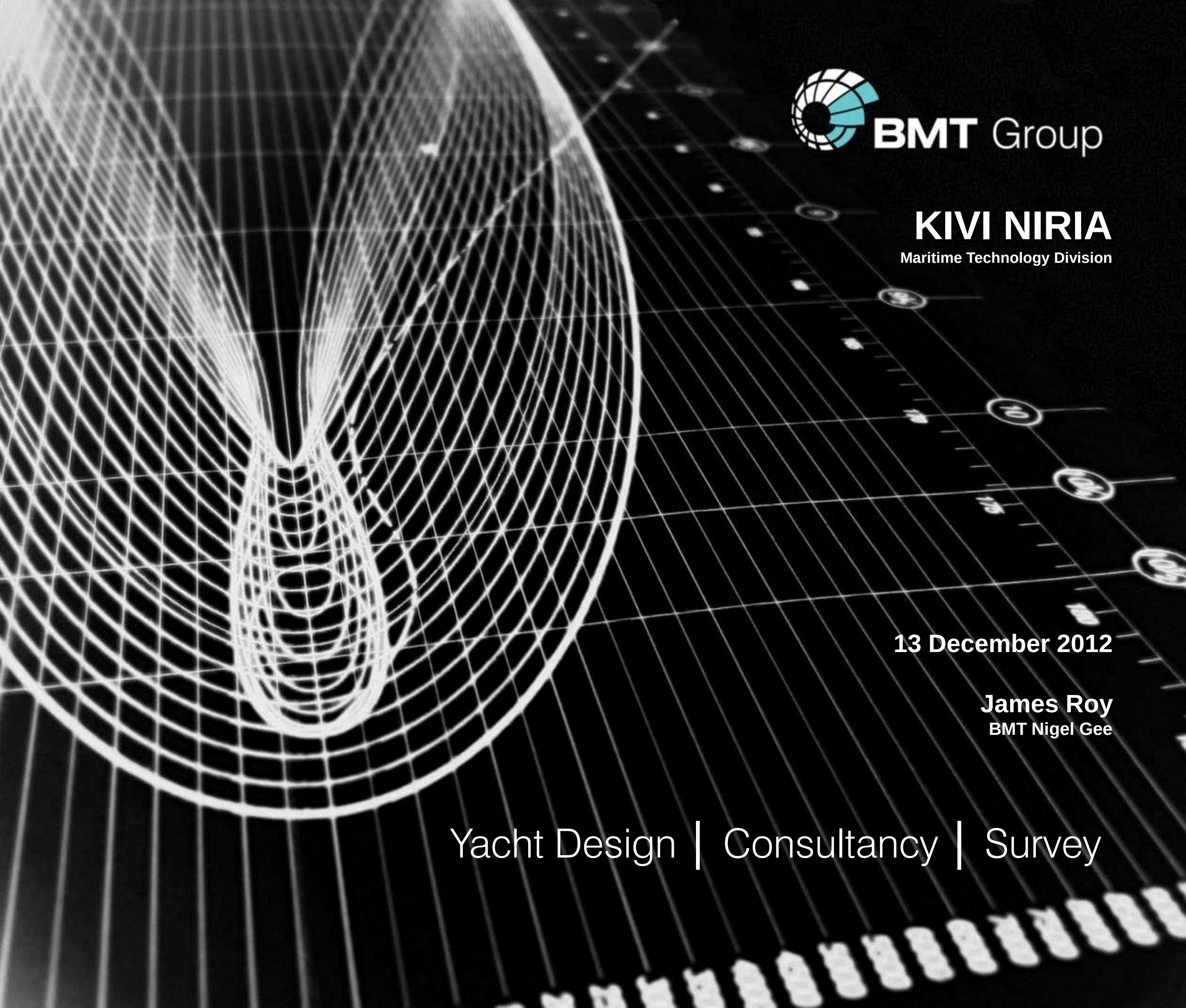


# KIVI NIRIA

**Maritime Technology Division**

**13 December 2012**

**James Roy**
**BMT Nigel Gee**

Yacht Design | Consultancy | Survey

# “UNIDENTIFIED SAILING OBJECTS”

The modern superyacht is a complex piece of engineering that often incorporates significant levels of new and emerging technology.

Despite having invested significant amounts of capital in designing and building these yachts, the owners are very conservative with the choice of hullform; the vast majority of large yachts are monohulls.

In contrast to the design process for commercial vessels, there is often no rational hullform selection process.

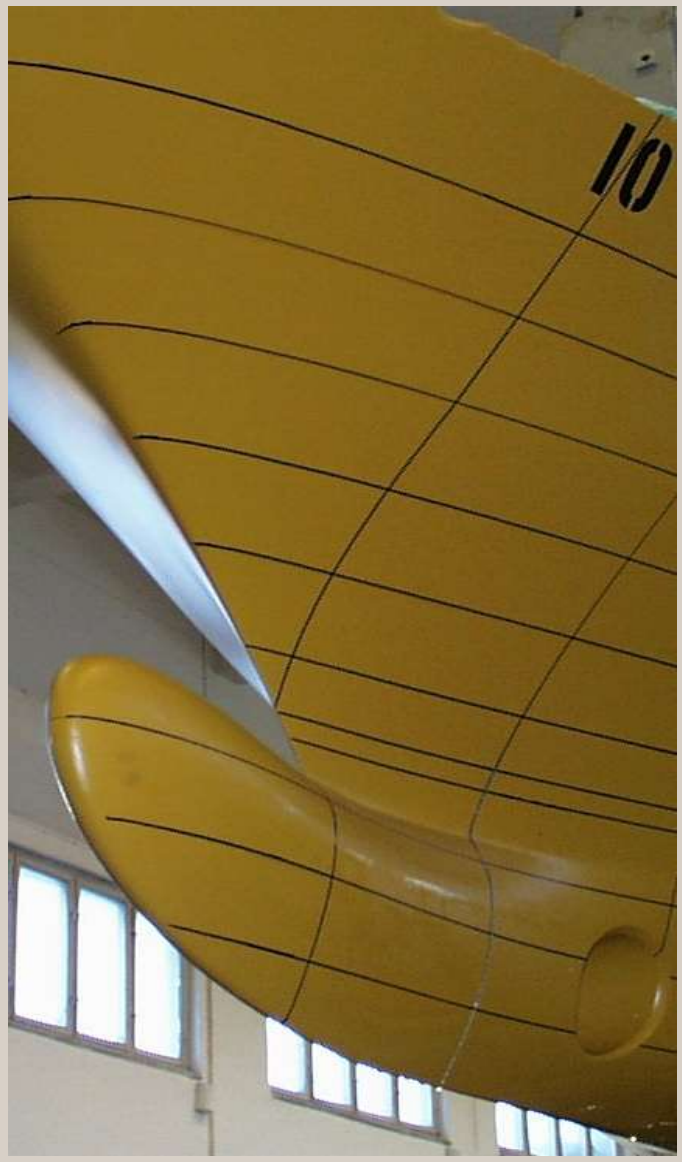
Bringing together experience from over 15 years in the design of specialist commercial vessels and superyachts, James Roy from BMT Nigel Gee will explore a range of hullform types and technologies, from the conservative to the radical, and debate their relative merits for application to large yachts.

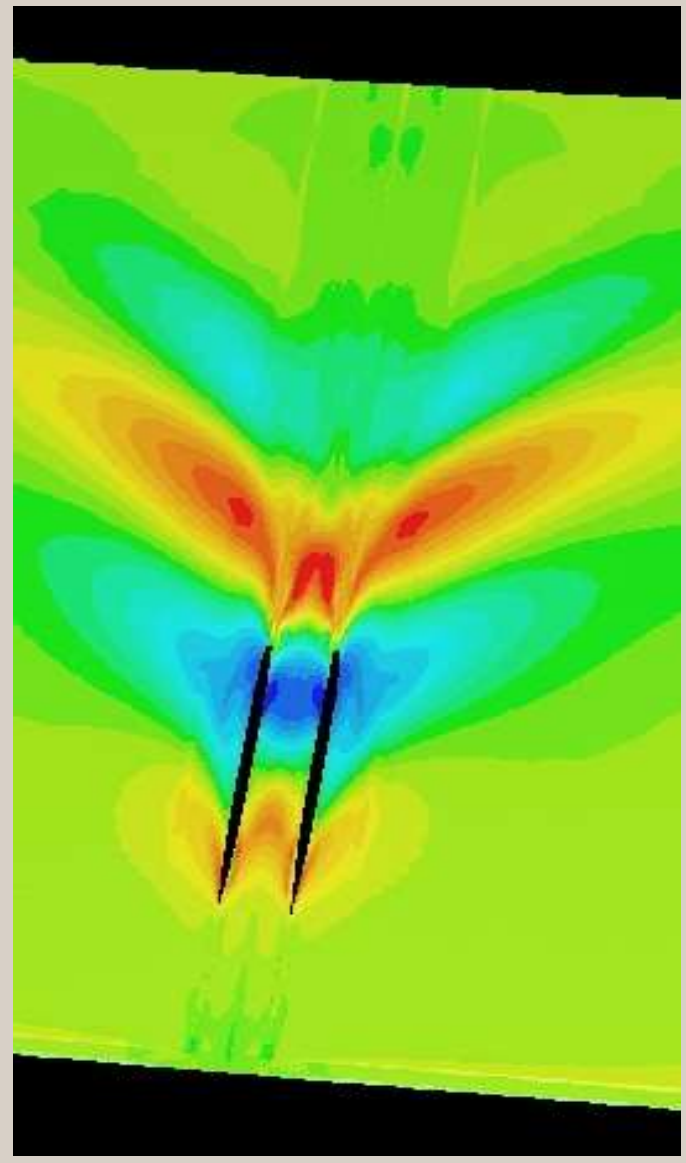
BMT Nigel Gee

## Presentation Overview

- Overview of BMT Nigel Gee and BMT Group
- The Superyacht industry
- Hull types – Superyachts & commercial vessels
- The weird and wonderful
- The sustention triangle
- Case study
- Flights of fancy……..
- This is nothing new!
- Questions?

# Company Overview





BMT Nigel Gee

# Company Overview

Established 1986

Southampton, UK

55+ Staff

150+ Vessels In Operation

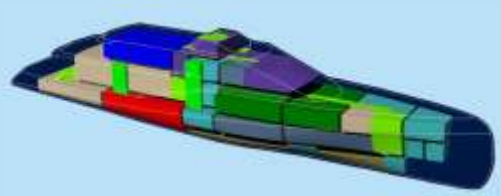
Full Range of Services

- Concept Design
- Naval Architecture
- Mechanical Engineering
- Structural Design
- Production Design
- Outfit Design
- Consultancy
- Plan Approval
- Survey

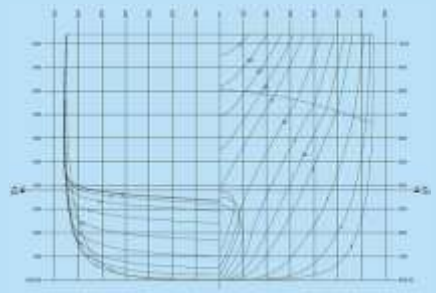


BMT Nigel Gee

# Scope of Services



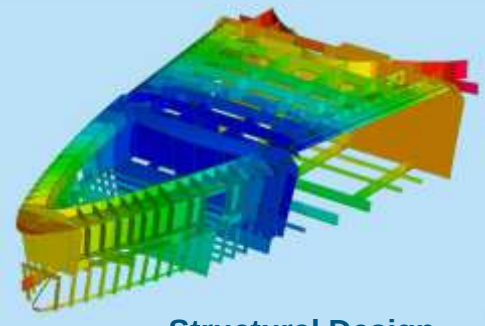
Concept Design



Naval Architecture

Machinery & Systems Design

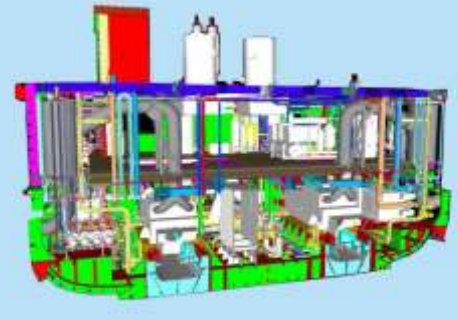
Trials Supervision & Analysis



Structural Design

Build Supervision & Weight Control

Outfit Design & Integration



Detailed Production Design

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# A Diverse Business

*Sailing Yachts*

*Classic Yachts*

*Motor Yachts*

*High Speed Ferries*

*Low Speed Ferries*

*Low Wash Ferries*

*Patrol Boats*

*Pilot Boats*

*Rescue Boats*

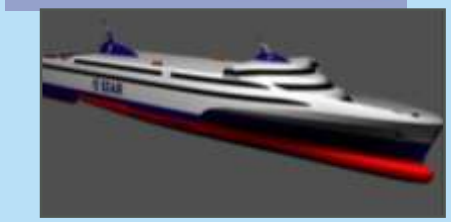
*Supply Boats*

*Work Boats*

*Recovery Boats*


*Containerships*

*RoRo*



*RoPax*

*High Speed Military*

*Future Military*

*Experimental Vessels*

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# Some Dutch Vessels!


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# Some Dutch Vessels!


