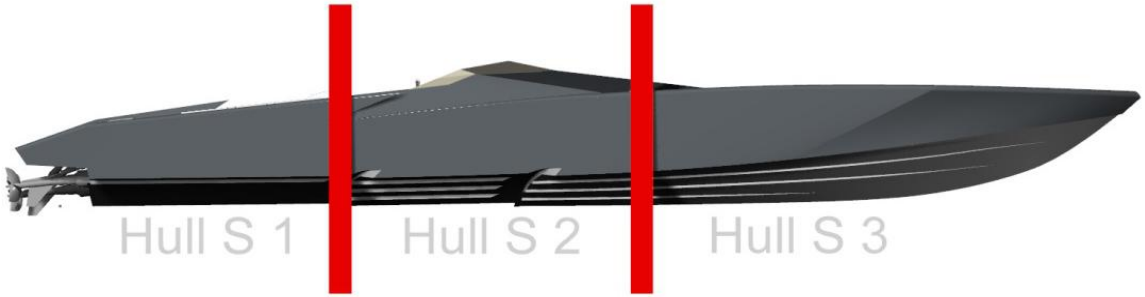
- The following is a high level concept for further discussion
- Presentation will present a modest preliminary analysis logic for new hull designs relative to key factors
- Several hull characteristics shall be examined based on key performance criteria for vessel over 60 knots
- Proving concepts with high level CFD and FEA.
- Utilizing model test and workable scale prototypes to generate data
- Advanced concepts – Leaf Spring Hull, Multihulls, additional reductions in loading
- General discussions

Preliminary Design Study

- Area of Operation – Sea State – Hmax Encounter Probability – Wave Length- Wind etc…
- Speed-Powering – design spiral
- Range – Fuel
- Payload - variations
- Usage
- Main Operational Requirement
  - Highest Speed
  - Best Maneuverability
  - Best Sea Keeping
  - All of the above (most common)

Simplified Design Study

- Hull Split into Three Sectors
  - Forward – Hull S3
  - Mid to (LCG) – Hull S2
  - Aft – Hull S1
- Determine base hull sections based on operational requirements -compromise study.



	Hull S 1	Hull S 2	Hull S 3	Compromise Factor
	Speed	Shock Reduction	Wavefront Dissipation	Total
Highest Speed	1	-0.5	-0.5	0
Highest Shock Mitigation	-0.5	1	0.5	1
Highest Wavefront Dispersion	-0.5	0.5	1	1
Best Overall	0.5	0.5	0.5	1.5

Localized Optimization of Hull Characteristics to Reduce Compromise

Hull Section 1 Aft – High Speed

- Step geometry and angle of attack of planning surface
- Dead rise reduction limits
- Spray rail placement and geometry – CFD study to determine best locations relative to flow paths
- Keel Flats – variable inserts
- Turbulence combs – angle of attack
- Ventilation feeds – Longitudinal Steps
- Variable dead rise – low compromise
- Transom cuts – drive line optimizations and Free Surface Profile Studies
- Integrated control surfaces
- Ballast systems

Localized Optimization of Hull Characteristics to Reduce Compromise

Hull Section 2 Mid to LCG – Shock Reduction – and some High Speed

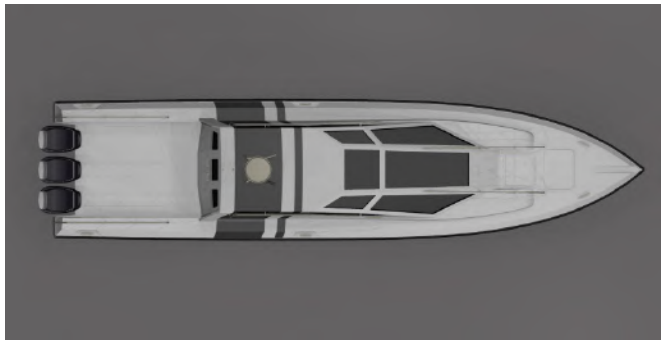
- Longitudinal Steps
- Variable dead rise
- Split chines
- Step features – angle of attack
- Ballast system
- Keel Flats
- Spray rail geometry verses dead rise deep/shallow
- Multihulls - Tunnels

