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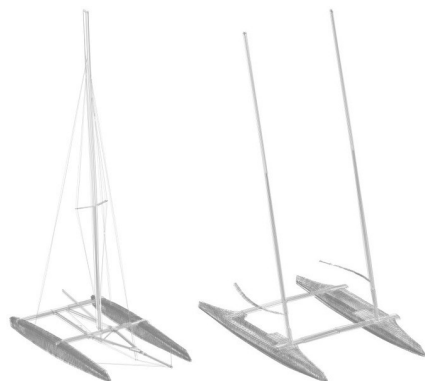
Tender – Volvo Ocean Race / Flying Multihull for « In-Port » Series

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# Foreword and Guidelines

This document presents a design only response, the work is presented by VMG Yacht Design.

Two visions of the future foiling multihull for the In-Port Series of the Volvo Ocean Race are highlighted. Both proposals are realistic and pragmatic answers to the statement of the Tender.

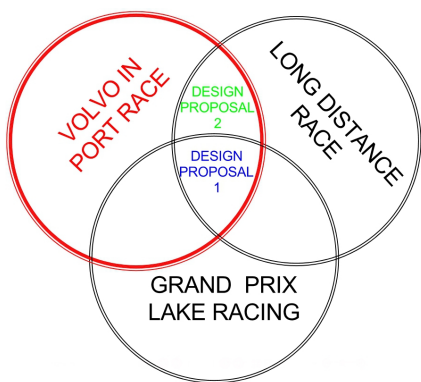


## Design Proposal 1:

This is a state of the art catamaran that includes all the latest features. This catamaran is a “limited risk project” and is an evolution of the current trend of foiling catamarans.

## Design Proposal 2:

The second project is the result of a brand new approach to the concept of foiling multihull. The innovation lies in turning the concept around, whereby the foils are the central piece of the boat. Although exotic and deliberately extreme, this concept is innovative with all the pros and cons of venturing off the trodden path.



At this stage, we deliberately choose to present two designs:

- The former being a strict answer to the following hypothesis: Design Brief = Volvo Ocean In-Port Race + Long distance race + Lake racing [including racing under 6 knots of wind and D35 circuit].
- The latter discards the D35 circuit but is compliant with lake racing and other circuits (Extrem Series ...).

# Design Team – VMG YACHT DESIGN



Back in 2006, whilst working on their respective Mini-Transat projects that Fabrice Germond and Mathieu Verrier met. Both have designed, built and race their protos across the Atlantic. Since then, these two naval architects who graduated from Southampton University have collaborated on various projects until they created their own office in 2013. VMG Yacht Design's activities are orientated towards racing boats, a few winning projects have been delivered on the Lake of Geneva, including the winner of the 2013 Bol d'or.

VMG Yacht Design will be in charge of the overall design and the naval architecture through the design coordination and right up to the building processes and all necessary coordination with the shipyards.



Fabrice Germond (1977) (BEng Yacht & Powercraft Design, 2002 – Mechanical Engineer ETS, 1999)

Fabrice is a passionate sailor since childhood, in both leisure and competition sailing. He competed with merit four times in the Tour de France à la voile and the Transat 650.

He has built up solid experience and expertise in boat building and hi-tech composite materials designing and building his Mini 6.50. He also participated in the construction of the Class America SUI-64, winner of the America's Cup with Alinghi Challenge, as well as appendages for the ORMA Trimaran, and of several 60 foot IMOCA, including the latest Bernard Stamm boat.

He worked on the production of Prosthesis as a research and development engineer and teaches naval design at the Atelier Hermès in Geneva. He completed several creditable design projects as an independent Naval Architect.

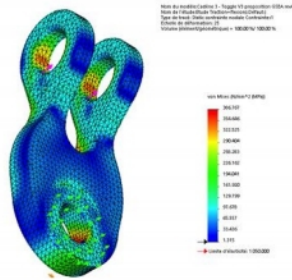


Mathieu Verrier (1978) (MEng Yacht & small craft, 2004 – First Class Honours)

It was aboard the family boat that Mathieu's passion for sailing was born. Since then, he has spent countless hours on the water.

In 2009 he raced the Transat 650 on a prototype which he designed and built on his own. During his studies, he specialised in Experimental Techniques (towing tank and wind tunnel) and Boat Speed Predictions (VPP). Mathieu worked as technical manager on various projects (Classe 40, Mini 6.50) and also worked on several high-tech projects as a boat builder with Yvan Ravussin whose company is well known for high-tech racing yacht appendages (America's cup, ORMA, MOD 70, 60' and C class). In doing so he has acquired an expert knowledge in the application of composite materials and construction techniques. He has also achieved several notable projects as an independent Naval Architect.

# Design Team – Engineering

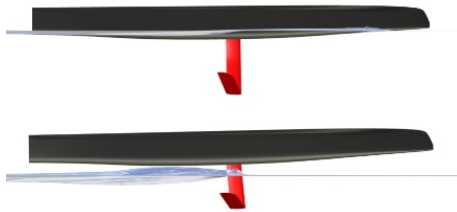


## STRUCTURE : GSEA DESIGN

Gsea Design is a French leading company created in 2009 by Denis Glehen and Hervé Devaux who is a pioneer in structural calculations for racing yachts. They collaborated in most of the well known French sailing projects of the last two decades as structural specialists. Gsea Design developed efficient design tools and software that deliver efficient and reliable composite structures.

For this project, Gsea Design will be in charge of all the structural calculations.

## HYDRODYNAMICS AND PERFORMANCE : Giorgio Provinciali (1969 - MEng in Naval Engineering)



Back in 1995, Giorgio was part of the student design team who designed, built and sea trialed the hydrofoil catamaran Techniques Avancées. During his last year of Study, Giorgio was hired at VPLP to develop a dynamic VPP to support the design of multihull yachts. He then collaborated with Michel Kermarec on most of the ORMA and Open 60. He was in charge of performance prediction as well as appendage design. His expertise is recognised in the community and he incorporated Prada's design team for the 2001 campaign. He also worked for Oracle for the 2008 campaign, collaborated on the AC72. Recently, he joined The Luna Rossa design team.

For this project, Giorgio will be in charge of the design of the foils, hydrodynamics, aerodynamics as well as the performance analysis.

## SAILING CONSULTANTS



For this project, we consulted several professional sailors of the racing catamaran circuits (GC32, Easy to fly, Flying phantom, D35, AC 45). At this first stage, they are not officially involved in this project but provided some very helpful feedback on their respective experience that were very valuable for understanding some of the issues sailors are really facing.