BMT Nigel Gee

# Some Dutch Vessels!


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# Some Dutch Vessels!


BMT Nigel Gee

# Some Dutch Vessels!


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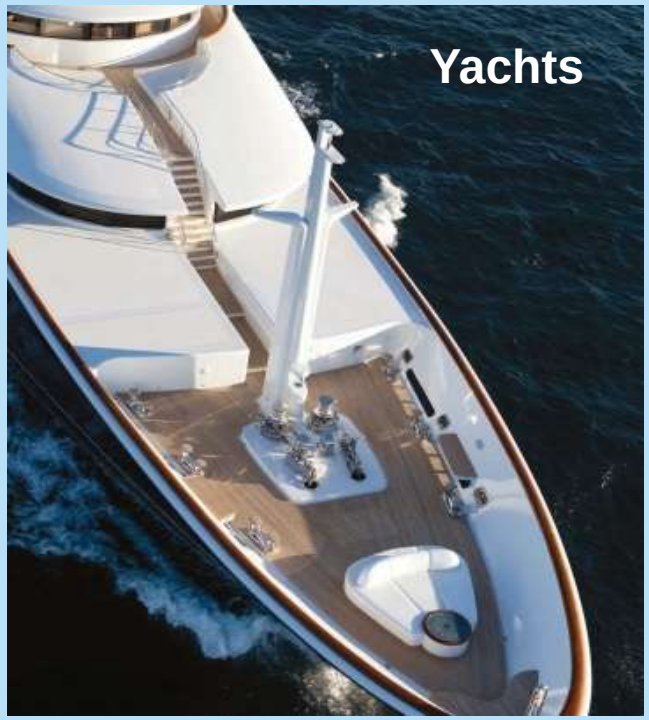
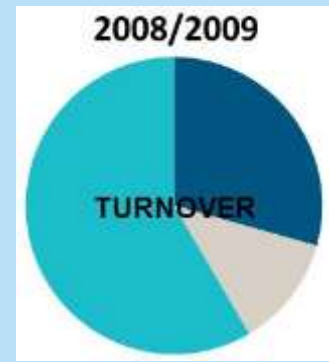
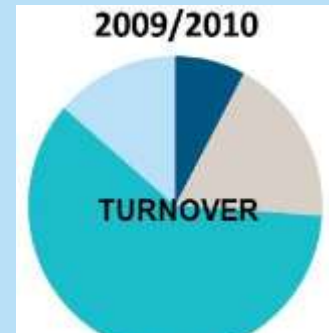
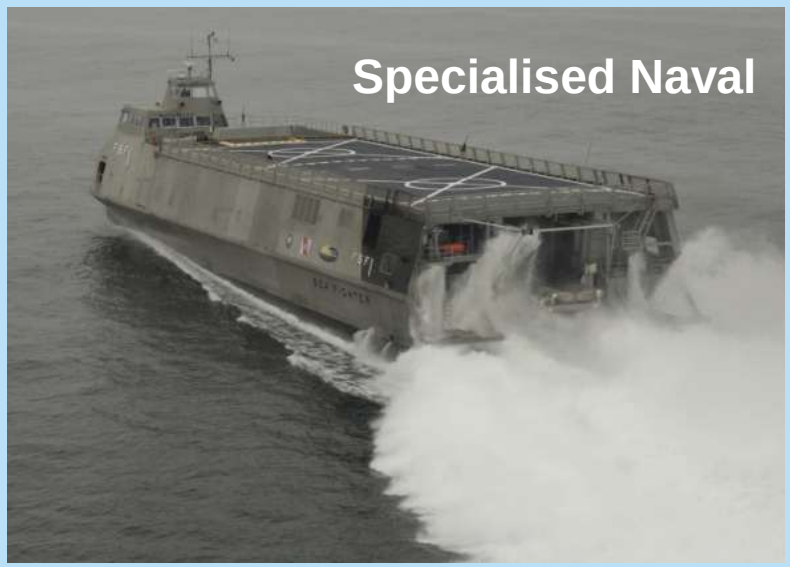
# Active Markets



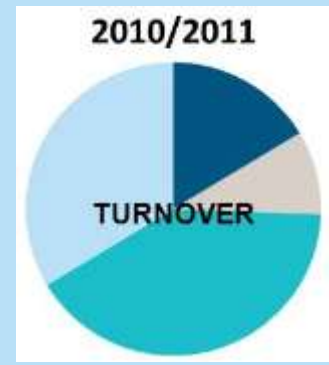










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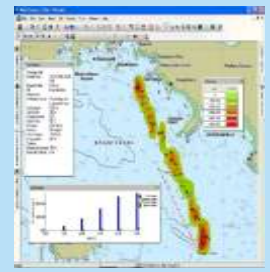
# Who Are BMT?

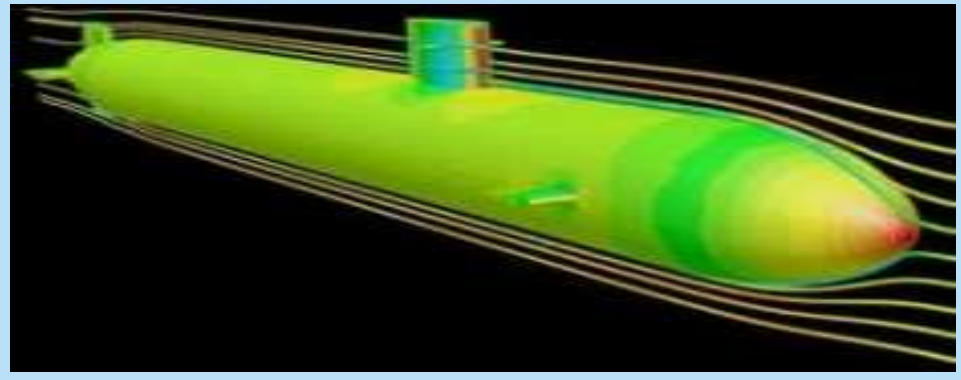
BMT is an international design, engineering and risk management consultancy, working principally in the defence, energy and environment and maritime transport sectors.

BMT invests significantly in research. Its customers are served through a network of international subsidiary companies. The group's assets are held in beneficial ownership for its staff.















BMT Nigel Gee

# A Growing Business

£150m turnover

24 companies

1300 staff

60 offices worldwide

24 countries

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# Commercial Stability

# Broader Capability

# Maintained Independence

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# The Superyacht Industry

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## What is a Superyacht?

This is not a superyacht, <30m LOA

# This is a superyacht, > 30m

Other industry terminology;

- “Mega Yacht”
- “Giga Yacht”

They all mean the same thing.....>30m = 100ft

Within Aisa a superyacht is actually termed as being >24m = 80ft

Vessels are growing in size – this is now ‘small’

| Name | Country | Year | length (ft) | |
|---|---|---|---|---|
| The Platinum | Dubai | 2005 | 525 | |
| Rising Sun | USA | 2004 | 452 | |
| Octopus | USA | 2003 | 414 | |
| Limitless | USA | 1997 | 315 | |
| Abdul Aziz | Saudi Arabia | 1984 | 482 | |
| Savarona | Turkey | 1931 | 440 | *(Never Complete)* |
| Hohenzollern | Germany | 1913 | 520 | |
| Trinacria | Italy | 1883 | 463 | |
| Mahroussa | Egypt | 1866 | 478 | |


Courtesy www.timesonline.co.uk

For many years this was the biggest – MV Dubai @ 162m (532ft)

BMT

This is the biggest – ‘Eclipse’ @ 163m (535ft) delivered in 2010.

But not for long!


Project Azzam, 180m (590ft) under construction.

Rumoured for completion in 2013.

# Some Industry Statistics

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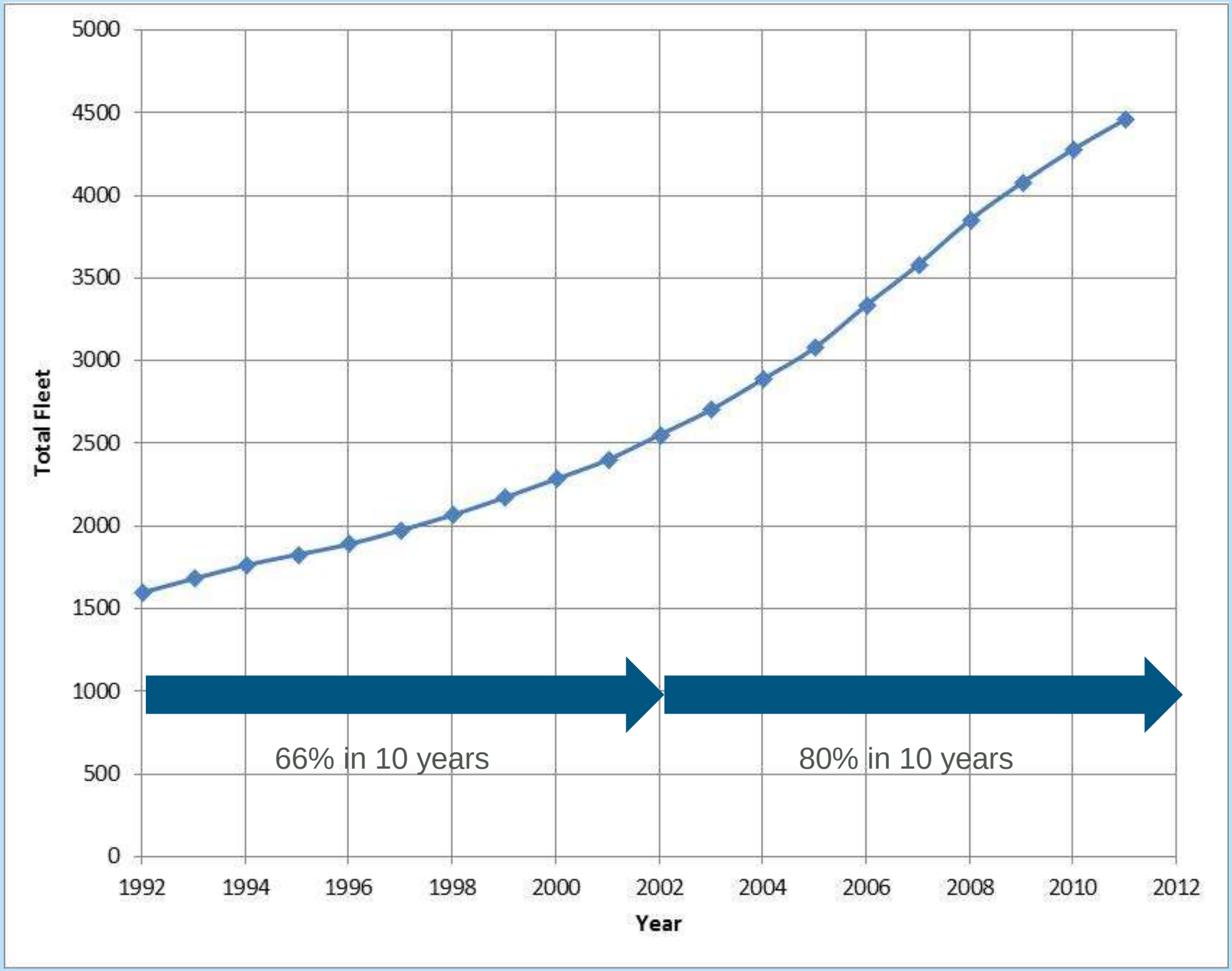
# World Fleet Growth 92-2012




