NEW 16M INTERCEPTOR CRAFT

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SOLAS MARINE LANKA (PVT) LTD.

Boats and Yachts Manufacturing Company

ALBATROSS MARINE DESIGN

CONTENT OF PRESENTATION

- Pre-history of design
- Statement of requirements
- Design study and parametric analysis
- Architecture
- Performance and seakeeping – predictions and trials
- Structural design approaches
- Construction and delivery
- Conclusions

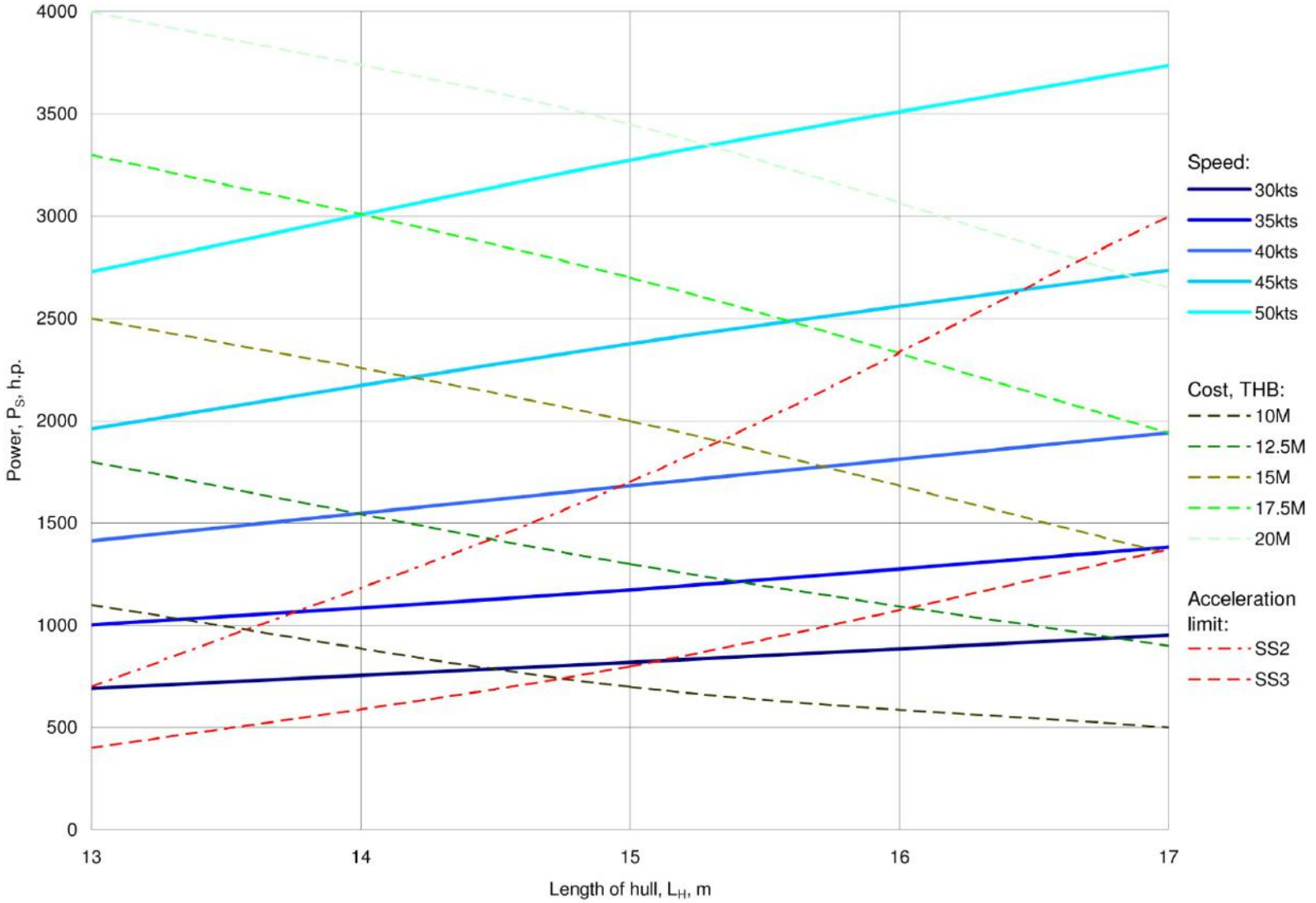
DESIGN REQUIREMENTS

According to statement of requirements, tasks for fast interceptor craft (FIC) design included interception of suspicious craft, patrol, rescue and law enforcement missions in coastal and inshore waters. Important features specially requested:

- Top speed of 45kts at calm water, fully loaded;
- Cruising range of 200 nautical miles at 15kts;
- Fully functional at sea state 3 and seaworthy up to sea state 4;
- Ballistic protection for NIJIII class for manned spaces;
- Crew/accommodation of 4 and life saving capacity for 12;
- Complete Navigation / Communication equipment, Day/Night Thermal Optical camera with integrated laser range finder.
- Special equipment – variations of medium and heavy machine guns (HMG, MMG), grenade launcher, long range acoustic device (LRAD) and boarding gear system.

General requirements for FIC were clearly formulated but allowed some flexibility for the designer and left space for creative and research approach.

DESIGN SPACE



ARCHITECTURE AND GENERAL ARRANGEMENT

Presentation images of conceptual design of SM16 FIC. Main particulars (final): length overall/at WL – 16.3/13.3m; beam of hull/chine 3.8/3.2m; draught 0.8m, loaded displacement – 16.5t; engines – 2x885HP Caterpillar C18; drives – 2xCastoldi TD400HC or Hamilton HJ364 jets; speed – 47…50kts; crew – 4.

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PERFORMANCE AND SEAKEEPING

Stage 1

Parametric analysis stage used for general dimensioning of craft; here power demand is defined using simplified relations 'anchored' to available reliable data for similar craft including our previous designs.

Stage 2

Hull shape design optimisation in terms of length to beam *L*/*B* ratio, desdrise β and its distribution, longitudinal position of centre of gravity (CG) and other factors – based on series calculations mainly by Savitsky method.

Stage 3

Selection of propulsion system inclusive of engine and jet drives; at this stage resistance prediction by different methods was made.