# Design Brief & Assessment



## DESIGN BRIEF REQUIREMENTS

- ✓ Close foil born racing in wind up to 30 knots
- ✓ 4 to 6 crew (+ Guest) for close high speed action
- ✓ Stable foiling (without complex and or expensive solution)
- ✓ Foiling tack / Foiling gybe
- ✓ The boat should lift off at 6 knots of wind speed
- ✓ Lake version to be considered & possible expansion of the class outside the box
- ✓ The boat must be quick and easy to unpack from the container / easy to assemble, to sail and launch (and back in the container)
- ✓ Mast sail package: boats must stay in water with masts up at stop over
- ✓ Design must be appealing to sailors and non sailors
- ✓ Racing in the Inport Series implies a number of races from 15 to 60 min.
- ✓ Controlled budget

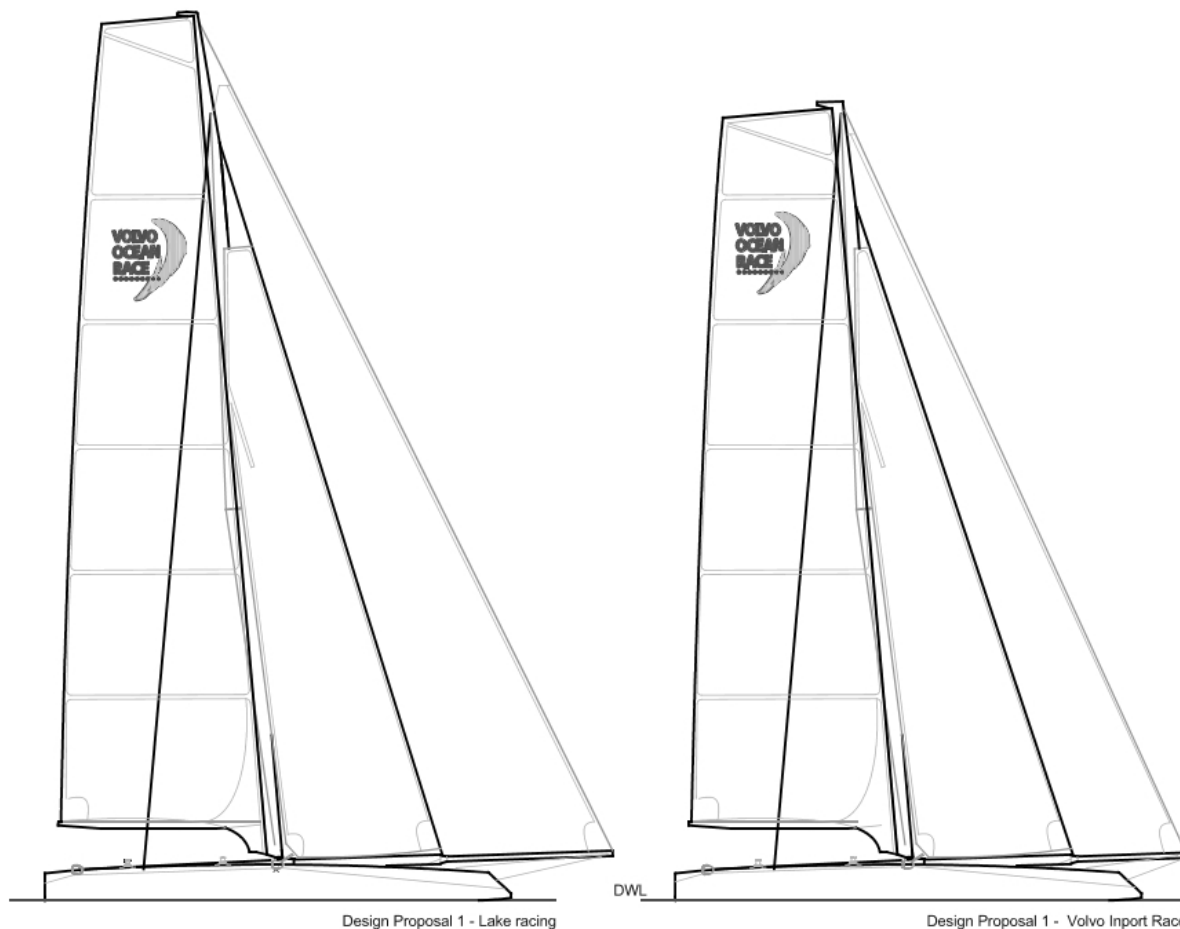
## DESIGN IMPLICATIONS

- ➔ Foiling capacity / Strict One Design / Manoeuvrability / Adapted sail plan / Capsize recovery
- ➔ Dedicated secured space for guest / Overall safety / Action for all
- ➔ Mechanical solution (wand) / Limitation of hydraulic and electronic devices
- ➔ Stability / 2 foils down at the same time / Weight distribution
- ➔ Lightweight / Efficient rig / Efficient foil system / Low drag overall
- ➔ Very light wind racing possible / Taller rig / Special set of foils or daggerboards / Class restrictions (?) / Other existing circuits (Extrem Series / D35 ...)
- ➔ Smart assembly solution / Easy to set up / No item longer than 12 metres / Limited weight of single items
- ➔ Flexible sails that can be taken down / No rigid wing
- ➔ Modern design / High performance / Innovative
- ➔ Ability to reach top speed on short distance / Manoeuvrability / Reliability
- ➔ Affordable solutions / Low maintenance costs / Limited number of sails, technology, size and systems