Source : Superyacht Intelligence

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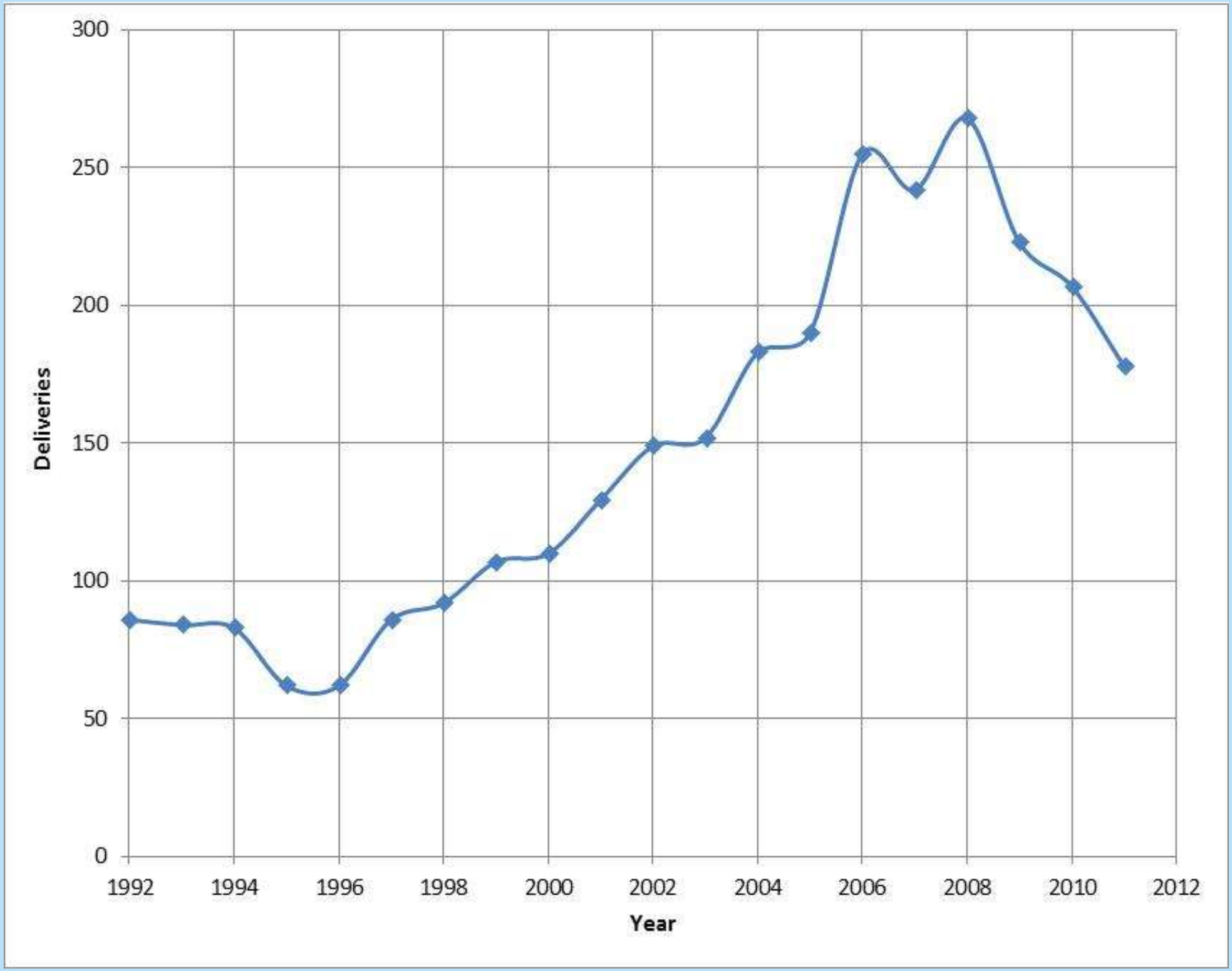
# World Deliveries 92-2012




Source : Superyacht Intelligence

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# World Fleet – Size Breakdown

Motor Yachts

Sailing Yachts


Inner chart represents the global order book (GOB)

Outer chart represents the total fleet (FLEET)

Source : Superyacht Intelligence

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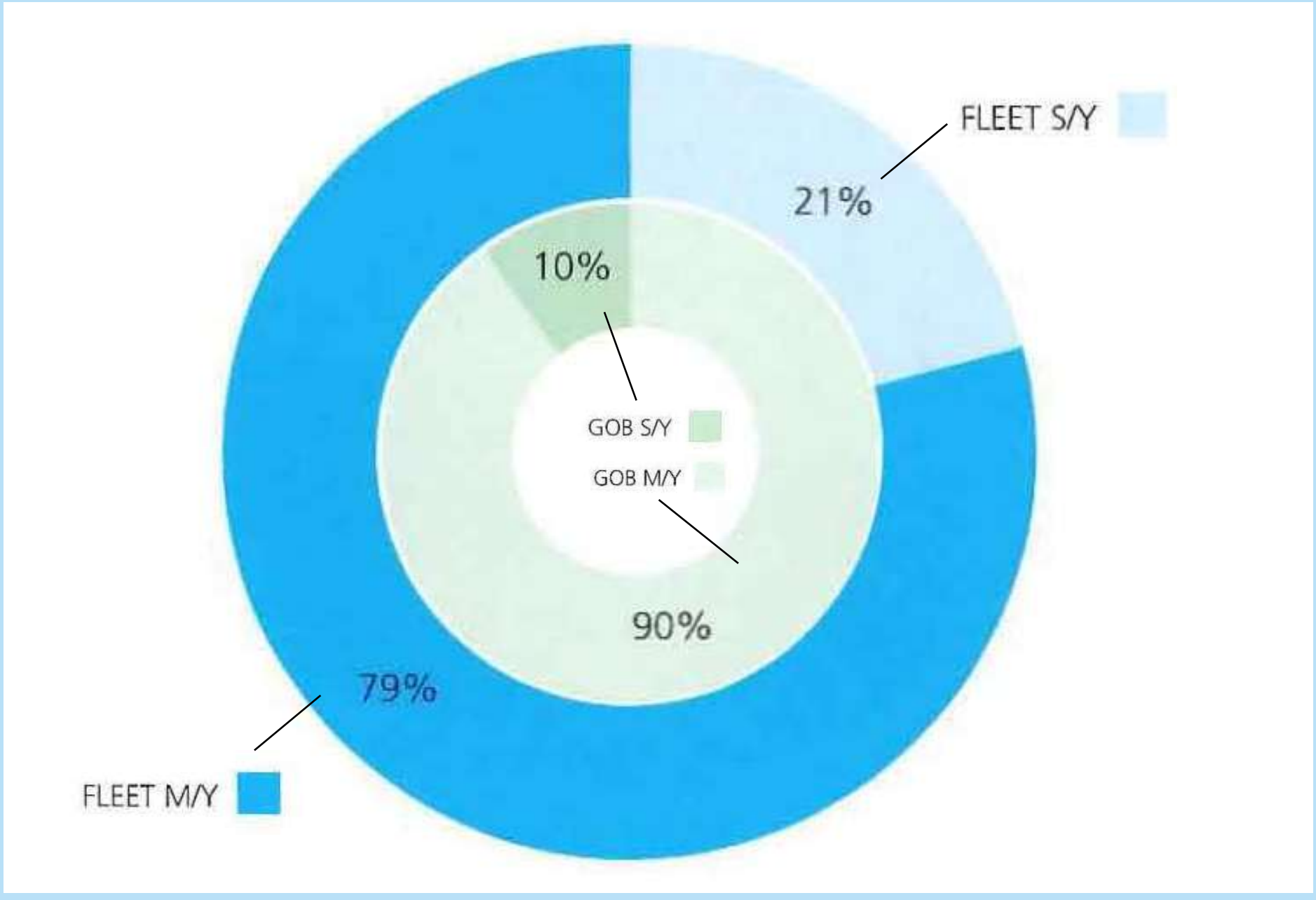
# World Fleet – Sail Vs. Motor




Source : Superyacht Intelligence

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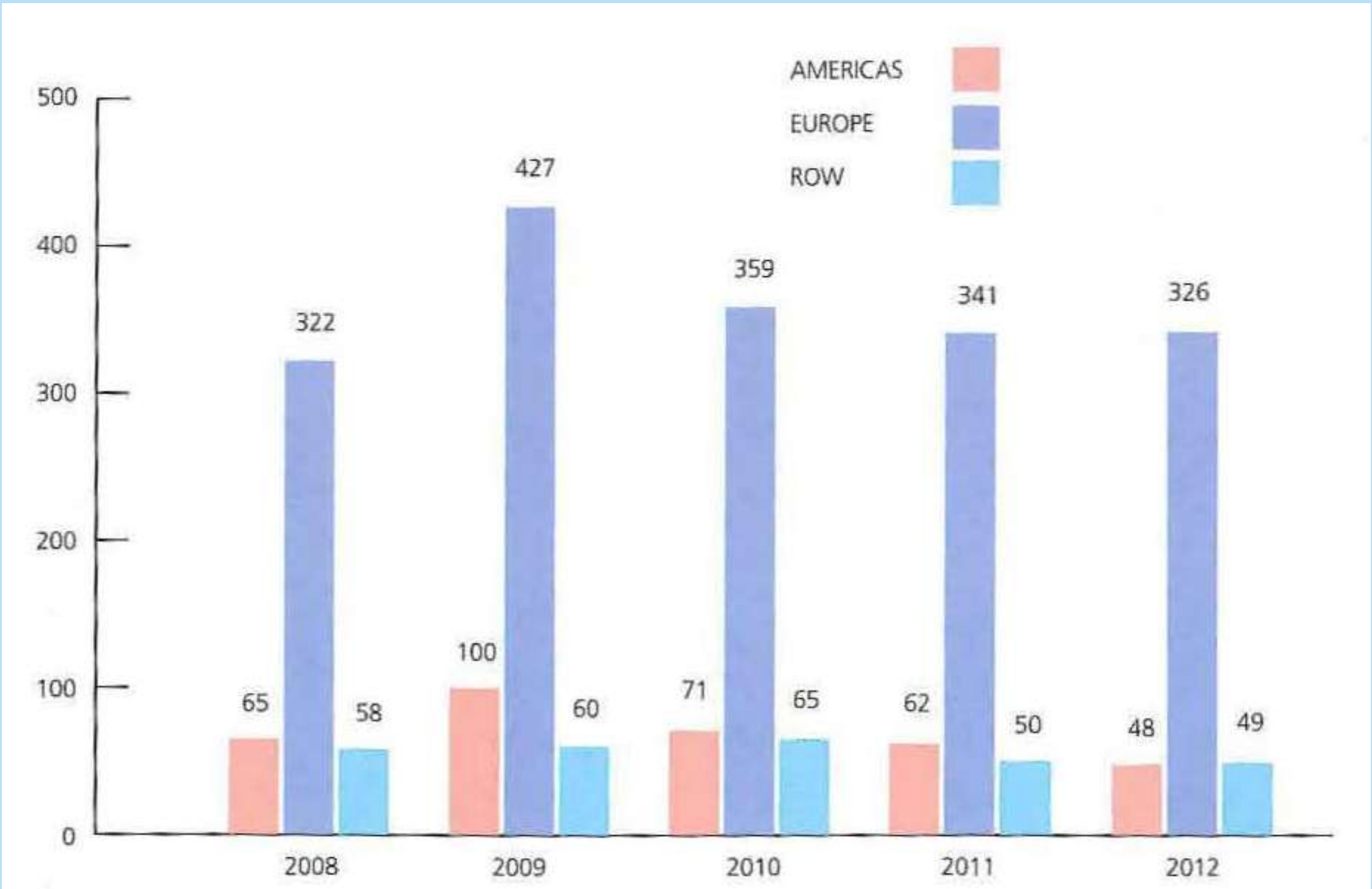
# Order Book By Region 08-2012




Source : Superyacht Intelligence

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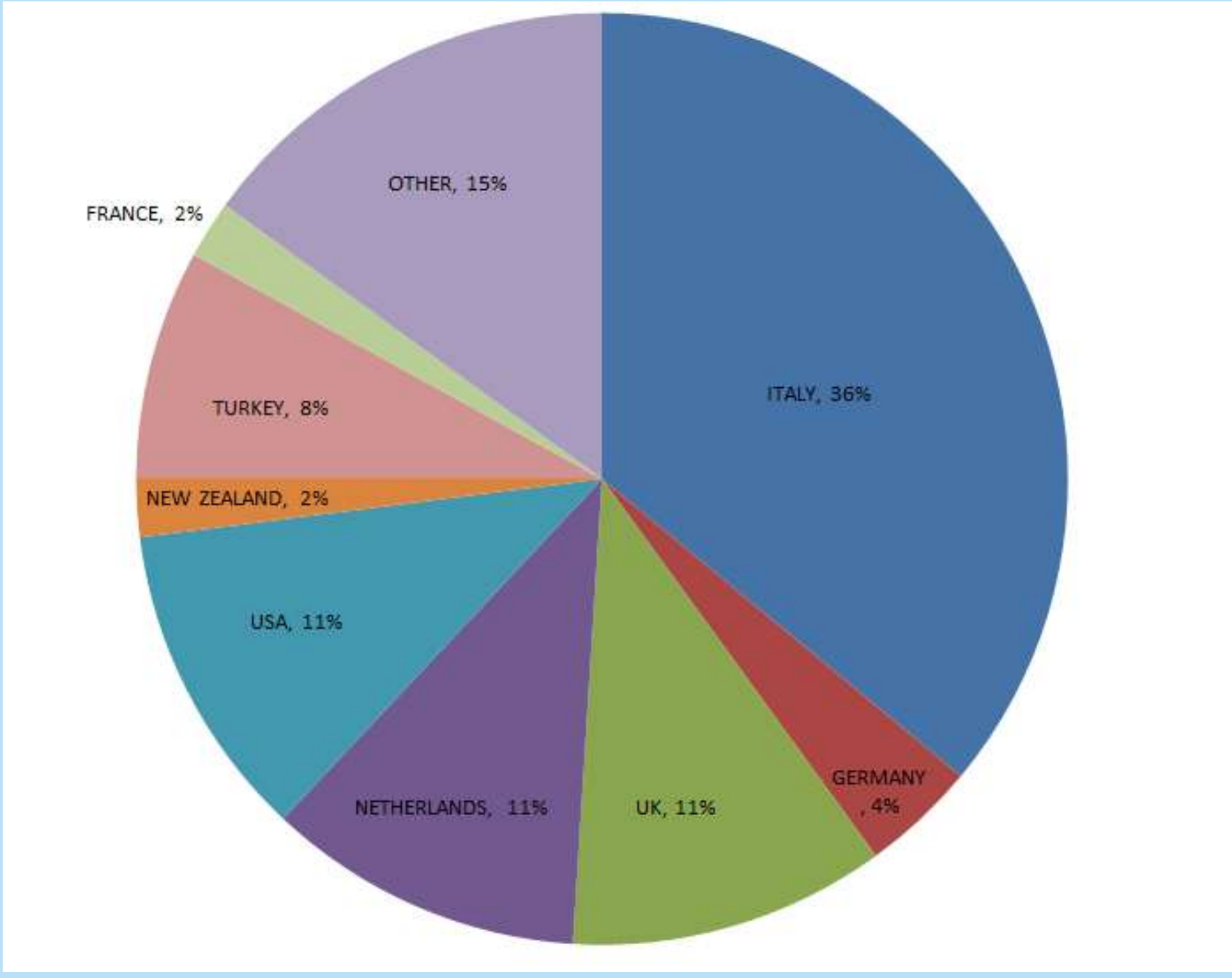
# Order Book By Country 2011