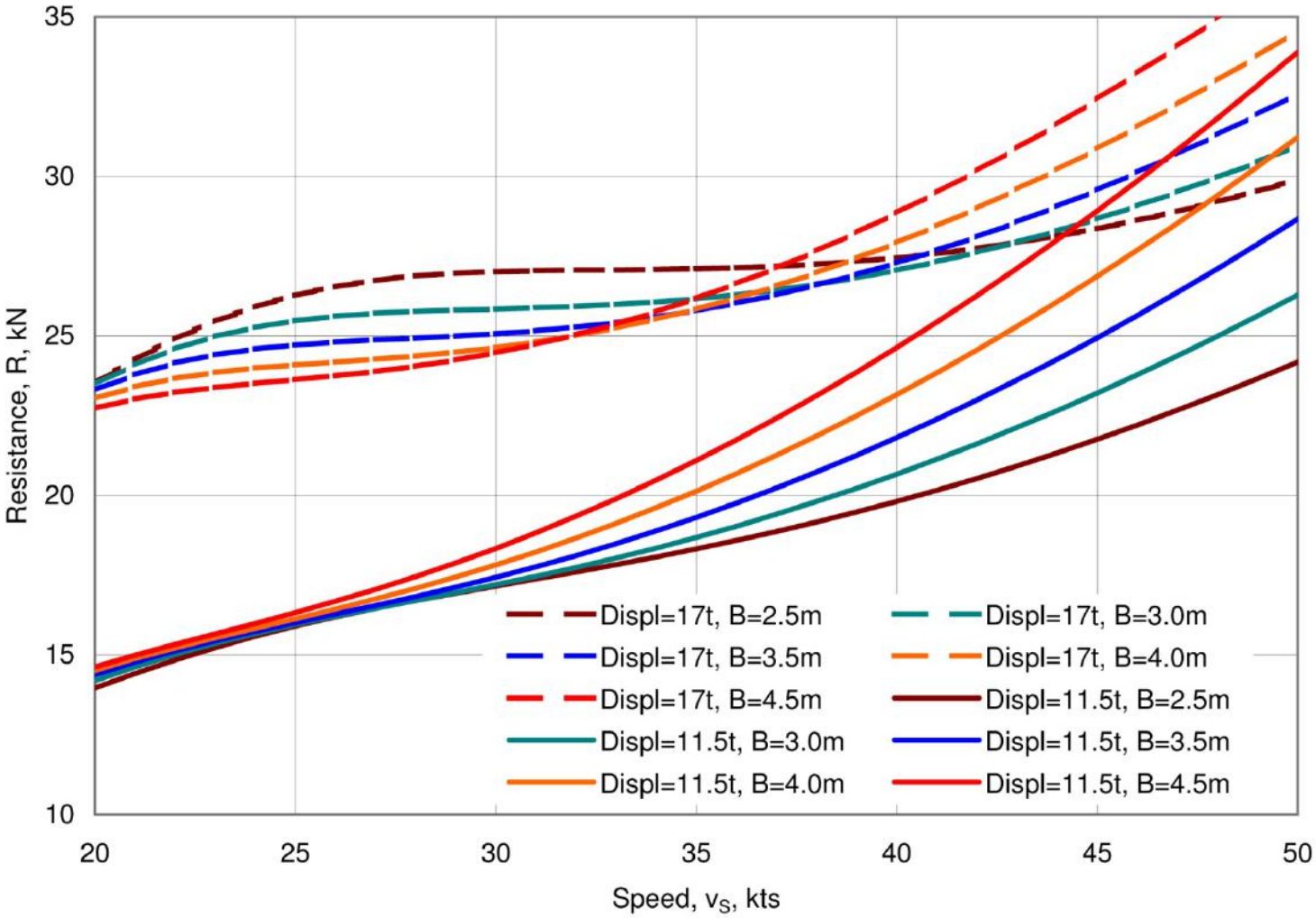
Stage 4

Verification of results of performance prediction by tank testing.

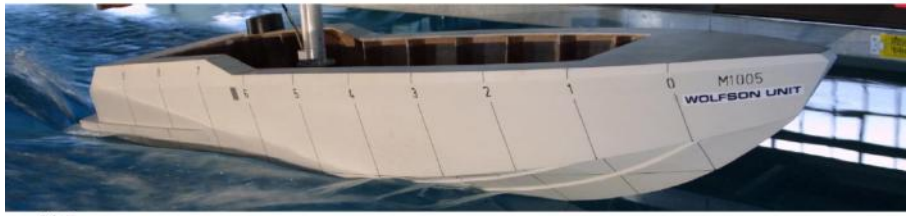
Stage 5

Sea trials and fine-tuning of craft, mainly covering shape of trim tabs/ interceptors and strakes.