# Overview – Design Proposal 1



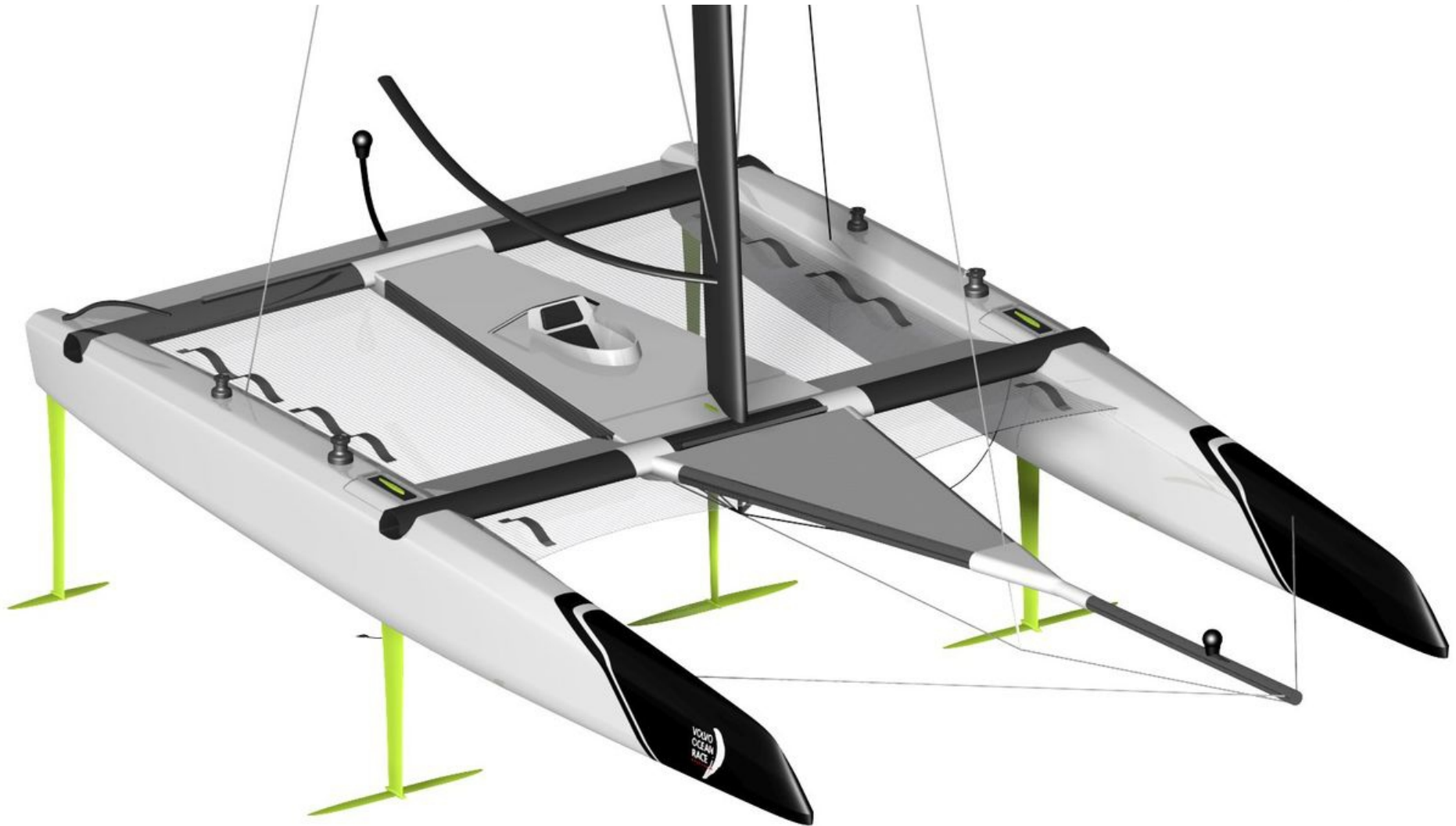
This boat is a state of the art 35' feet flying catamaran. This boat can race in either of the following mode: Archimedean or Foiling. Therefore, this boat is somehow a “3 in 1” boat that is compliant with the specificity of being a full foiling boat on short In-Port Series, an exciting one design boat for long distance racing and a boat that can deal with very light winds encountered on some lakes.



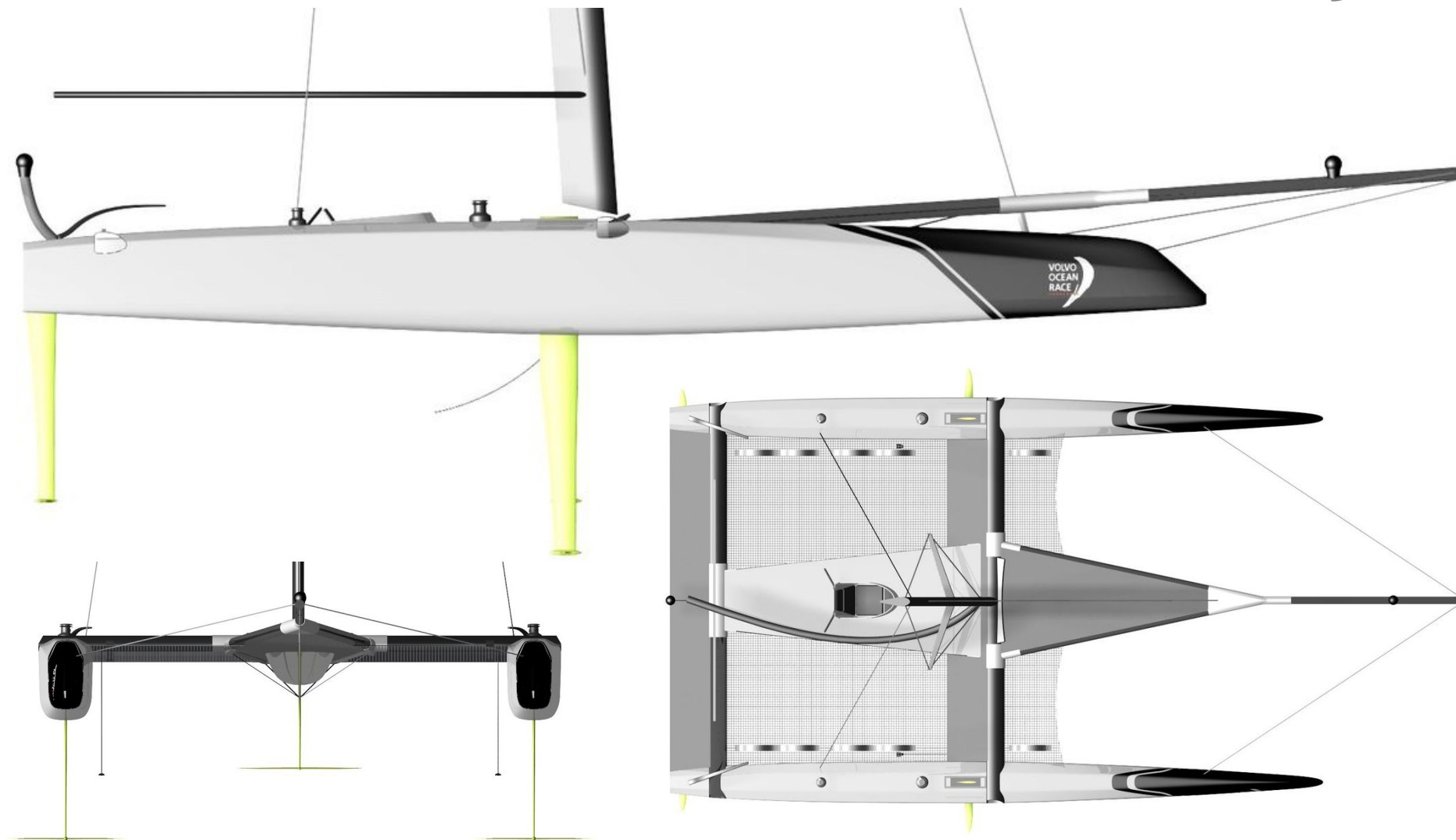
## MAIN DIMENSIONS (Preliminary)