Source : Superyacht Intelligence

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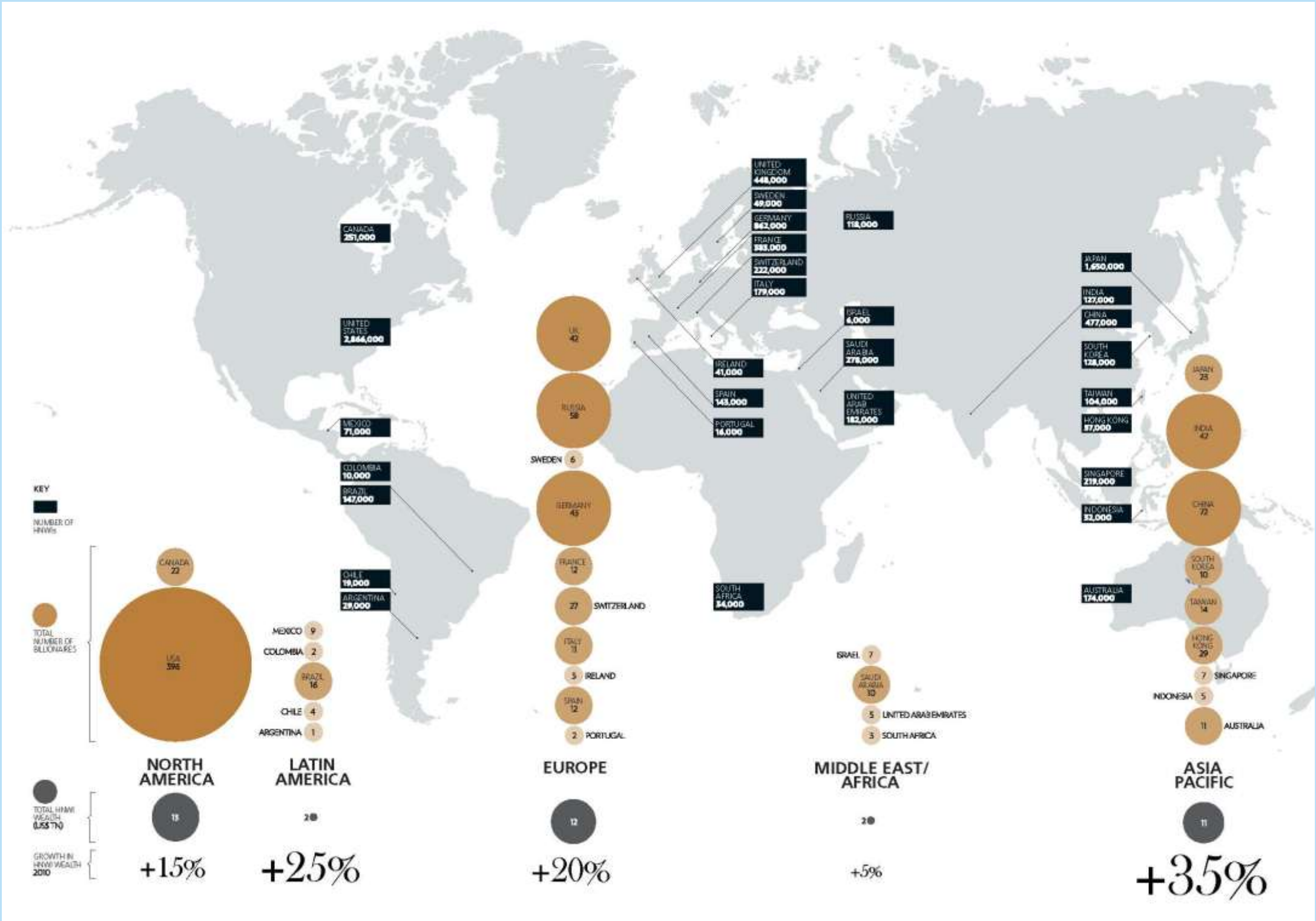
# World Wealth Map 2011




Source : The Wealth Report 2011

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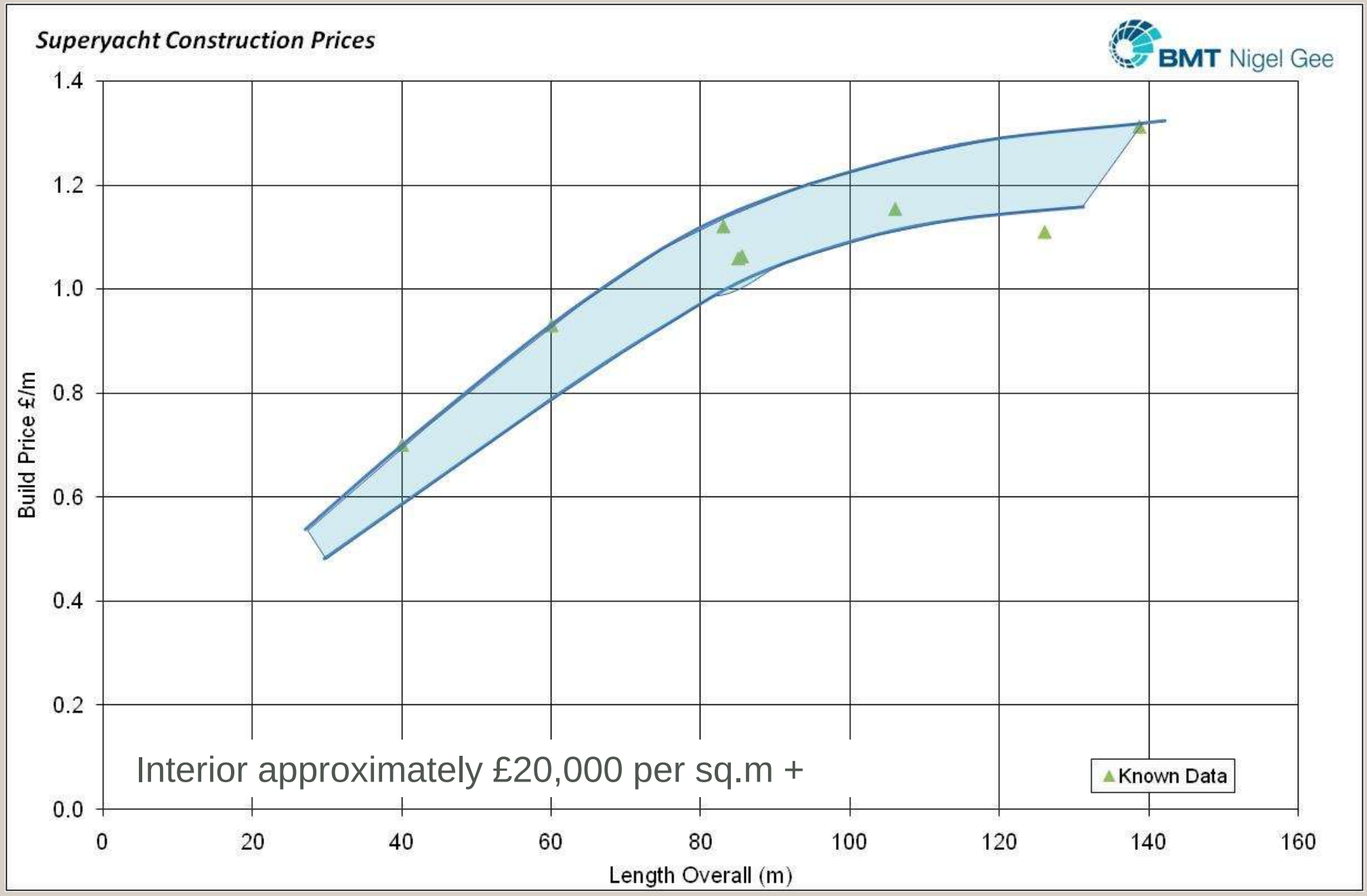
# Prices




Build Price Per m is not the best metric.

Caution - data correct at 2006

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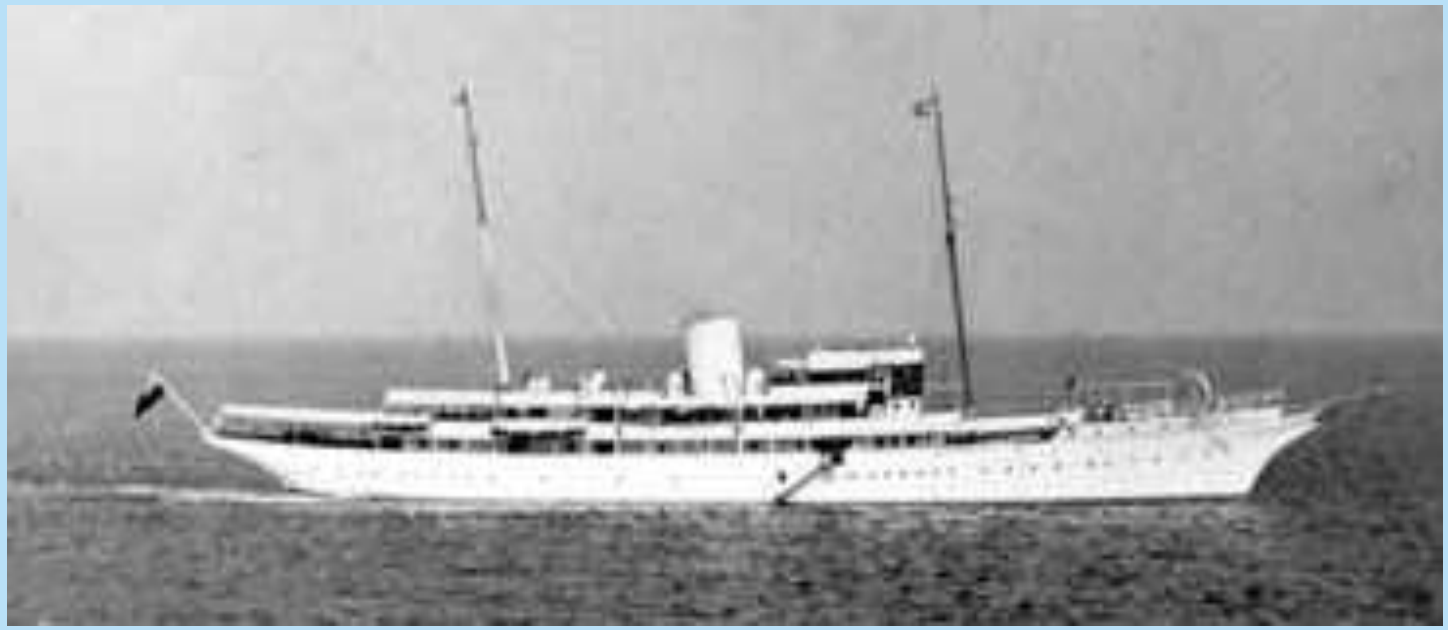
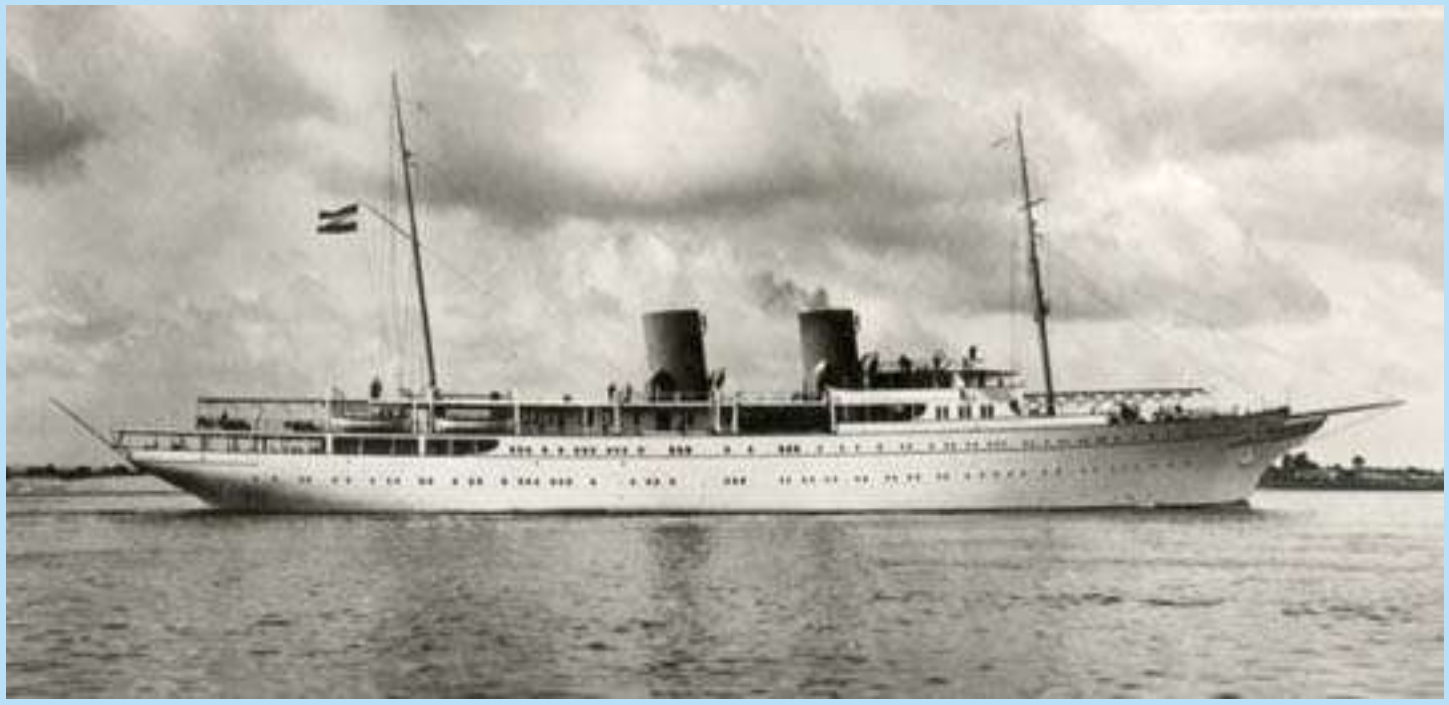
# Prices

- Better to price on a cost per unit volume approach?
- Volume is measured by GT.
- Price depends on region of build and brand.
- Typically £30k / GT low end….++++.
- What about commercial boats?
- A very large cruise liner is about £3 - 4k / GT
- A smaller cruise liner (<30k GT) is about £6 - 8k / GT.
- Yachts are therefore very expensive by comparison.