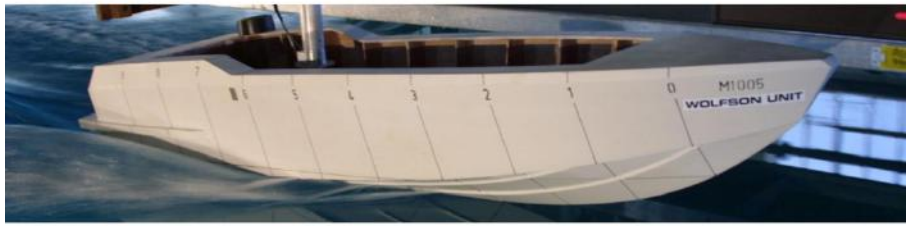
PERFORMANCE – HULL SHAPE DESIGN



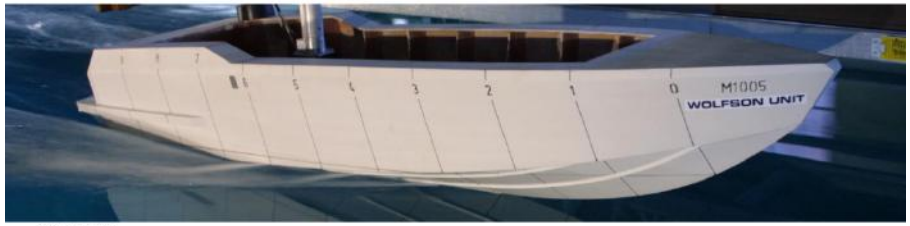
10 knots



20 knots



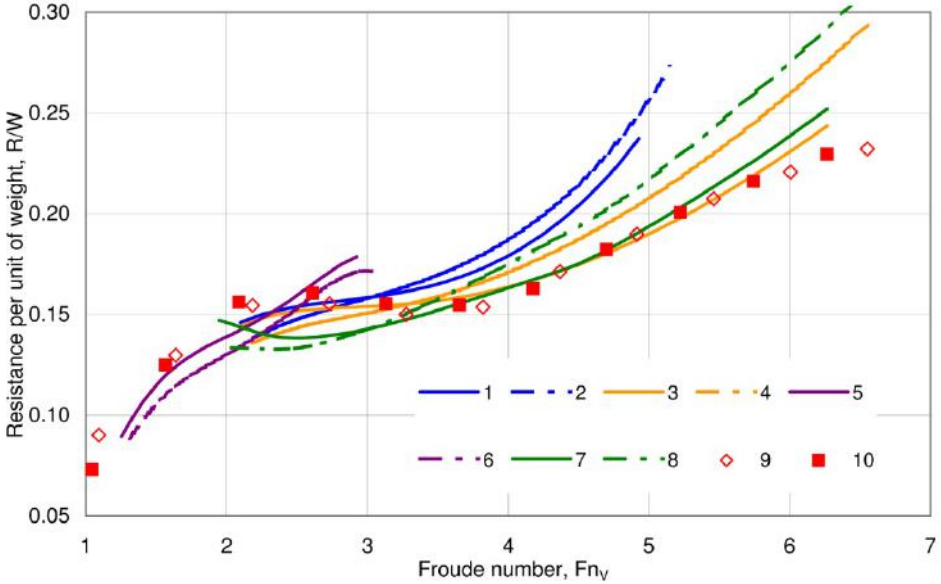
30 knots



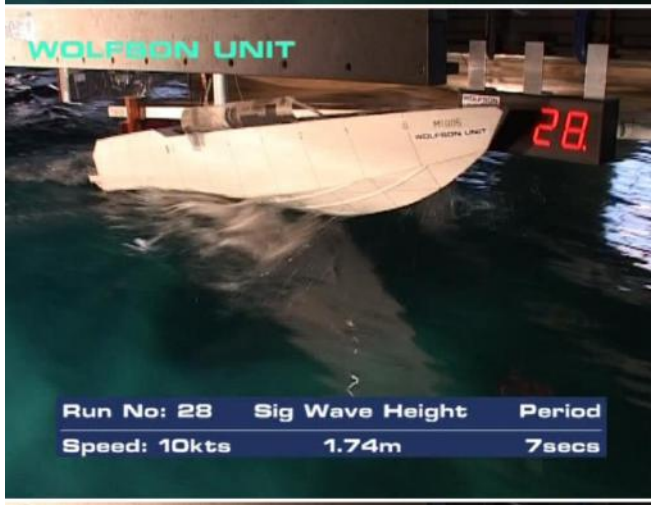
40 knots

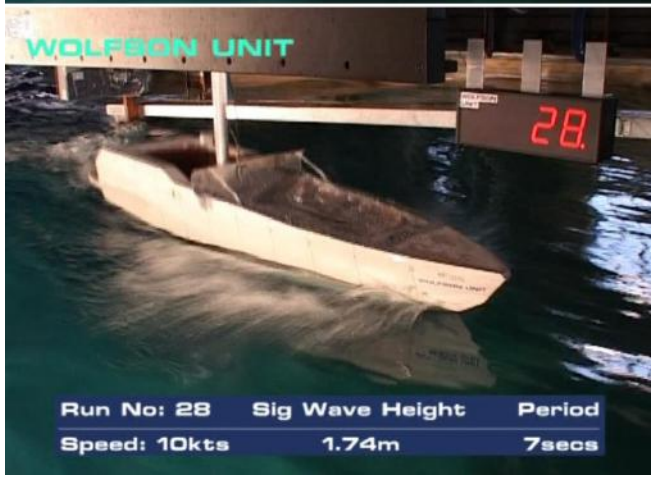
60 knots

TANK TESTING: CALM WATER RESISTANCE