Hull length : 10.85 m (35')  
Overall Length (in-port / lake) : 11.85 m / 13.2 m  
Beam : 7.0 m  
Freeboard at front beam : 0.94 m  
Air Draft (in-port / lake) : 18.50 m / 20.50 m  
Lightweight displ. : 900 kg  
Sailing displ. : 1450 kg  
Draft : 0.20 m / 2.1 m  
Upwind sail Area (in-port / lake) : 85 m<sup>2</sup> / 98 m<sup>2</sup>  
Type of foils (in-port) : 5 T foils (central is optional)  
Type of foils (lake) : Daggerboards or 4 T foils  
  
Material Hulls : sandwich carbon fibre / foam or  
nomex core / epoxy  
Materials Foils / structure / mast : Carbon fiber  
  
Design : VMG Yacht Design  
Hydrodynamics and VPP : Giorgio Provinciali  
Structure : Gsea Design

# RENDERING – Design Proposal 1



# Rendering – Design Proposal 1



# Special Features – Design Proposal 1



✓ Innovative Central structure:

> Encompasses the best aerodynamic possible, both jib and mainsail have “end plate” features to enhance efficiency > Withstands the loads from the rig and the foils in a smart way to improve the overall stiffness > Simplifies the boat assembly as it is built as a unique item that limits the issues with pretensioning the platform > Offers a safe dedicated seat for the guest > The guest is fully protected and can enjoy the show > The central pod can be totally removed if necessary.

✓ Aerodynamic package:

Improves overall aerodynamics of the Platform > Soft « 3Di » carenage. They can easily be installed or replaced > Improved rig efficiency with end plate effect available on both sails > Decksweeper mainsail > Lightweight solution > Streamlined hulls.

✓ Hydrodynamic package:

The hulls are designed for the low speed range in Archimedean mode > Least drag hull with narrow transom > Forward volumes designed for dynamic lift to help take off.

✓ Foil arrangement and systems:

T foil Rudders (can either be coupled or uncoupled to adjust the righting moment) > Main T foils (can either be coupled or uncoupled to adjust the righting moment) > Optional Central T foil: Operates as a light wind booster. The central foil raises out of the water when boat speed is high enough > Elevators of different sizes available for the different circuits > The control system is a mechanical solution to reduce the maintenance issues (wand) > The daggerfoil cases allow the foils to be pre raked to operate efficiently in a wide speed range > The daggerfoil case can also fit a standard centre board for lightwind conditions in case of a non one design regatta.

✓ Deck layout:

The deck layout will be developed with experimented sailors to design the most efficient solution both in terms of performance and safety > All the hardware is off the shelf. Loads are kept to human size > No hydraulic hardware.

✓ Overall safety

The T foils are kept low at all time to prevent crew injury > The guest is kept on a safe environment.

✓ Rig and sail package:

2 mast heights available. A common lower mast part to be assembled to a long or a short upper part > 2 Sets of sails available (3 for one design racing with the short mast - 4 for open classes regattas with the tall mast) > Self tacking jib.

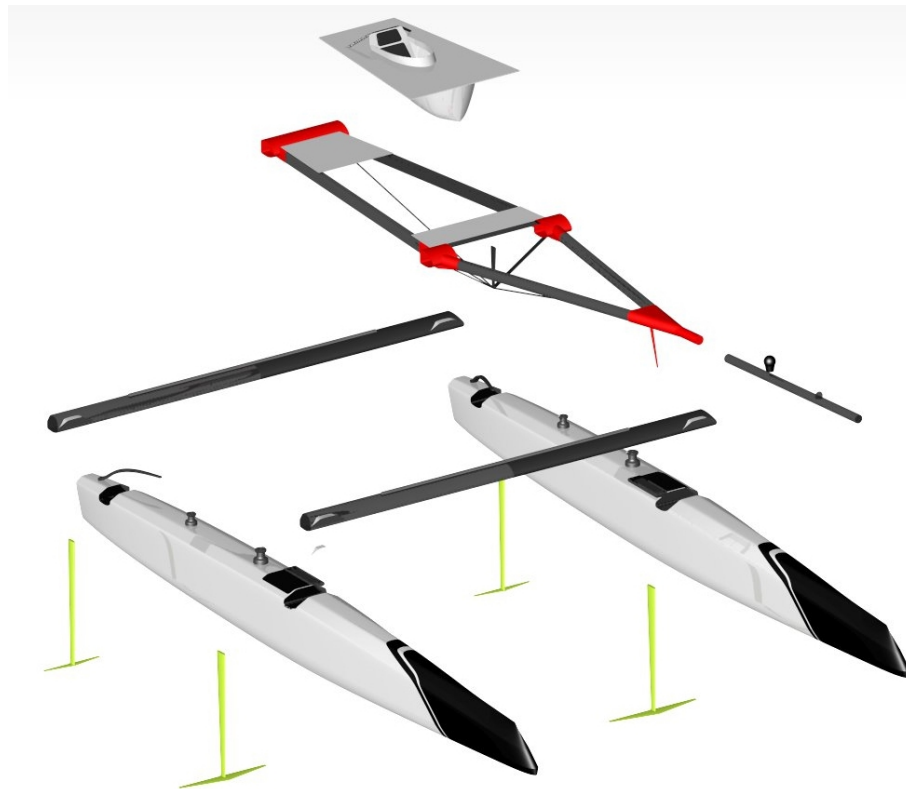
✓ High transportability:

All the items can fit in a 40' container > The platform is designed to be easily assembled and stacked in a container.