# Design





Yacht Design – Historically Both Art and Science

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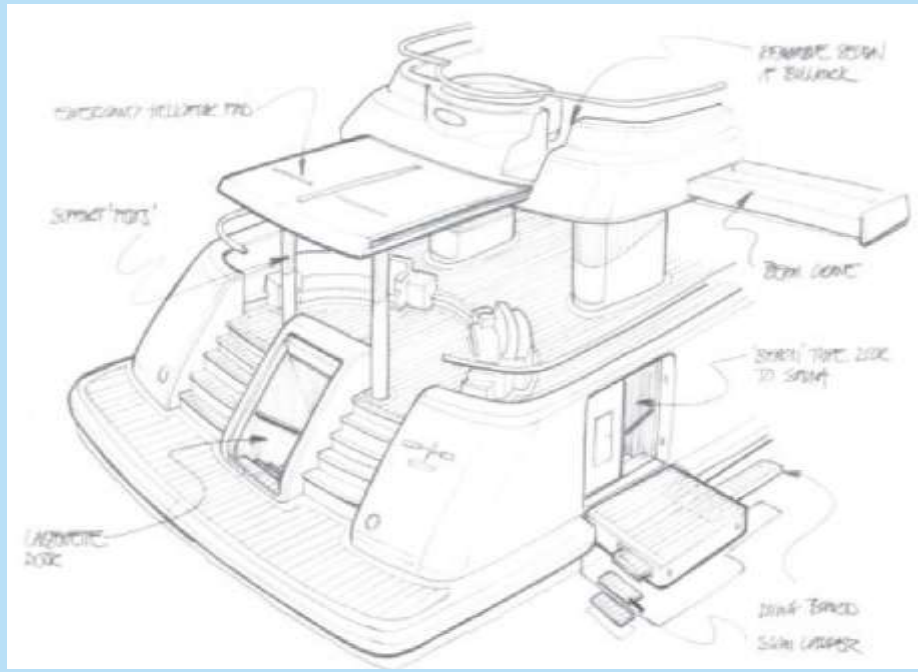
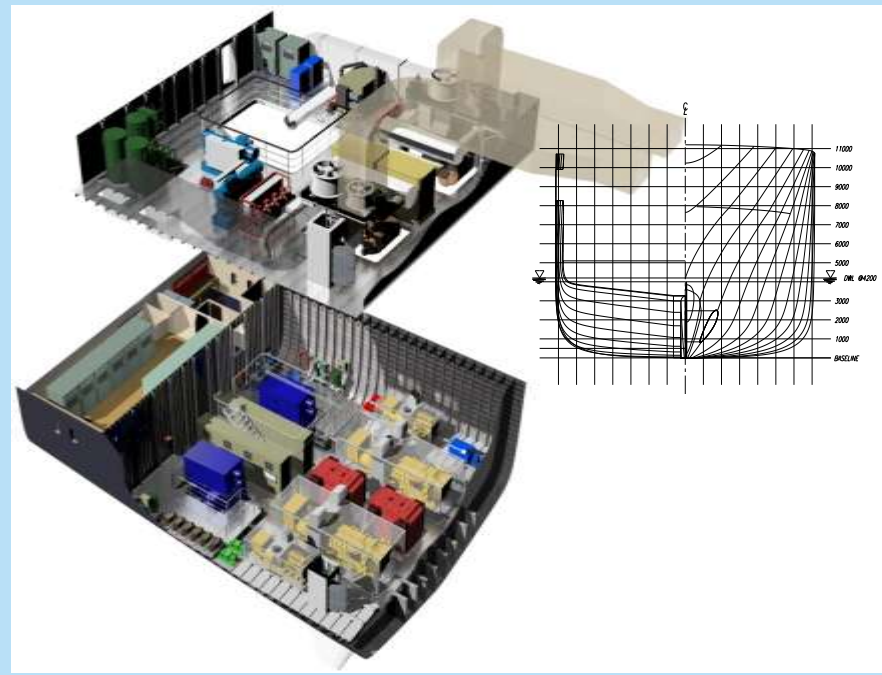


Stylist / ‘Designer’



Naval Architect

Shipyard

Yacht Design –Today Disciplines Are Often Separated

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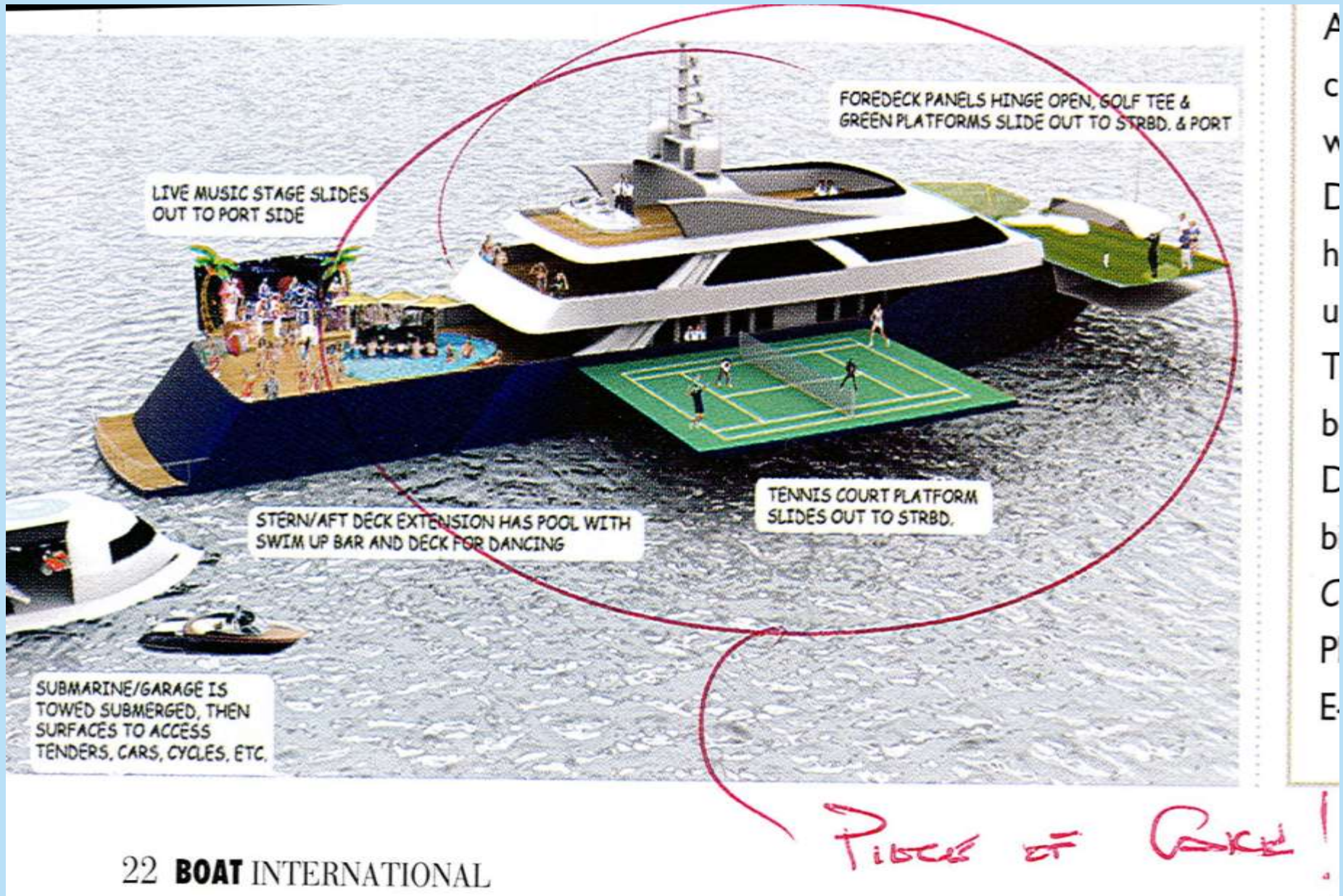


# Designer / Stylist – Occasional Flights of Fancy

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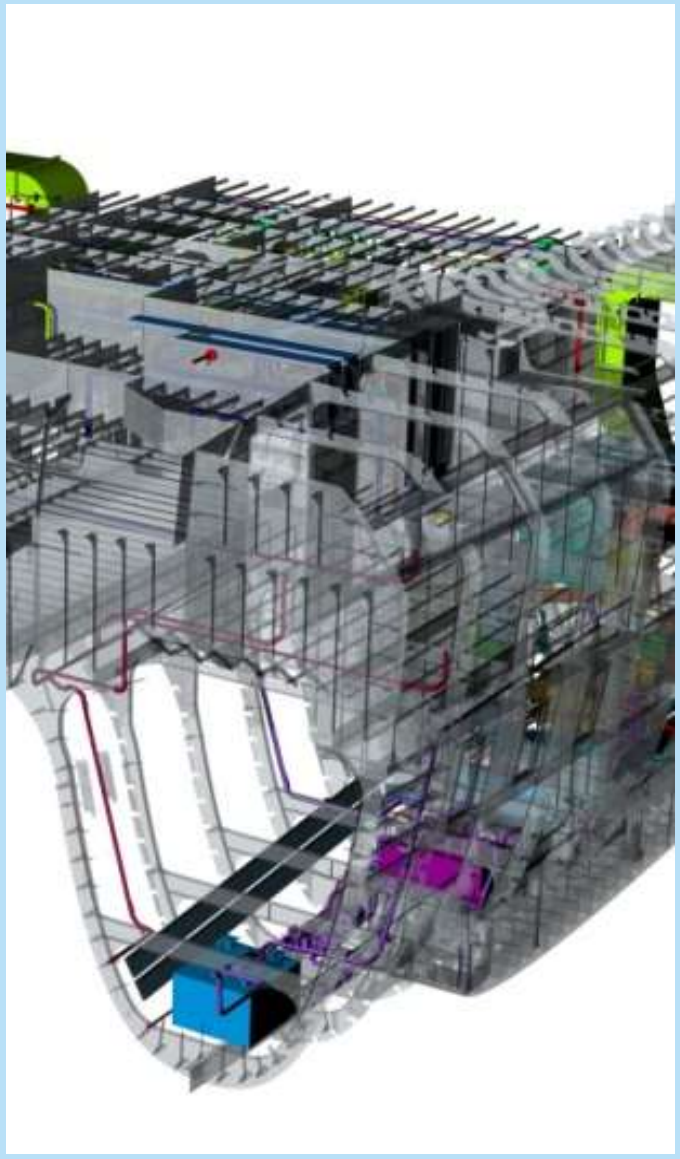
# Hull Types

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# 99 (.9)% Are Monohulls

A few limited exceptions

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# A Short Story…..