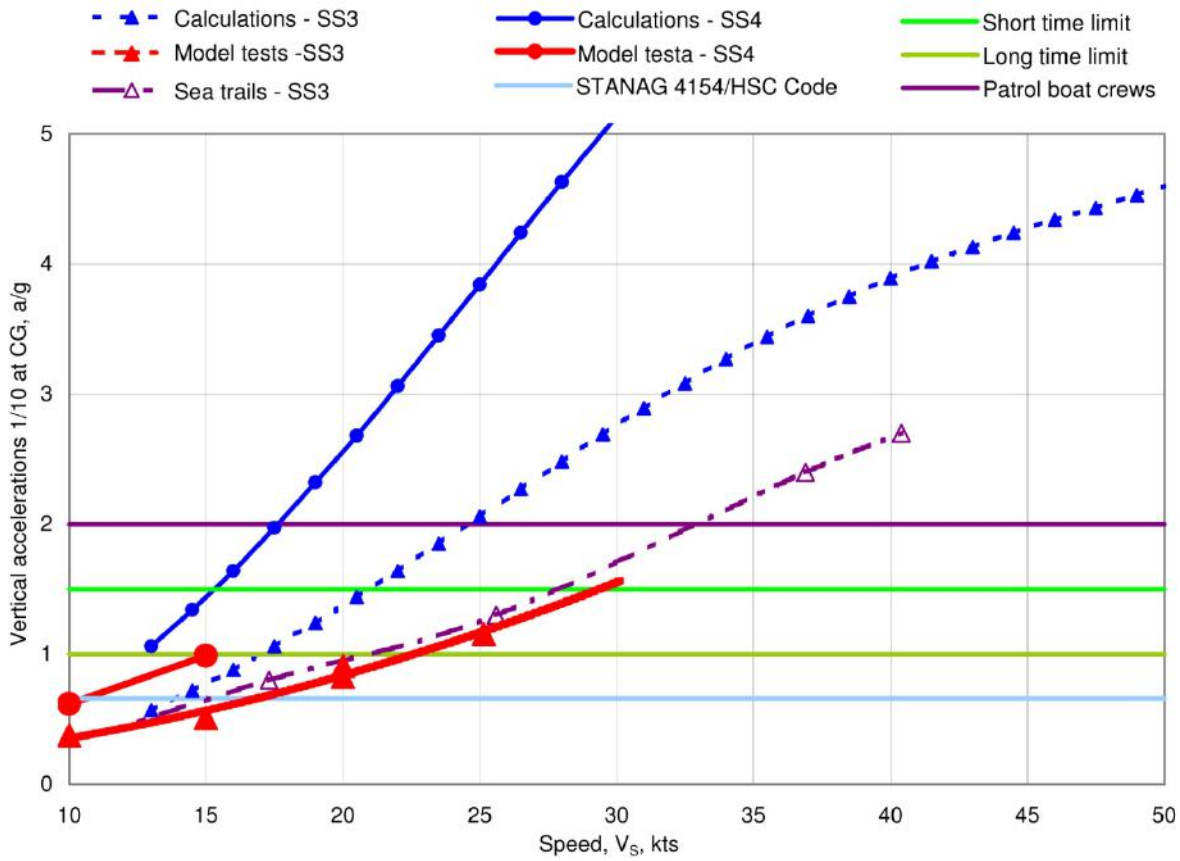


Photos of tank testing and comparison of test results with predictions, for light craft and full load conditions; 1, 2 – Wolfson high speed craft method; 3, 4 – Savitsky method; 5, 6 - Wolfson chine craft method; 7, 8 – Lubomirov method; 9, 10 – tank tests