# Assembly & Transformability – Design Proposal 1

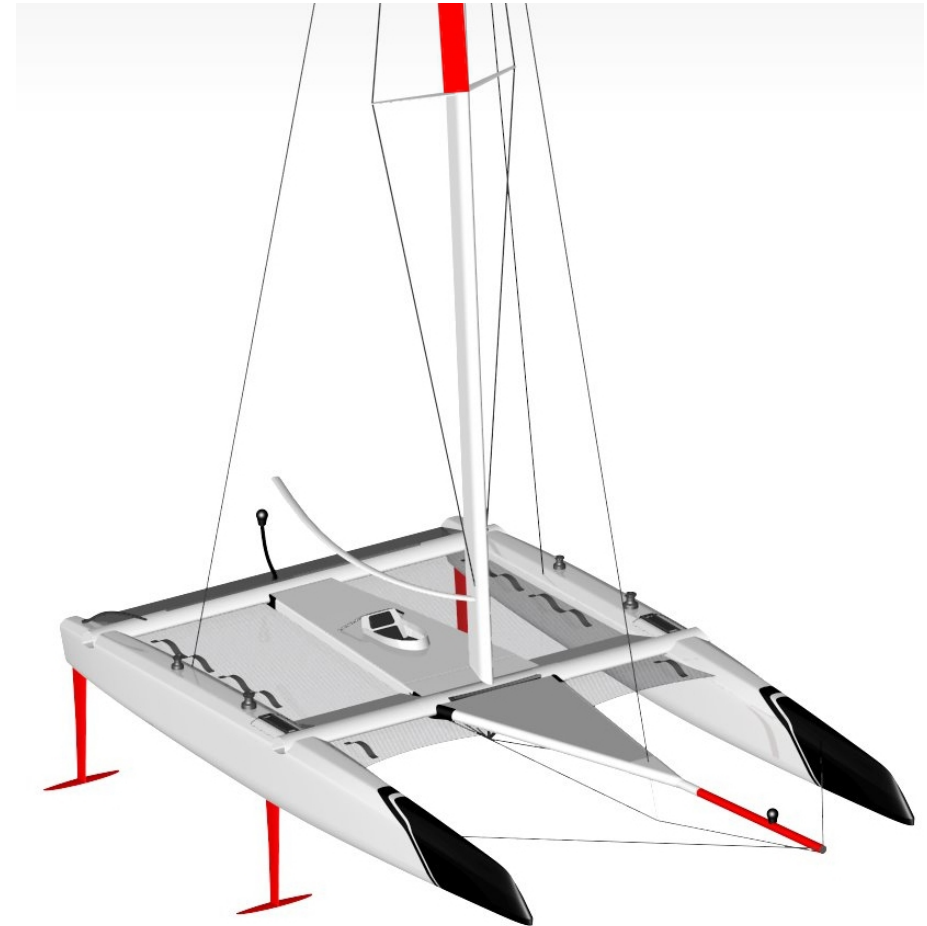


## ASSEMBLY



All the items fit in a 40' container

## TRANSFORMABILITY



In Red, the parts that can be replaced to fit with other Series requirements

# Overview – Design Proposal 2



This boat is a new type of 39' catamaran, light and efficient with a twin rig with soft wing sails. The hulls are limited to the strict buoyancy requirement to maintain the boat afloat when not foiling. The overall flight stability is clearly enhanced as the distance between the main foil and the rudder is maximum. This new approach does not represent high speed sailing as we know it today. However it reflects the future of sailing whilst having appeal to sailors and non sailors alike.

## MAIN DIMENSIONS (Preliminary)

Hull length : 11.85 m (39')

Overall Length : 11.85 m

Beam : 8.50 m

Freeboard at front beam : 0.65 m

Air Draft : 15.25 m

Lightweight displ. : 750 kg

Sailing displ. : 1300 kg

Draft : 0.20 m / 2.1 m

Upwind sail Area (2 \* Soft wing) : 90 m<sup>2</sup>

Type of foils : 5 T foils

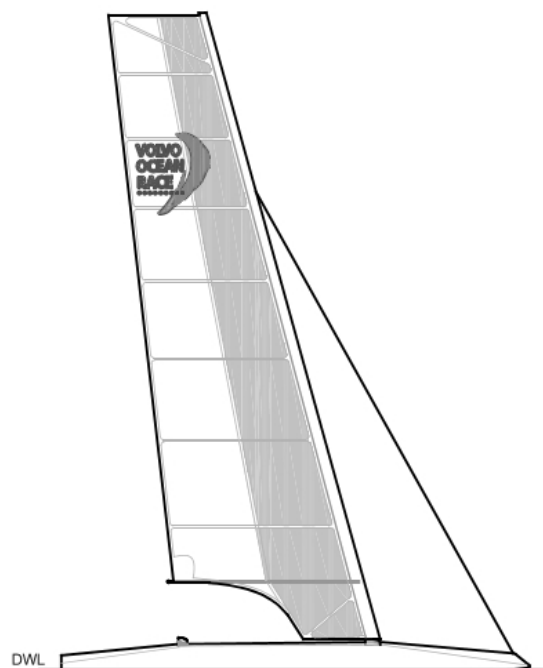
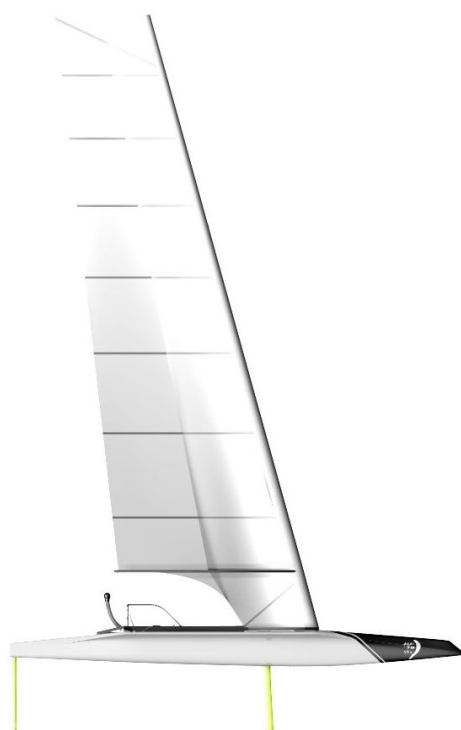
Material Hulls : sandwich carbon fibre / foam and  
Nomex core / epoxy