Localized Optimization of Hull Characteristics to Reduce Compromise

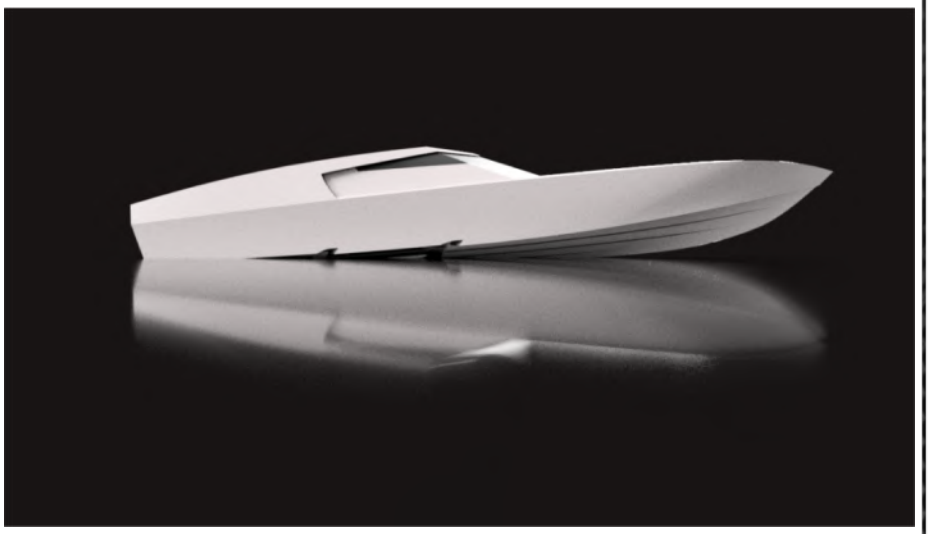
Hull Section 3 Fwd – Wave Front Dispersion

- Various bow types – conventional to reverse
- Keel/stem entry angles
- Dead rise Transition
- Variable dead rise
- Chine endings and geometry – ramp effect
- Localized flare
- Longitudinal steps
- Forefoot
- Ballast systems