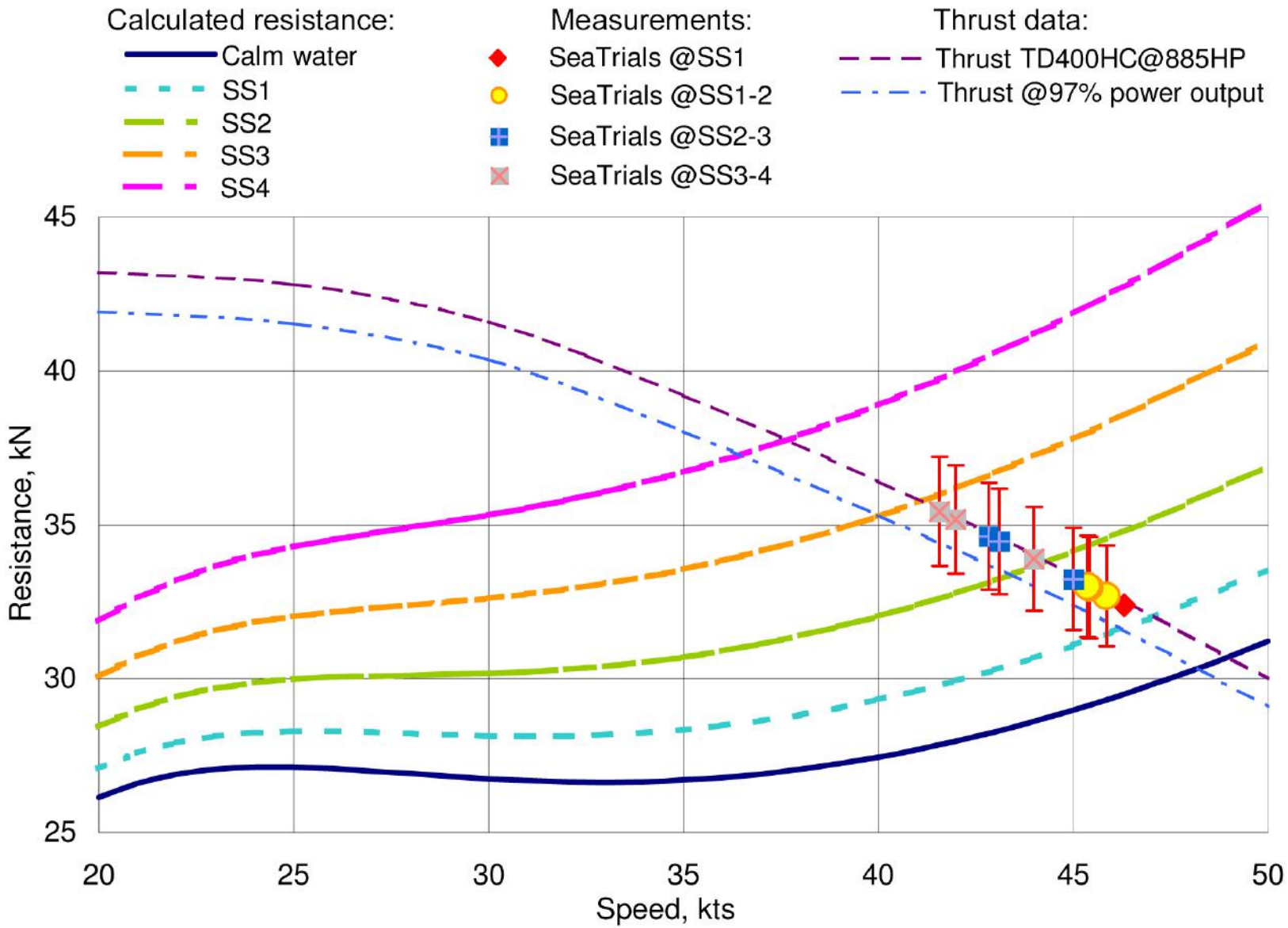


TANK TESTING: SEAKEEPING

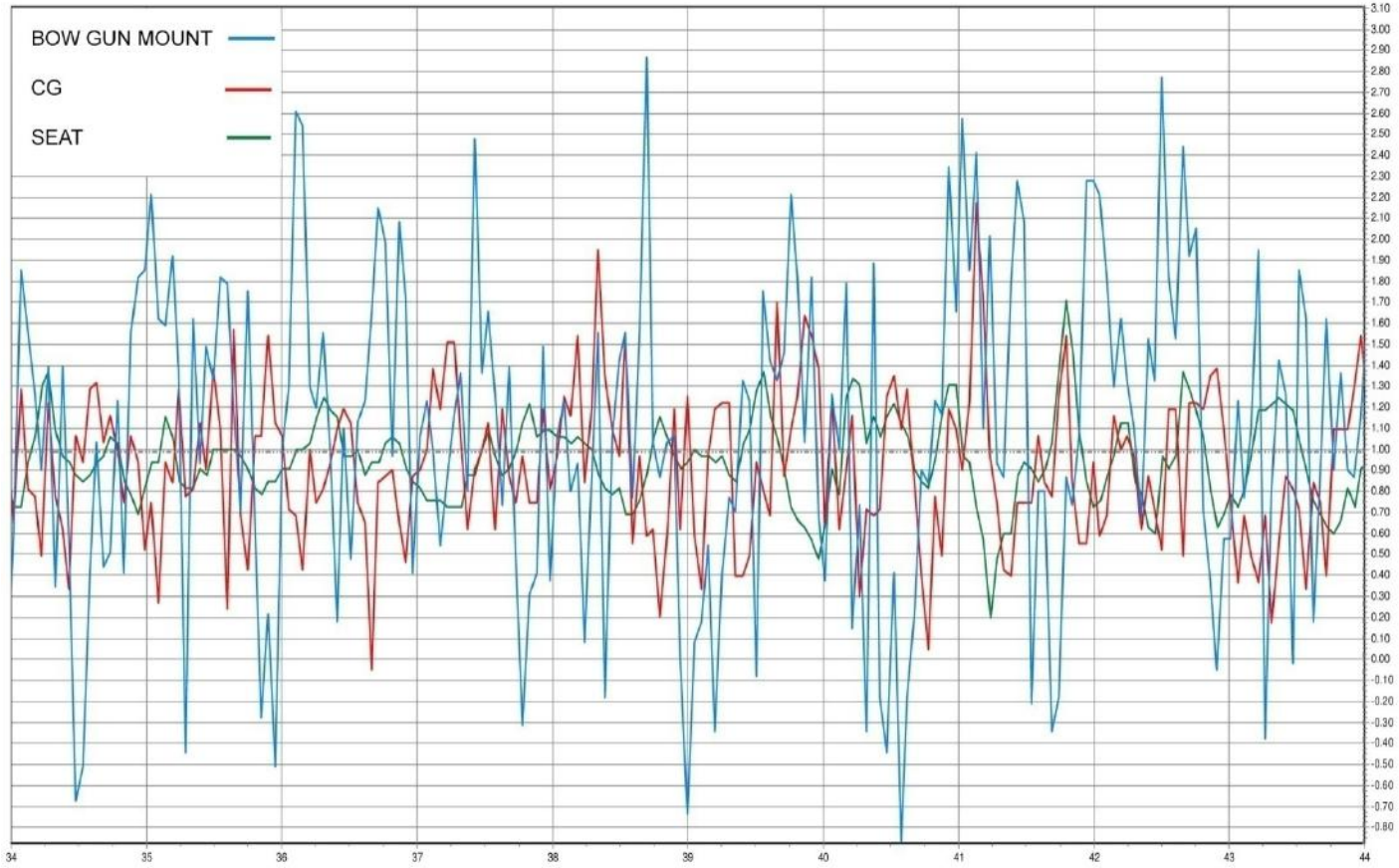


Results of calculations of vertical accelerations using original Savitsky-Brown method, superimposed with tank testing and sea trials data, at sea states 3 and 4, head seas.