Materials Foils / Structure / mast : Carbon fiber

Design : VMG Yacht Design

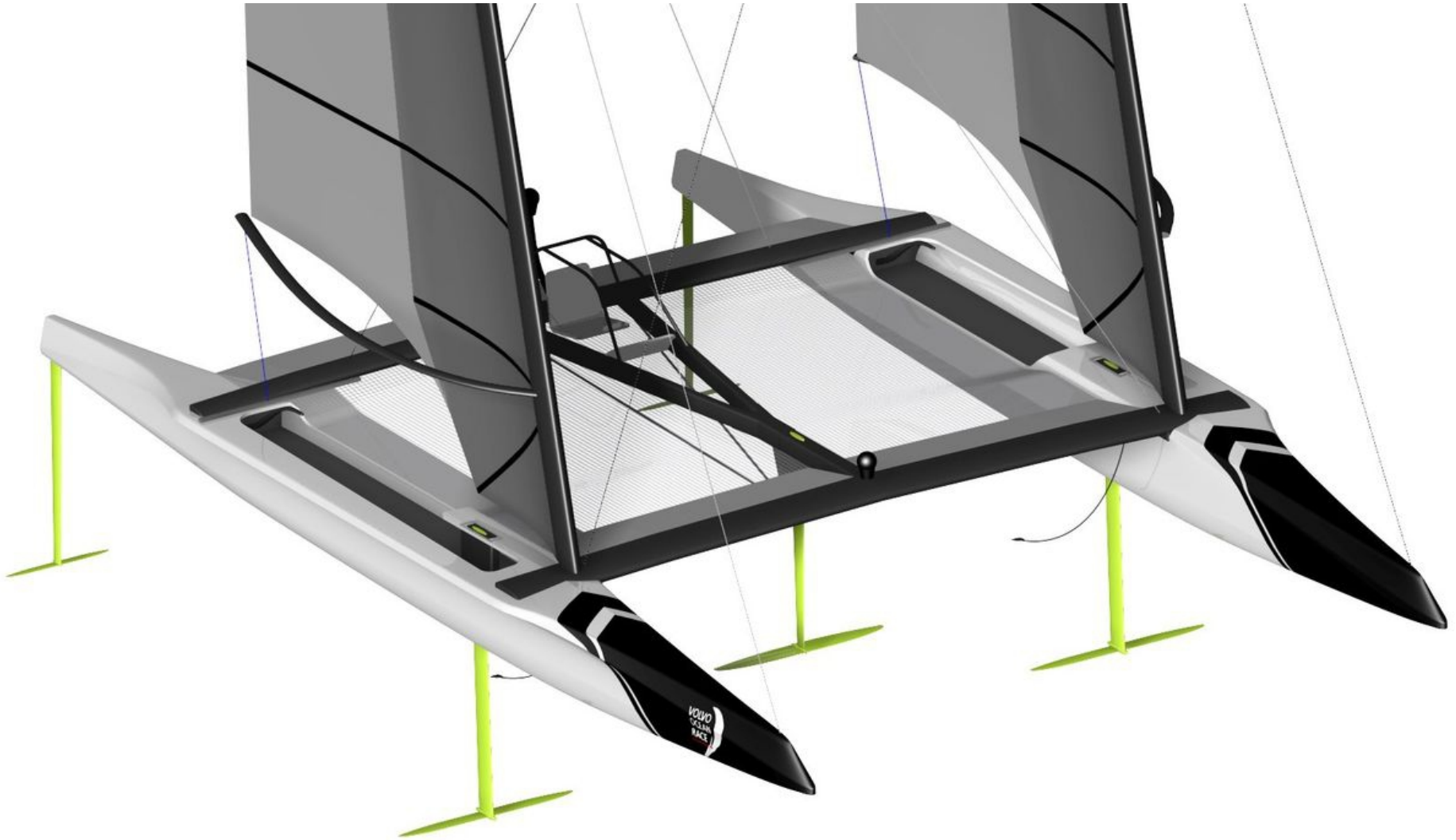
Hydrodynamics and VPP : Giorgio Provinciali