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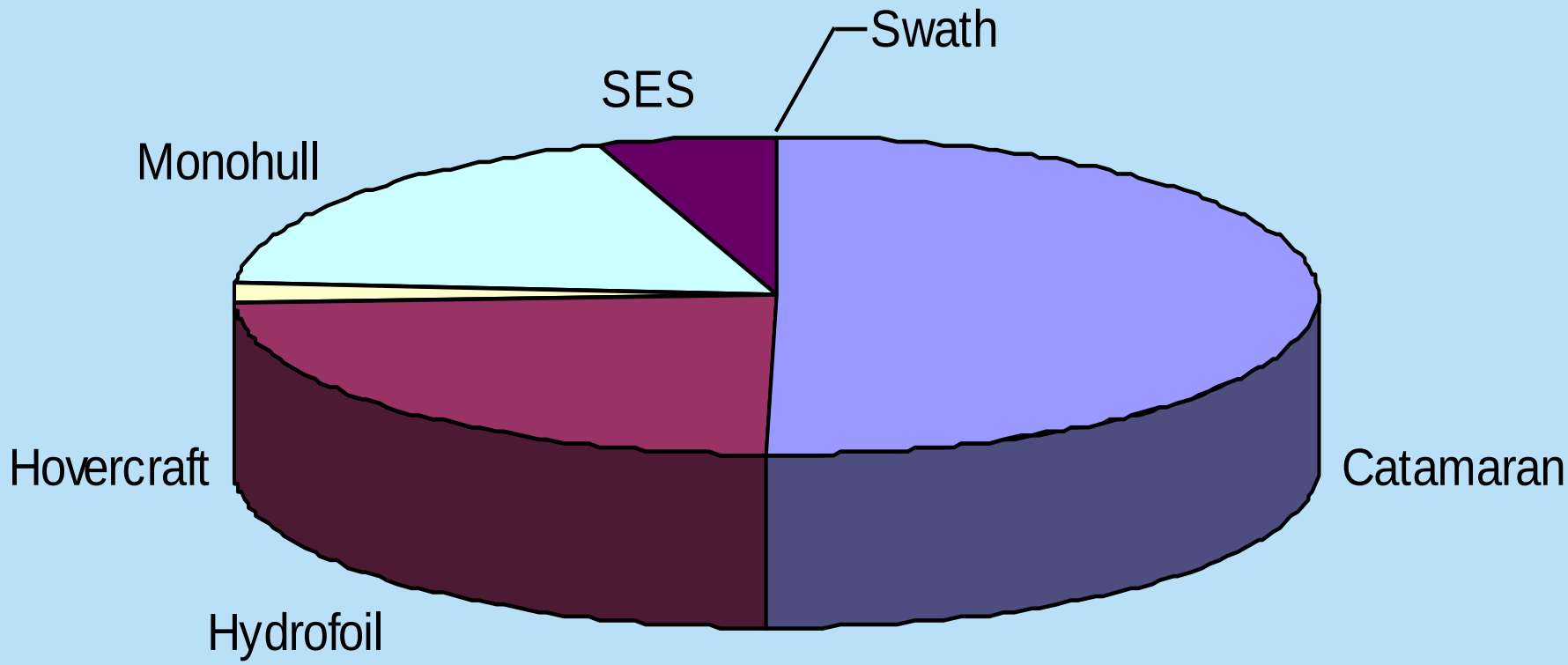
# Fast Ferry Industry – Hullforms In Use




World Fleet = approx 1600 vessels

Vessels with Vs > 25 knots, High Speed Light Craft (HSLC)

Caution - data correct at 2006

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# Hull Types – The Basics



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# The Weird & The Wonderful









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# The Weird & The Wonderful







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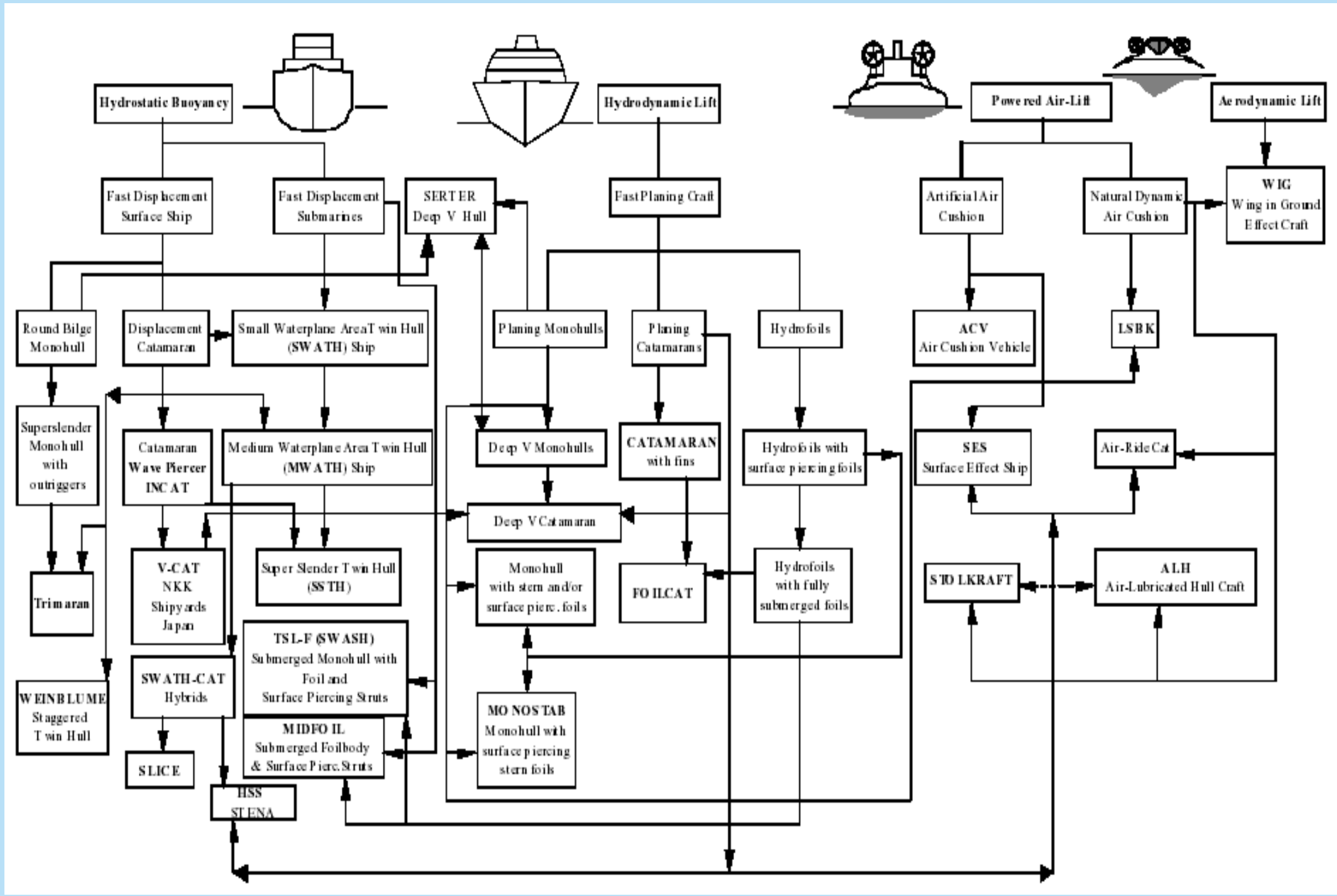
# A Whole Host of Variants

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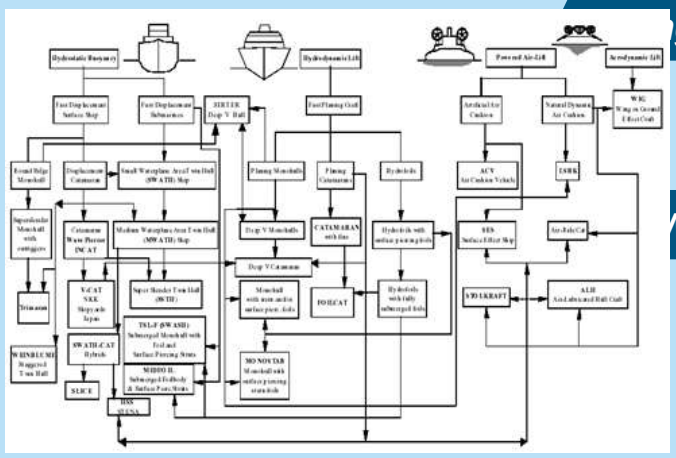
# The Sustention Triangle



Hydrofoil

WIG

Dynamic Lift

g Mono, Cat etc

WAS

Higher Efficiency = Lower Fuel Cost

More Complex = Higher Ownership Cost

?

?

Mono, CAT, Tri

SWATH

Hovercraft

Buoyant Lift

SES

Powered Lift

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# Hydrofoil

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# Hovercraft

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# SWATH

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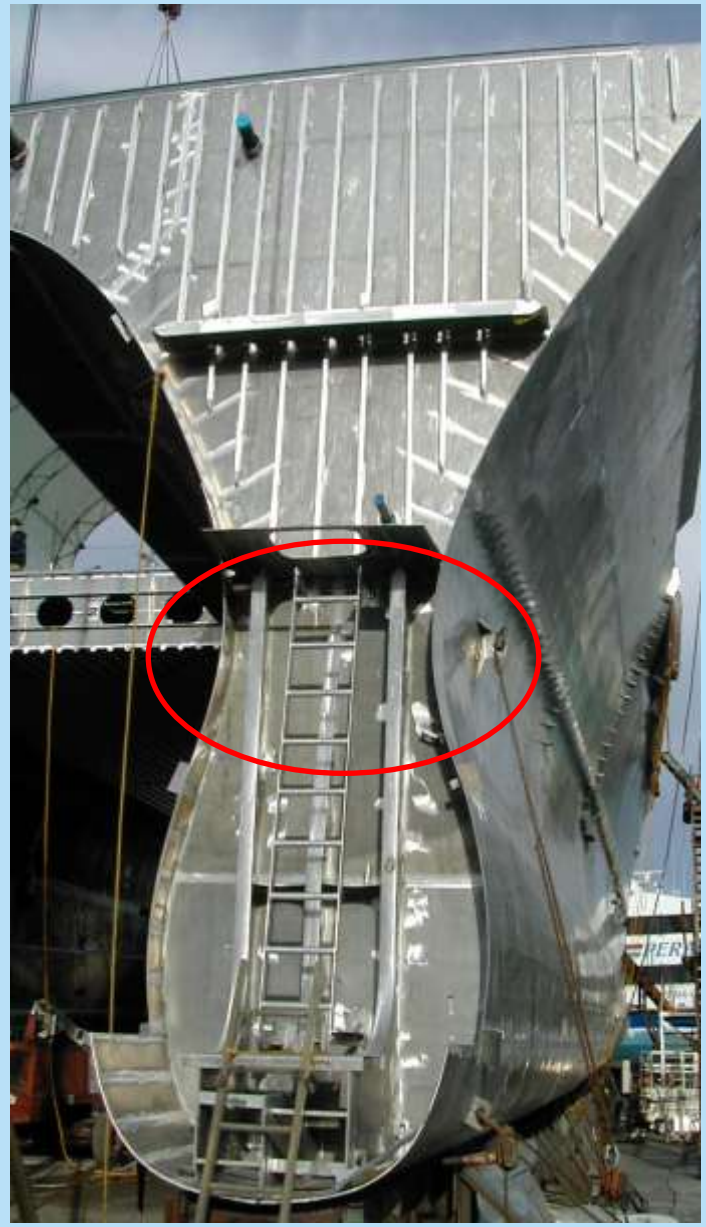
# SWATH

True SWATH

***Small Waterplane Area***

***Very Low Pitch Stiffness***



Semi - SWATH

***Moderate Waterplane Area***

***Low Pitch Stiffness***

True CAT

***Large Waterplane Area***

***High Pitch Stiffness***

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# WIG

## Caspian Sea Monster



| | |
|---|---|
| **Wing Span** | 131 ft (40 m) |
| **Length** | 348 ft (106 m) |
| **Height** | 22 m |
| **Weight** | 495 tonnes - loaded<br>540 tonnes - maximum takeoff |
| **Engine** | 10 (8+2) x VD-7 |
| **Maximum speed** | 500 km/h |
| **Range** | 3000 km |
| **Armament** | None |
| **Crew** | ? |
| **Produced** | 8 (1965-78) |

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# What About Yachts?