Current Low Compromise Designs Examples – WP18-CCMMkI-V3-X17-Dv16 – Common Logic

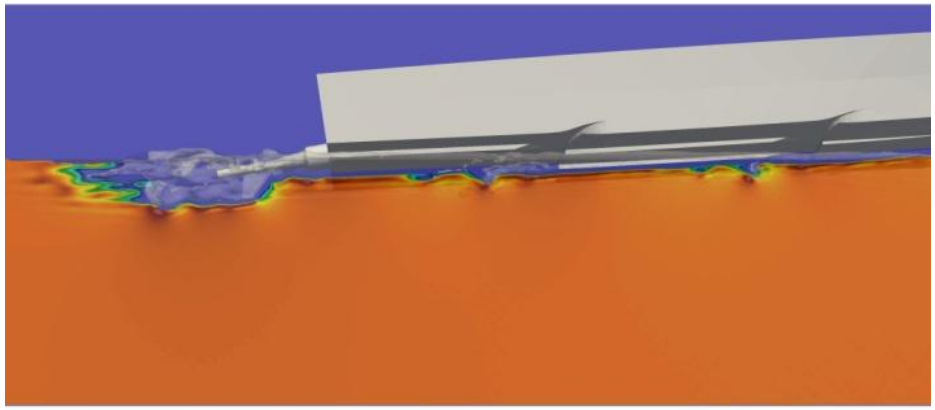


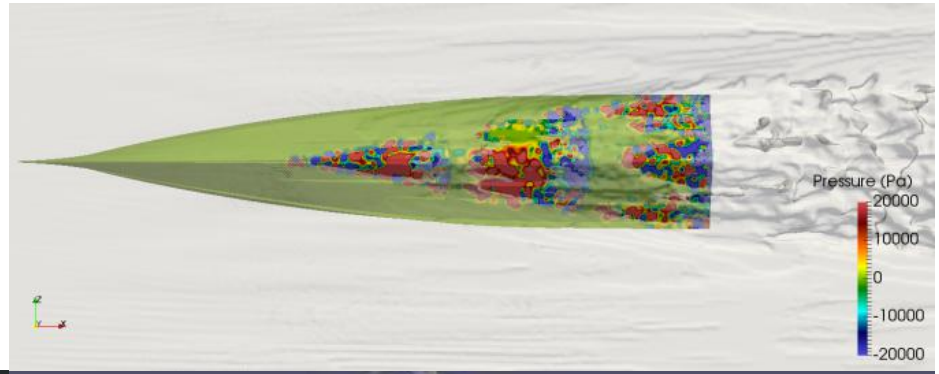
Very High Speed Craft Sector – High and low levels of compromise

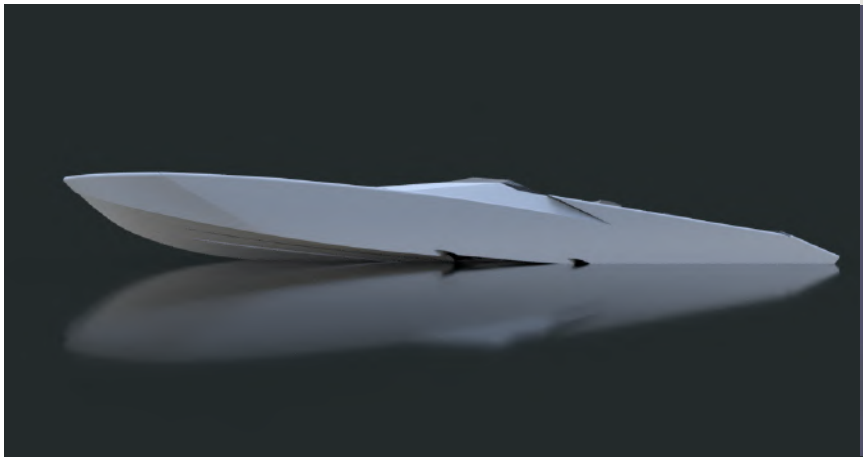


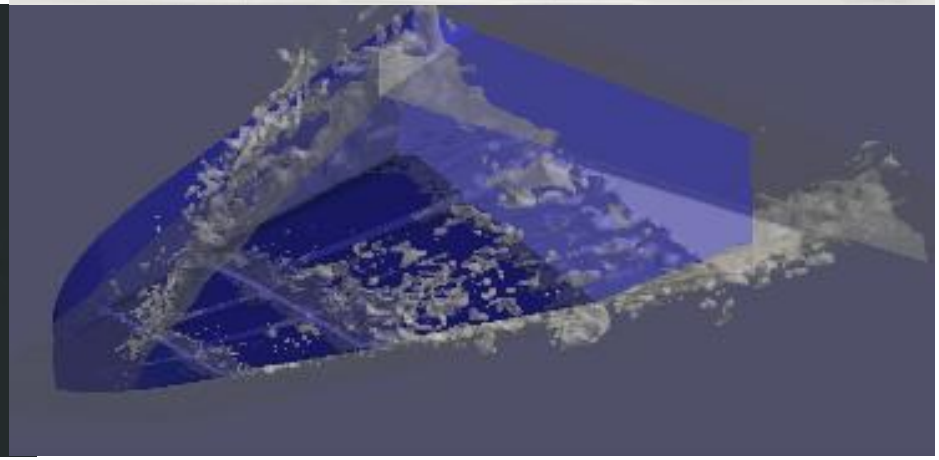
Tools to Verify Optimizations

- Custom CFD high speed craft specific – localized feature optimization-12000 cores
- Model testing
- Working prototypes
- Accel data
- Verify speeds, trim, WSA, power efficiency etc…
- Strain data – optimizing with FEA – weight savings









Advanced Concepts

- Leaf Spring Hull
- Multihulls
- Different is good…:)

Thank you

Discussion