RESISTANCE ON WAVES - HOGGARD-JONES METHOD

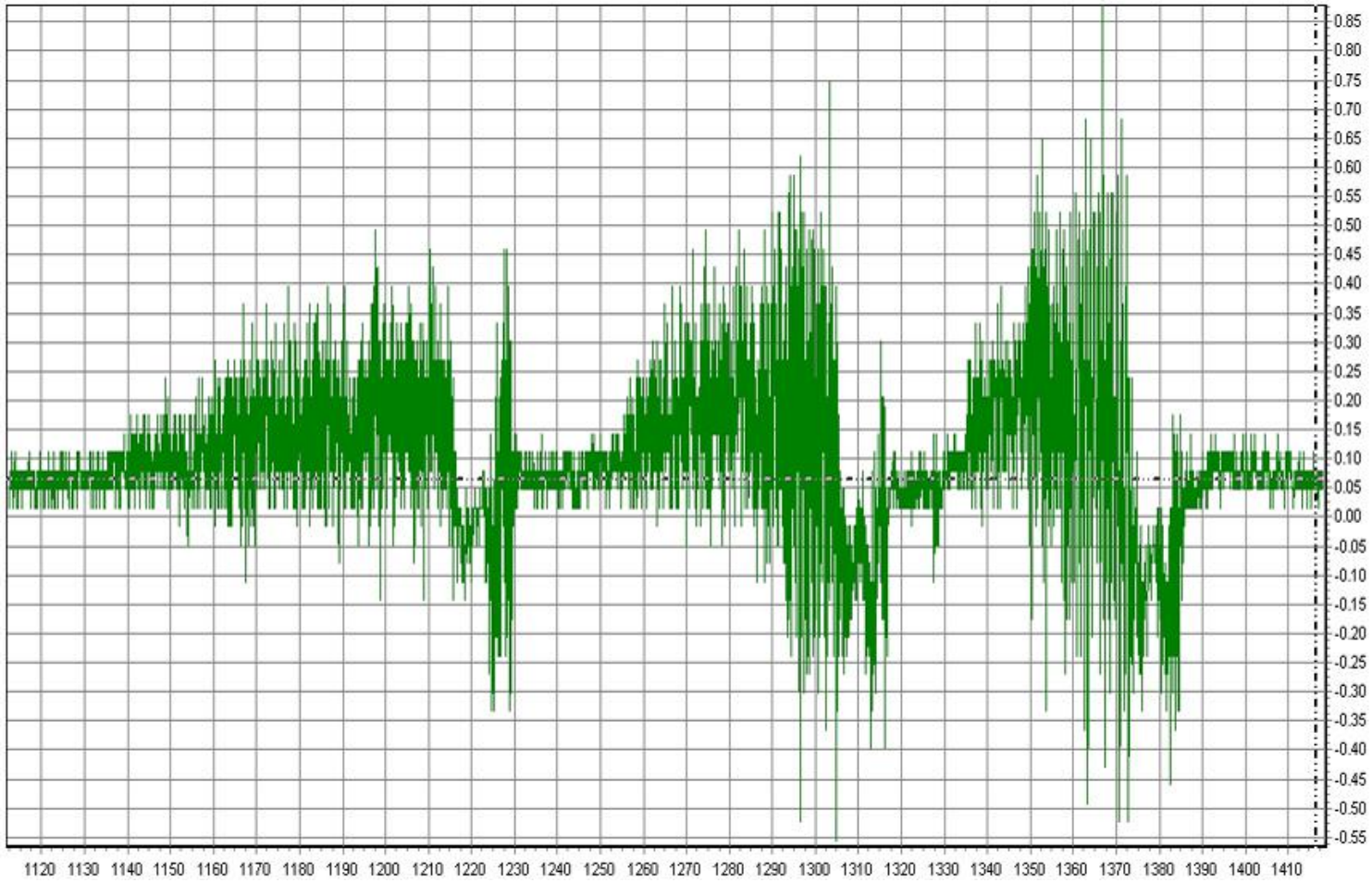


SEA KEEPING - MEASUREMENTS OF VERTICAL ACCELERATIONS



Record of vertical accelerations at 45kts, head wave sea state 2, at bow gun mount, at centre of gravity and at shock mitigation seat, during sea trials.

RIDE CONTROL AND MANOEUVRING



Sample records of longitudinal accelerations at emergency stop during sea trials from speed 21, 37 and 45kts.

STRUCTURAL DESIGN – APPROACHES

Common approaches to structural design of high-speed planing monohull craft with $L \leq 24$m in composites are:

• Local strength analysis performed using ‘rulebook’ loads and common laminate stack analysis methods. In AMD’s practice this type of analysis is performed using software from classification societies or customary spreadsheets.

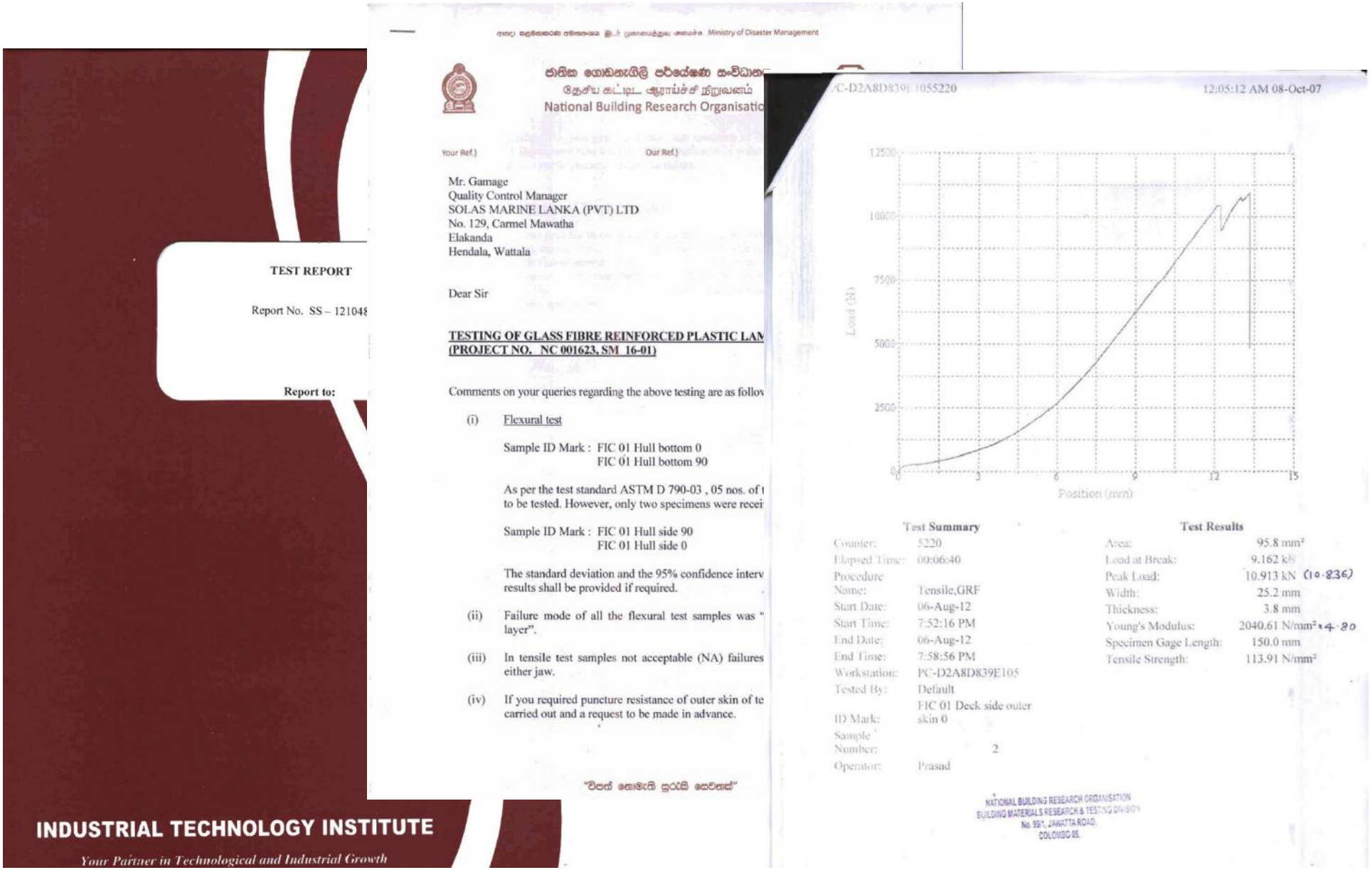
• Global strength usually presents no issue for given size of craft and is provided by default once local strength requirements are satisfied.