- Most superyachts are monohulls
- This is choice is often an **emotive** one but not necessarily the right technical choice to best fulfil the owner's requirements form a purely technical perspective.
- The following needs to be considered when **objectively** selecting the hull form:
  - Speed
  - Overall Displacement - Deadweight
  - Seakeeping Characteristics (i.e. Level of Comfort)
  - Special Requirements
    - Low draft – Access to small ports
    - Low beam – Passage through canals & locks
    - Carriage of Special Equipment – Helicopter, sailing boat, toys etc
    - Special features – large swimming pool, tennis court…

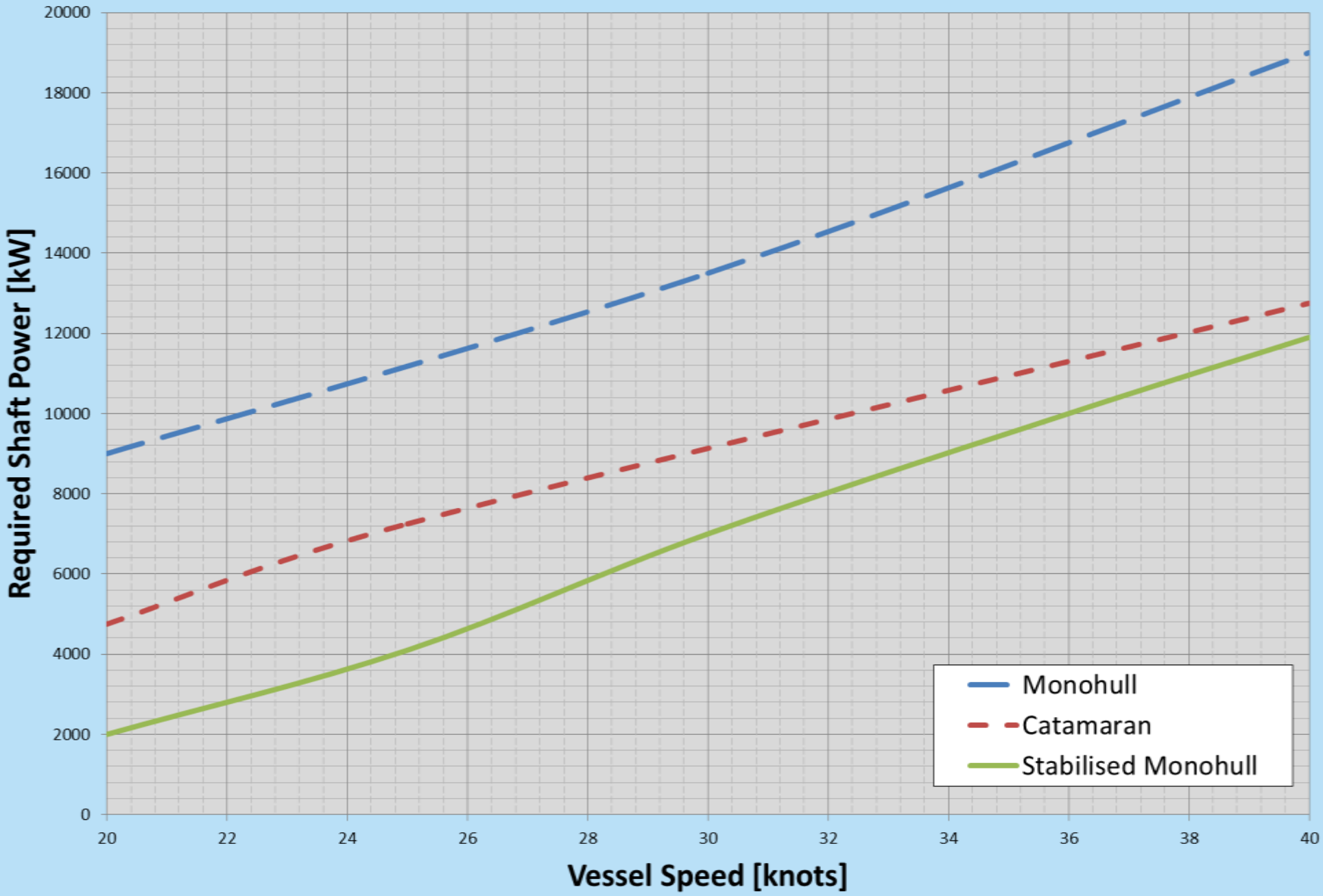
# Case Study Using Objective Criteria

Three high-speed (commercial) vessels have been designed based on a common payload and range.

| | Catamaran | Monohull | Stabilised Monohull |
|---|---|---|---|
| LOA [m] | 72.00 | 96.20 | 105.00 |
| LWL [m] | 64.05 | 84.30 | 95.40 |
| BOA [m] | 18.00 | 14.60 | 20.20 |
| T [m] | 2.66 | 2.140 | 2.50 |
| Lightship [t] | 553.00 | 613.50 | 596.30 |
| Fuel Load [t] | 42.00 | 61.80 | 36.00 |
| Payload [t] | 151.30 | 151.30 | 151.30 |
| Displacement [t] | 745.3 | 826.60 | 1083.60 |
| Shaft Power (36 knots) [MW] | 12.90 | 19.34 | 10.90 |

Note how the vessel dimensions differs. This illustrates one step of the optimisation process.

# Case Study – Speed and Power

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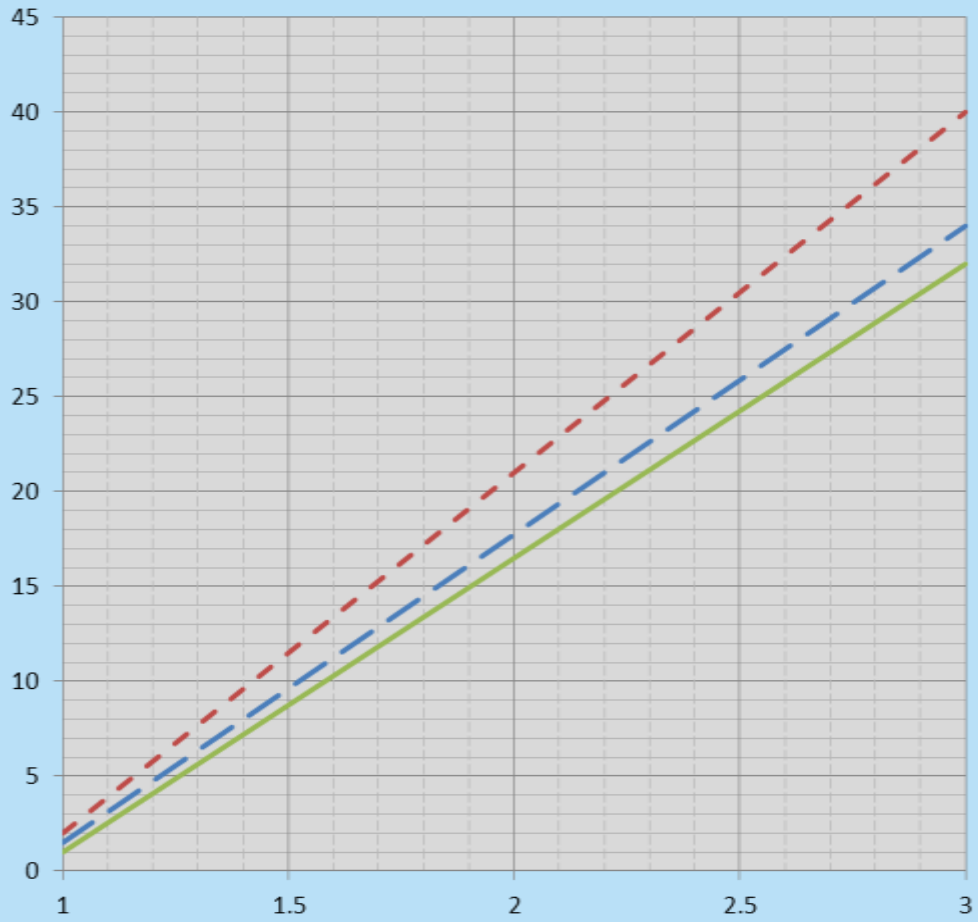
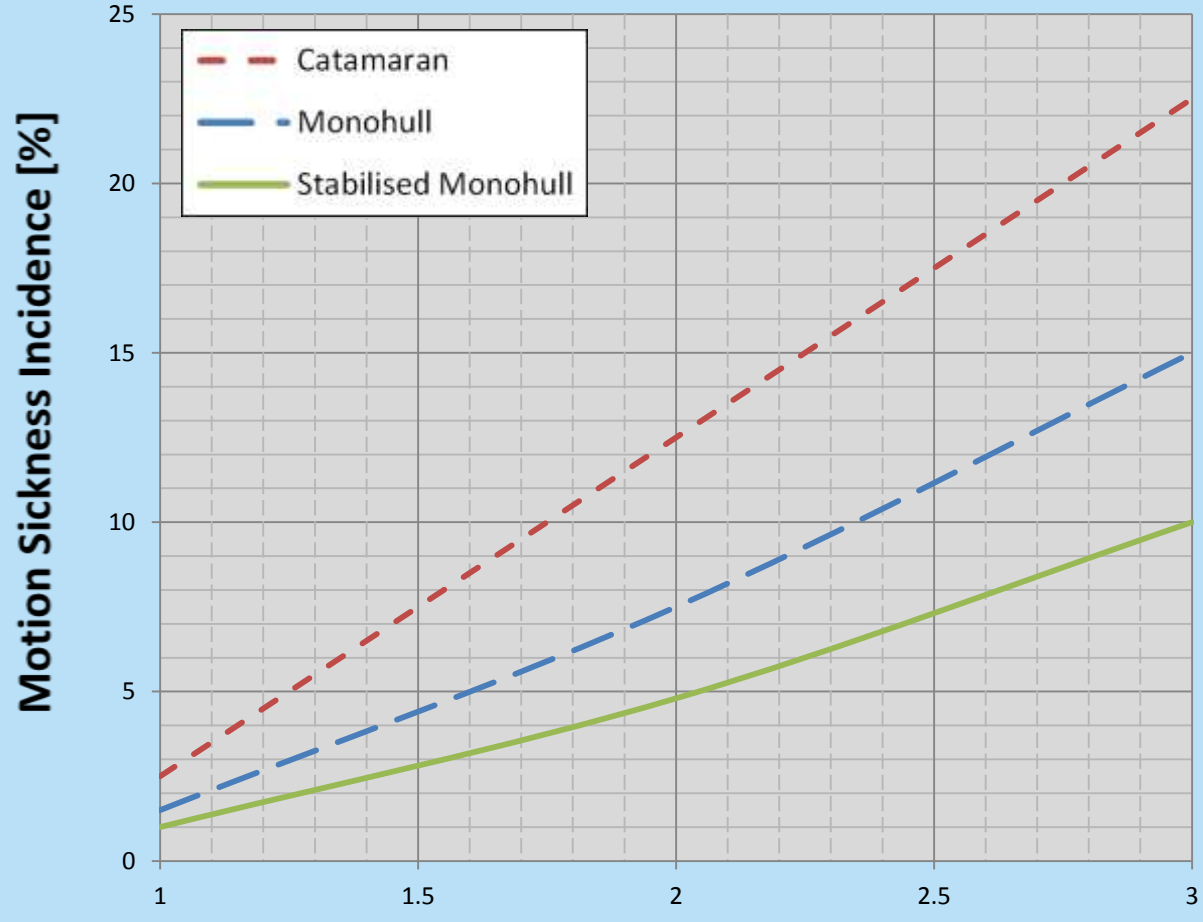
# Case Study – Seakeeping

The Motion Sickness Incidence (MSI) - a comparison tool




Bow Quartering




Significant Wave Height [m]

Beam Seas

The MSI has been calculated for a typical route crossing of two hours in Sea State 3, 4, and 5.

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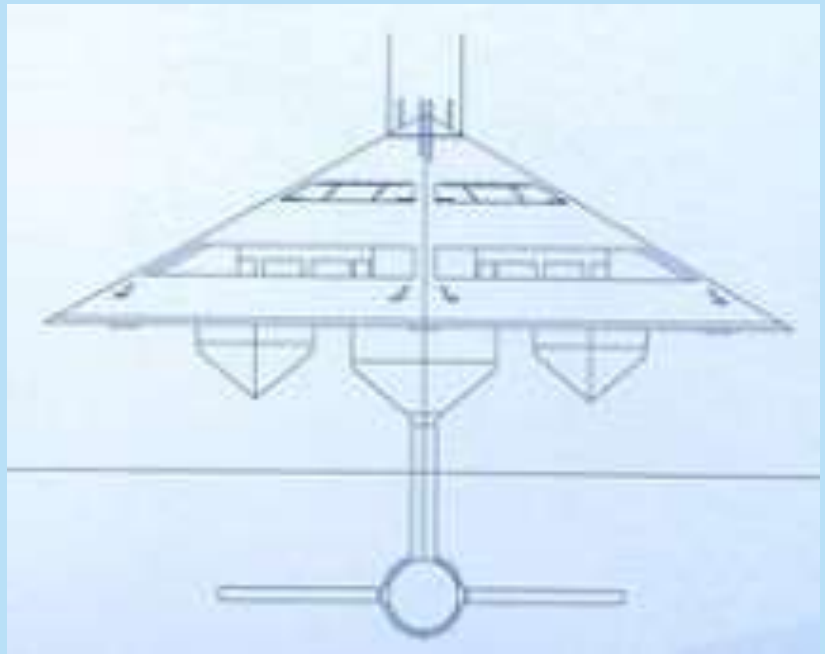
# Case Study - Discussion

- Criteria was common payload and range.
- In this case the stabilised monohull was best.
- It was also the largest, but may not have been the best economic case.
- Such a basis of comparison would not work with a yacht.
- Payload is effectively zero.
- Perhaps a common GT (volume) would be better basis for comparison?
- It is in most cases nearly impossible to make such objective studies with yachts.
- In most cases style and visual appearance are the primary criteria, few owners are concerned about hull type optimisation to objective functions.
- Monohulls probably offer the most flexible platform for yachts.

# Flights of fancy…….


- Hydrofoil Small Waterplane Area Ship (HYSWAS)
- 70ft x 70ft x 70ft. Draught 7m / 3m.
- 40 knots.