Structure : Gsea Design

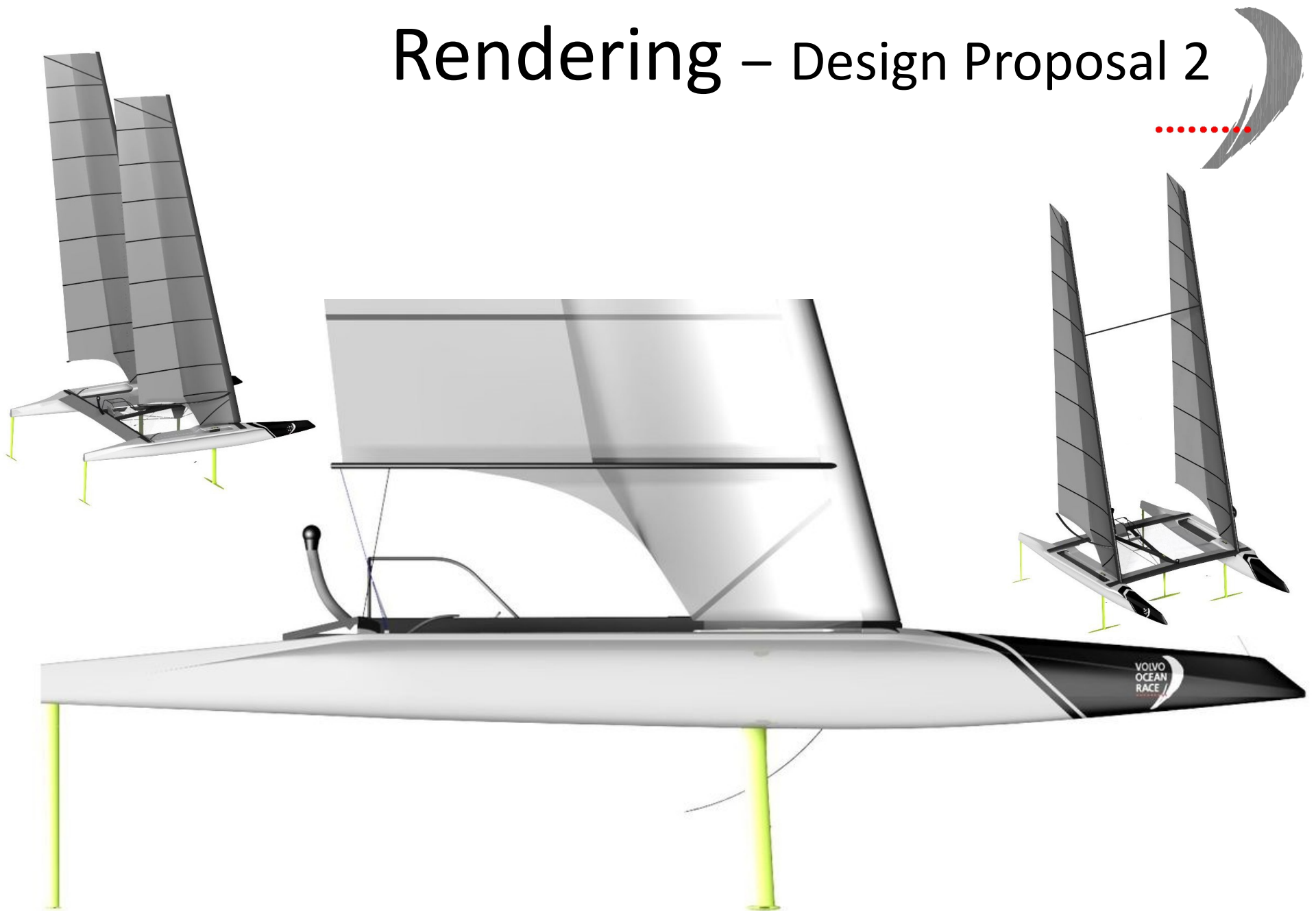


Design Proposal 2 - Volvo Inport Race

# Rendering – Design Proposal 2



# Rendering – Design Proposal 2



# Special Features – Design Proposal 2



✓ Twin rig and soft wing sail

Innovative soft wing sail developed by VMG Yacht Design for high efficiency. Two lighter masts can be disassembled to fit in a 40' container > Deck sweeper sails > Lower heeling arm > The mast compression is limited and the overall structure is simpler > Sail set limited to two sails > High aerodynamic efficiency and minimised drag > The sails can be lowered

✓ Innovative central structure:

The guest has a dedicated secured seat > Includes the central foil system

✓ Aerodynamic package:

Improves the overall aerodynamics of the Platform (with similar solutions) > Improved rig efficiency with end plate effect available from the hull itself > Twin soft wing sail > Deck sweeper main sail > Streamlined hulls

✓ Hydrodynamic package:

The hulls are designed for a very narrow speed range > Least drag hull with narrow transom and smallest wetted surface > Forward volumes designed for dynamic lift to help take off.

✓ Foils arrangement and systems:

T foil rudders (can either be coupled or uncoupled to adjust the righting moment) > Main T foils (can either be coupled or uncoupled to adjust the righting moment) > Optional central T foil, operates as a light wind booster. The central foil raises out of the water when boat speed is high enough > Elevators of different sizes available for the different circuits or wind conditions > The control system is a mechanical solution to reduce maintenance issues (wand) > The daggerfoil cases allow the foils to be pre-raked to operate efficiently in a wide speed range.

✓ Deck layout:

The deck layout will be developed with experimented sailors to design the most efficient solution both in terms of performance and safety > All the hardware is off the shelf. Loads are kept to human size > No hydraulic hardware. > Very simple Deckplan

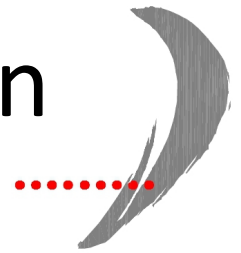
✓ Overall safety

The crew sail the boat from a cockpit > The T foils are kept low at all time to prevent crew injury from the trailing edges > The guest is kept in a safe environment

✓ High transportability:

All the items can fit in a 40' container > The platform is designed to be easily and quickly assembled and stacked in a container.

# Proposal 1 or 2 & Foil Selection



## DESIGN PROPOSAL 1

- ✓ Fully Controlled Design Process
- ✓ Archimedean mode and D35 circuit compliant
- ✓ State of the art technology and design
- ✓ Public and sailor's perception predictable
  
- ✗ Conventional Concept

## DESIGN PROPOSAL 2

- ✓ Innovative concept
- ✓ Innovative twin soft wing rig and implications
- ✓ Lighter structure
- ✓ Enhanced longitudinal stability
  
- ✗ Tight schedule for development
- ✗ Unknown perception of the public
- ✗ Non compliant with D35 circuit

## FOIL CONFIGURATION SELECTION : THE T FOIL CHOICE OVER THE L FOIL IS MAINLY DRIVEN BY THE FOLLOWING ARGUMENTS :

- ✓ Good overall performance
- ✓ Strut and elevator can be developed and modified separately
- ✓ The foils are low at all time (security - manoeuvrability)
- ✓ Easier and cheaper to build (simpler tooling – Smaller Autoclave)
- ✓ Possibility to adapt the Elevator size
- ✓ Easier Handling on shore

# CONCLUSION



Two concepts have been presented for this tender. Both are fully resolved design solutions and are the result of a well thought out approach.

- ➔ The first is an innovative vision of the foiling multihull inspired by the last America's Cup. Moreover, it is clearly a limited risk solution at all levels, performance, concept, building and running issues. This type is compliant with the D35 circuits and is a potential Bol d'Or winner.
- ➔ The second proposal is innovative and appears to be a very exciting challenge that could turn out to change sailing as we see it today. Of course the path is not straightforward but the result will definitely be a nice achievement. We are confident that together with the specialists that we appointed, we will be in a position to deliver a boat matching what you see as being the future of sailing.