• Analysis of structural details and specific load cases, such as engine base, equipment foundations, lifting points, etc. Usually this group of problems involves direct engineering methods using specified loads.

STRUCTURAL DESIGN – DESIGN PRESSURES

Parameter	ISO	LR	IRS	GL
Design acceleration at CG, 1/*g*	4.32	3.79	2.50	4.08
Design pressures on bottom, kN/m^2				
FWD panel	110	94	90	123
MID paned	103	112	124	159
AFT panel	116	75	132	118

STRUCTURAL DESIGN – MATERIAL TESTING



INDUSTRIAL TECHNOLOGY INSTITUTE

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TEST REPORT

Report No. SS – 121048

Report to:

Ministry of Disaster Management

National Building Research Organisatio

Your Ref.) Our Ref.)

Mr. Gamage
Quality Control Manager
SOLAS MARINE LANKA (PVT) LTD
No. 129, Carmel Mawatha
Elakanda
Hendala, Wattala

Dear Sir

TESTING OF GLASS FIBRE REINFORCED PLASTIC LAM
(PROJECT NO. NC 001623, SM 16-01)

Comments on your queries regarding the above testing are as follov

(i) Flexural test

Sample ID Mark : FIC 01 Hull bottom 0
FIC 01 Hull bottom 90

As per the test standard ASTM D 790-03 , 05 nos. of t
to be tested. However, only two specimens were recei

Sample ID Mark : FIC 01 Hull side 90
FIC 01 Hull side 0

The standard deviation and the 95% confidence interv
results shall be provided if required.

(ii) Failure mode of all the flexural test samples was "
layer".

(iii) In tensile test samples not acceptable (NA) failures
either jaw.

(iv) If you required puncture resistance of outer skin of te
carried out and a request to be made in advance.

"විපත් නොමැති සුරැකි සෙවනක්"

PC-D2A8D839E1055220 12:05:12 AM 08-Oct-07

Test Summary

Counter:	5220
Elapsed Time:	00:06:40
Procedure Name:	Tensile,GRF
Start Date:	06-Aug-12
Start Time:	7:52:16 PM
End Date:	06-Aug-12
End Time:	7:58:56 PM
Workstation:	PC-D2A8D839E105
Tested By:	Default
ID Mark:	FIC 01 Deck side outer skin 0
Sample Number:	2
Operator:	Prasad

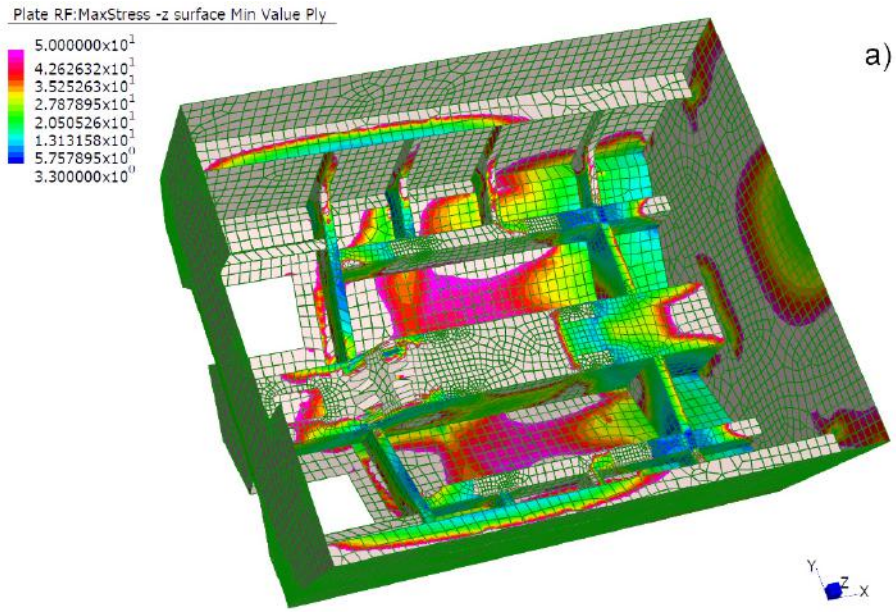
Test Results

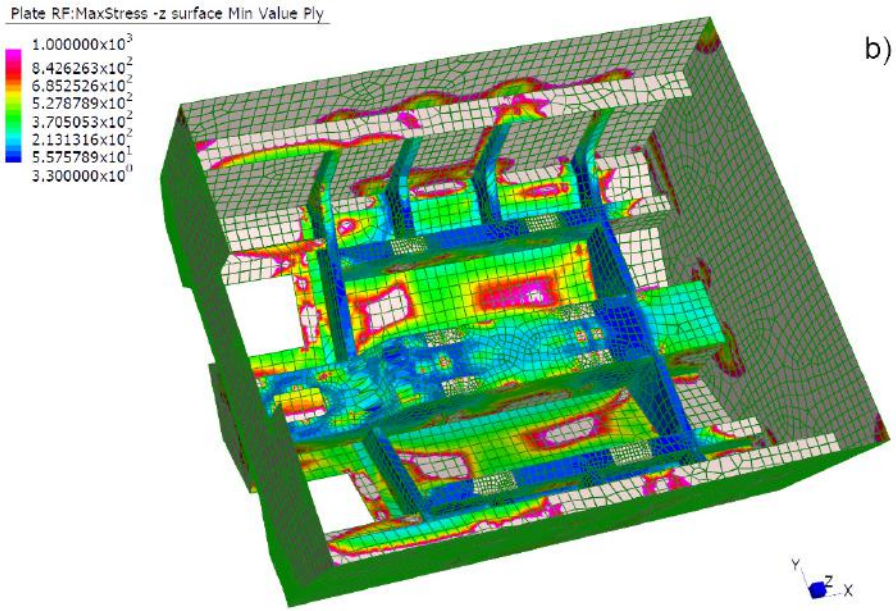
Area:	95.8 mm²
Load at Break:	9.162 kN
Peak Load:	10.913 kN (10.236)
Width:	25.2 mm
Thickness:	3.8 mm
Young's Modulus:	2040.61 N/mm² (4.80)
Specimen Gage Length:	150.0 mm
Tensile Strength:	113.91 N/mm²