# CONTACT



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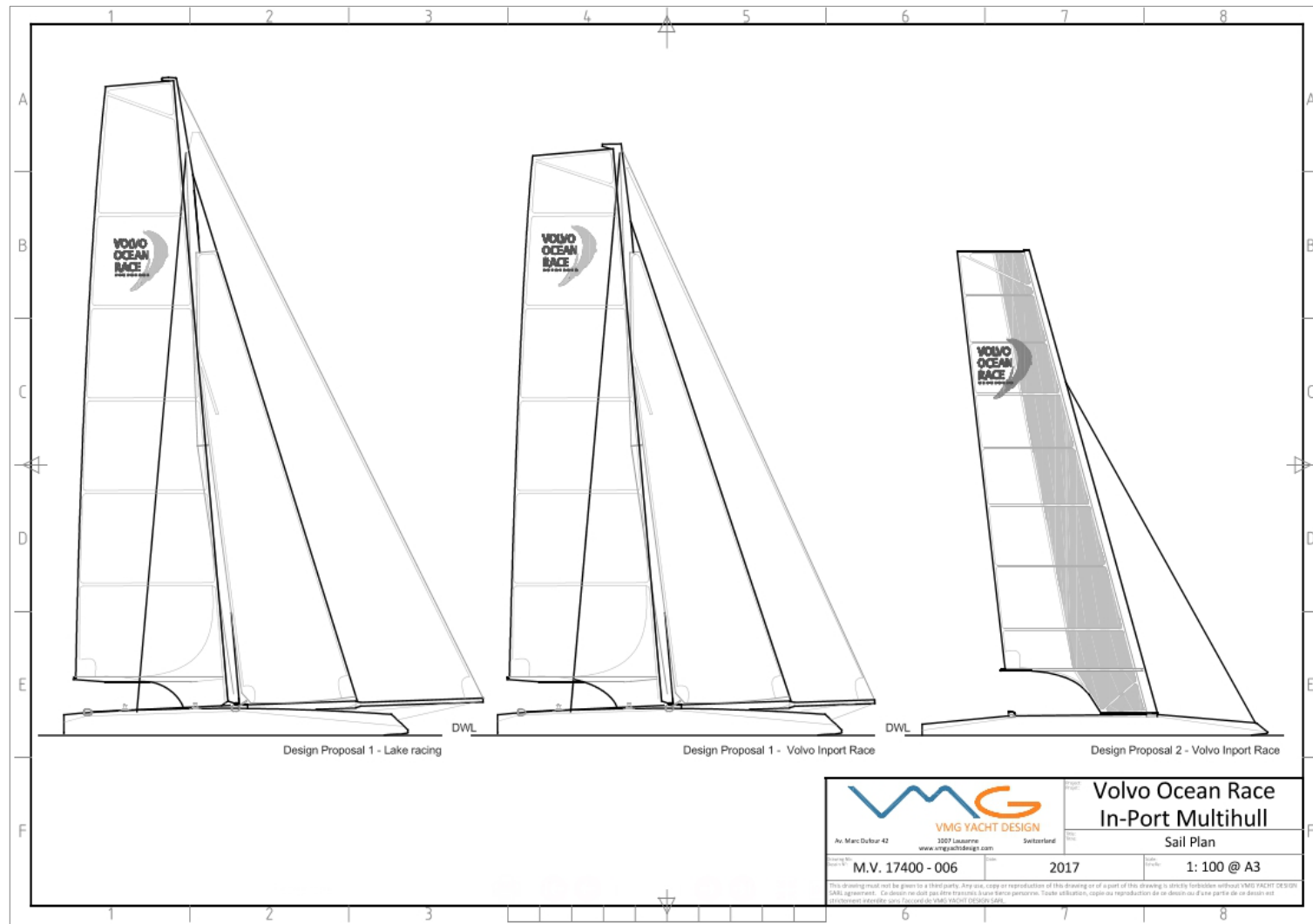
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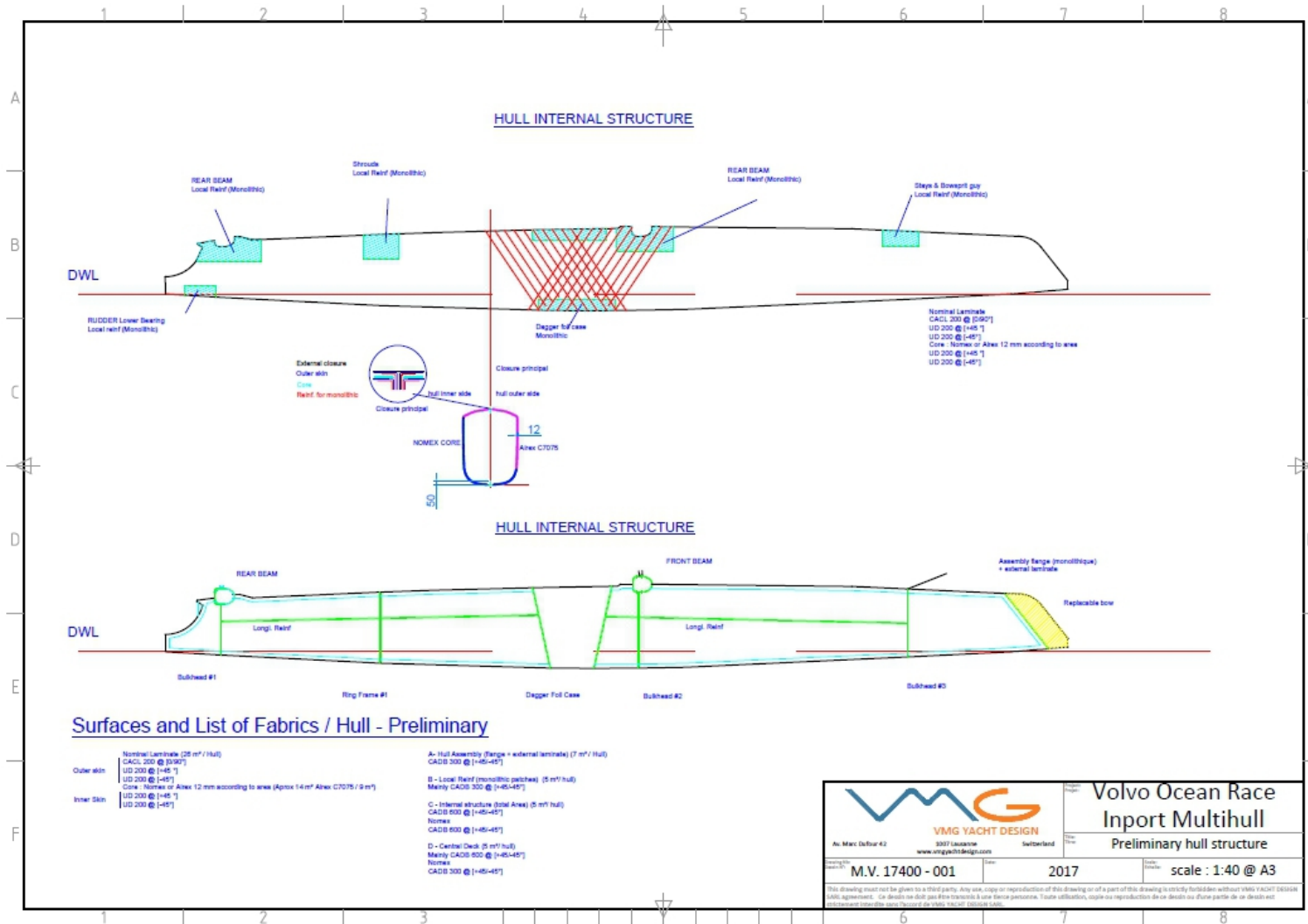
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# Appendix – Structure



# Appendix – Structure



# Appendix – Structure