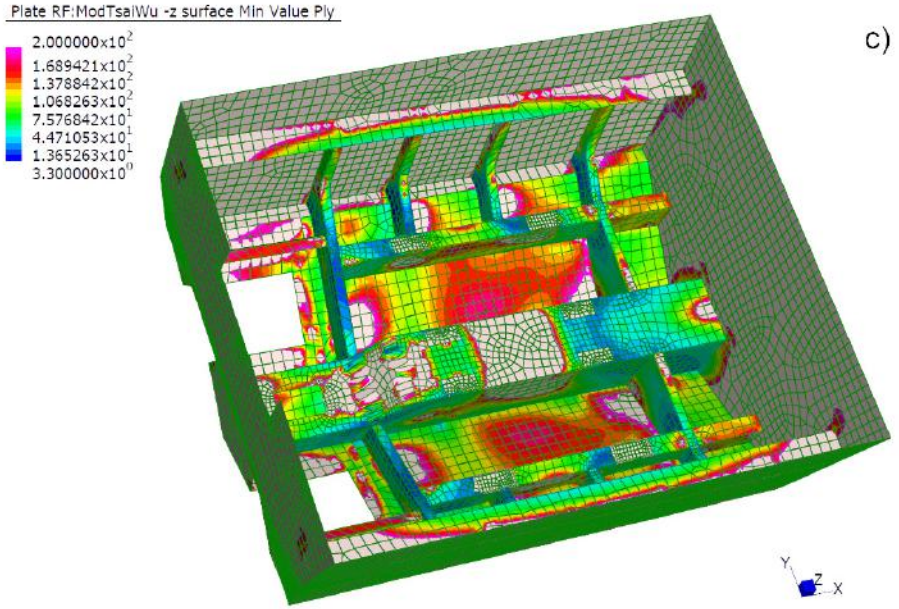
NATIONAL BUILDING RESEARCH ORGANISATION
BUILDING MATERIALS RESEARCH & TESTING DIVISION
No. 99/1, JAWATTA ROAD,
COLOMBO 05.

STRUCTURAL DESIGN: ENGINE BASE ANALYSIS

FEM analysis of SM16 engine base studied for a) forward impact acceleration b) side acceleration c) vertical acceleration







CONSTRUCTION

Some of SM16 construction snapshots: CNC-cutting of hull plug

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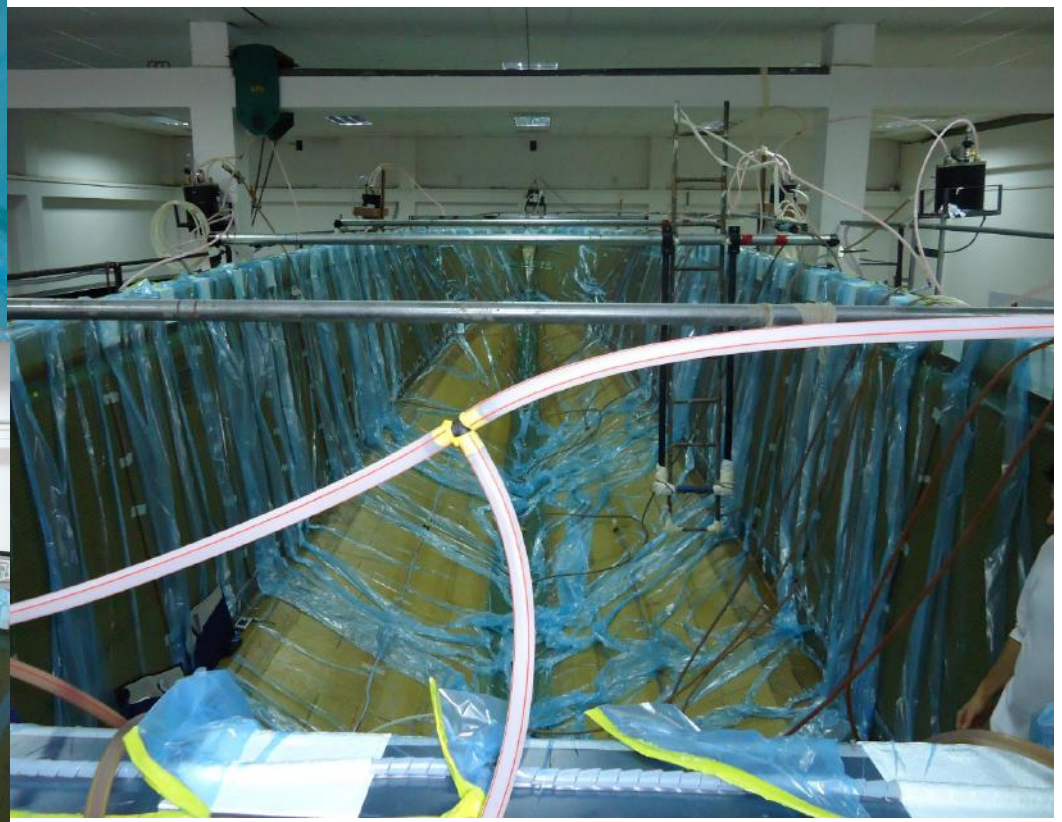

Some of SM16 construction snapshots:
vacuum infusion of the hull

CONSTRUCTION

Some of SM16 construction snapshots: installation of outfit

TRIALS AND DELIVERY

First batch of SM16s pictured at Sri Lanka prior to delivery to Indian Navy

CONSTRUCTION AND DELIVERY

Pilothouse interior of SM16 (demonstration version of the craft)


T401


T401

NEW DEVELOPMENTS

Rescue/pilot craft

Ambulance/rescue craft

CONCLUSION

Series production of SM16 is in progress, with 24 boats in service at Indian Navy by May 2014. Production system, two sets of tooling and pre-ordered equipment allows the builder to produce 4 boats batch every 2 months.

Experience of creating of such a high tech and modern design and highly efficient production system in Asia opens new horizons for both builder and designer looking to undertake new challenges.

THANK YOU FOR YOUR ATTENTION

SOLAS MARINE LANKA (PVT) LTD.

Boats and Yachts Manufacturing Company

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MARINE DESIGN