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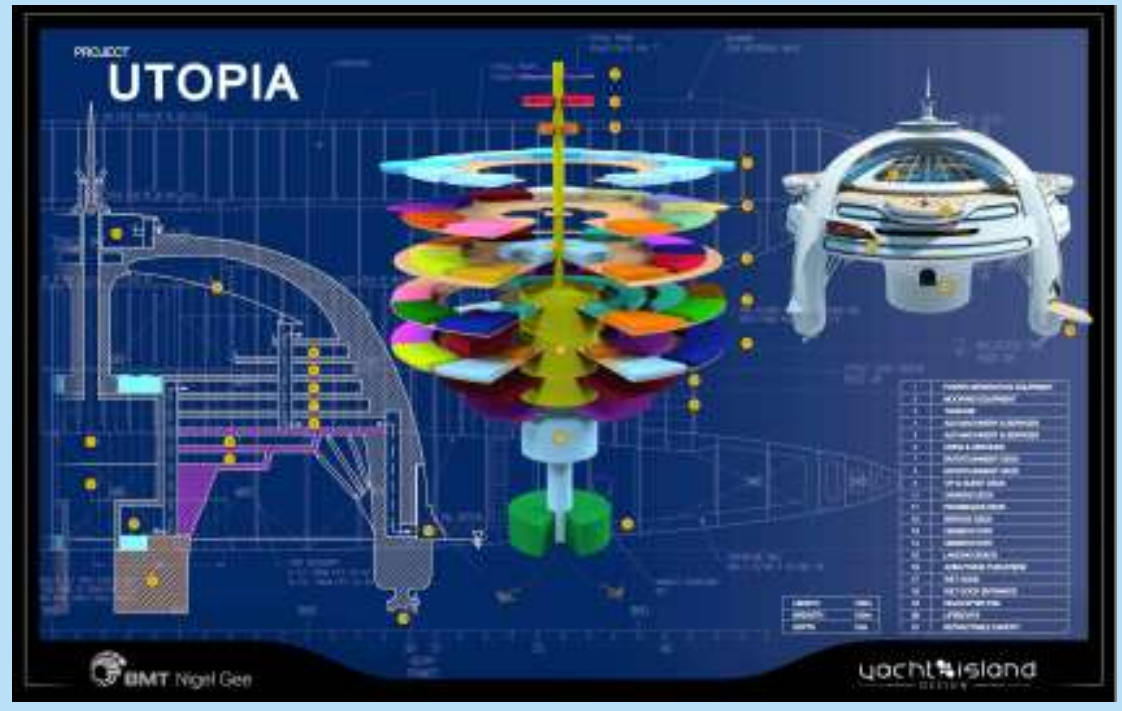
# Flights of fancy…….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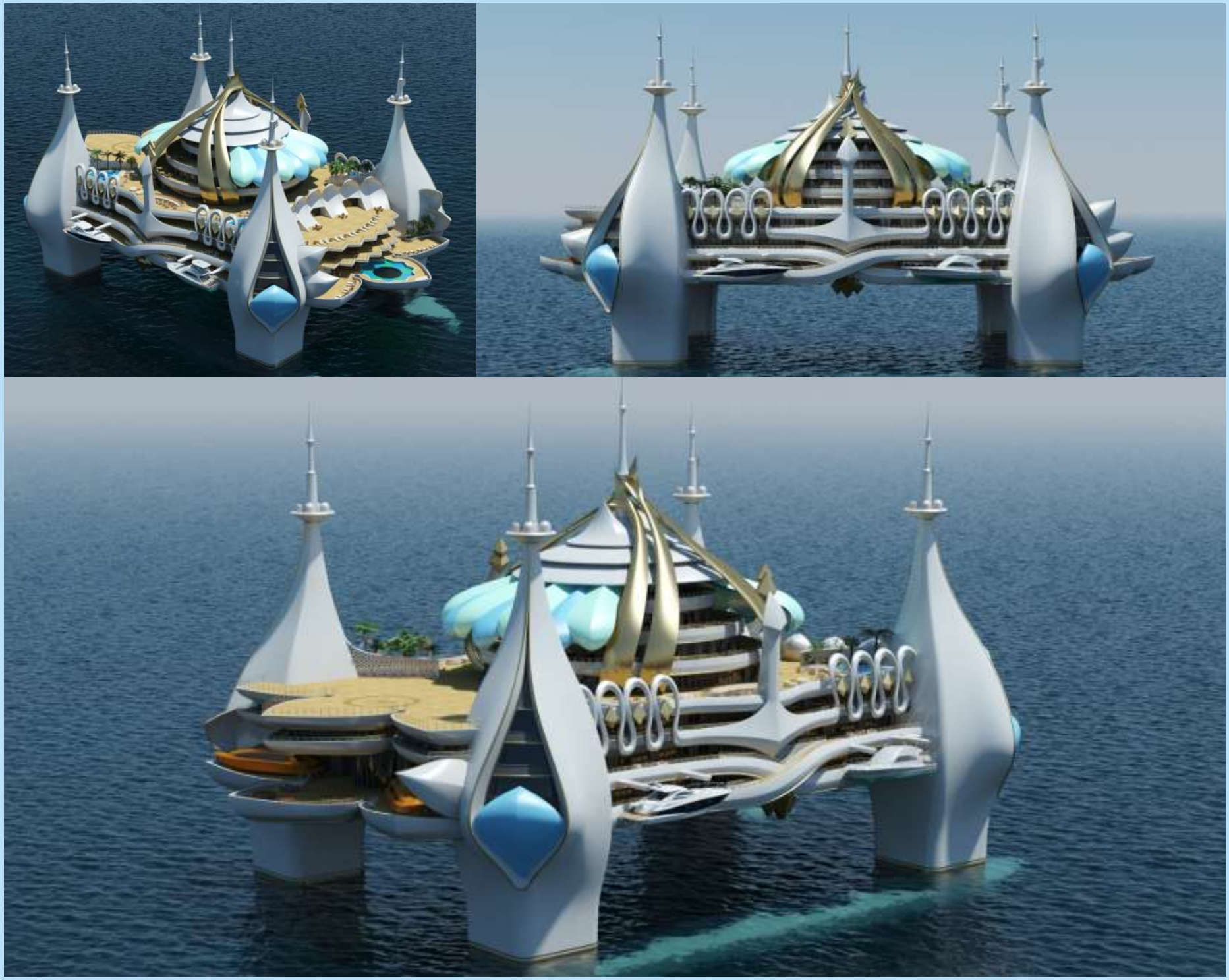
# Flights of fancy…….

BMT Nigel Gee

# Flights of fancy…….

BMT Nigel Gee

# Flights of fancy…….



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# Flights of fancy…….







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# Flights of fancy…….








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# This is nothing new!

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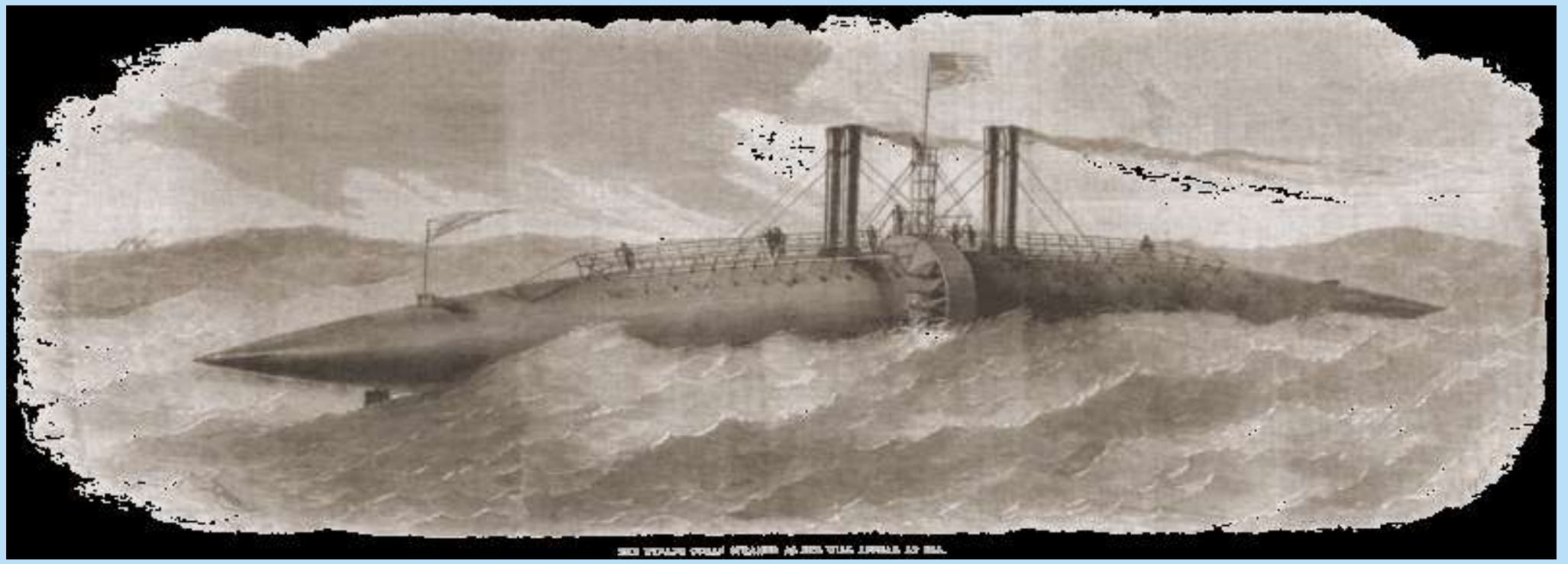
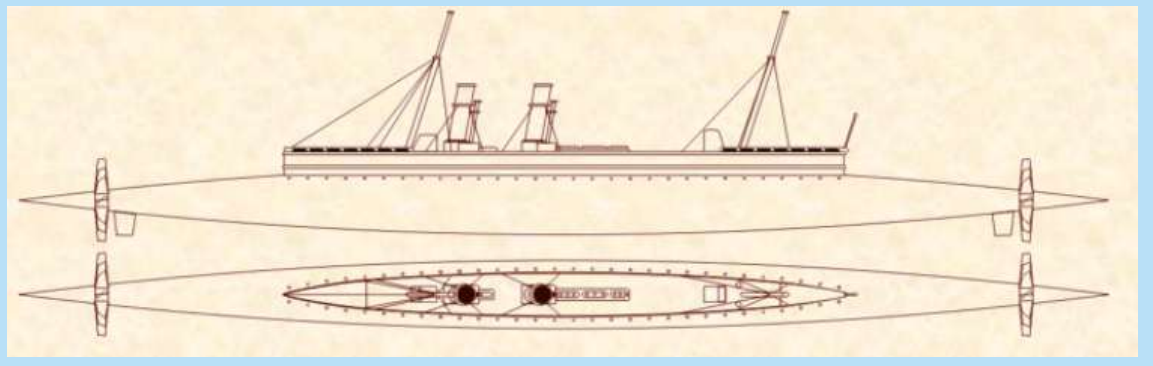
# Lessons from History





- Winan brothers cigar ship.
- 4 ships built.
- 1858 – 1866.
- 70ft – 256ft.
- Including 1 yacht.
- Innovative midship shrouded propeller (amongst other new and unproven concepts).
- All ships a failure but many innovations were taken up in latter designs.

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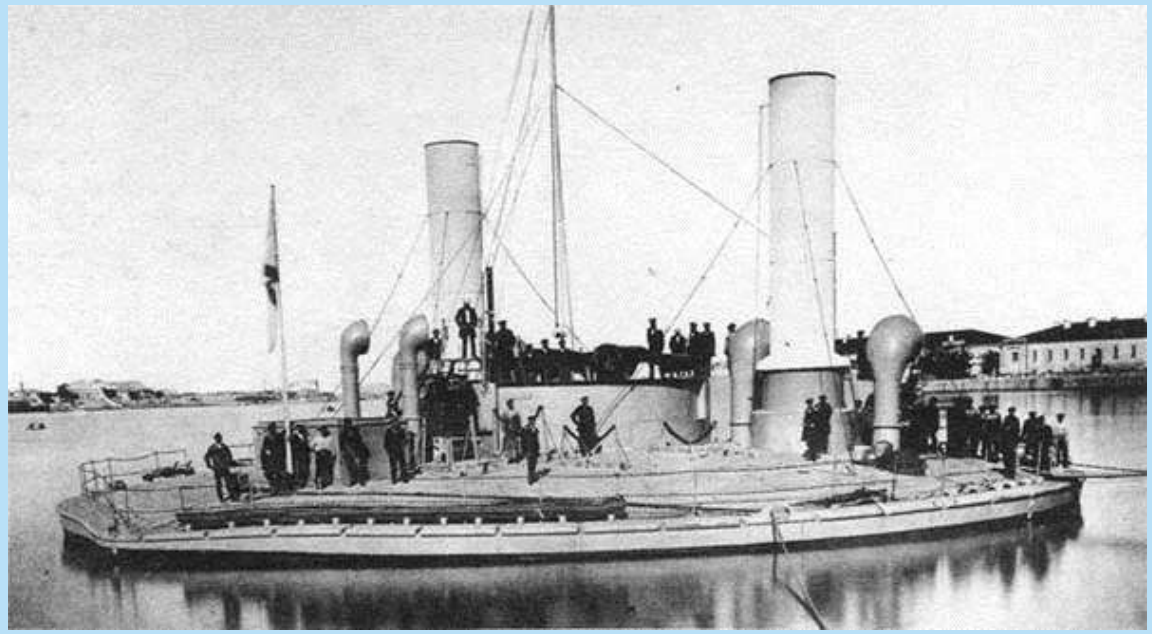
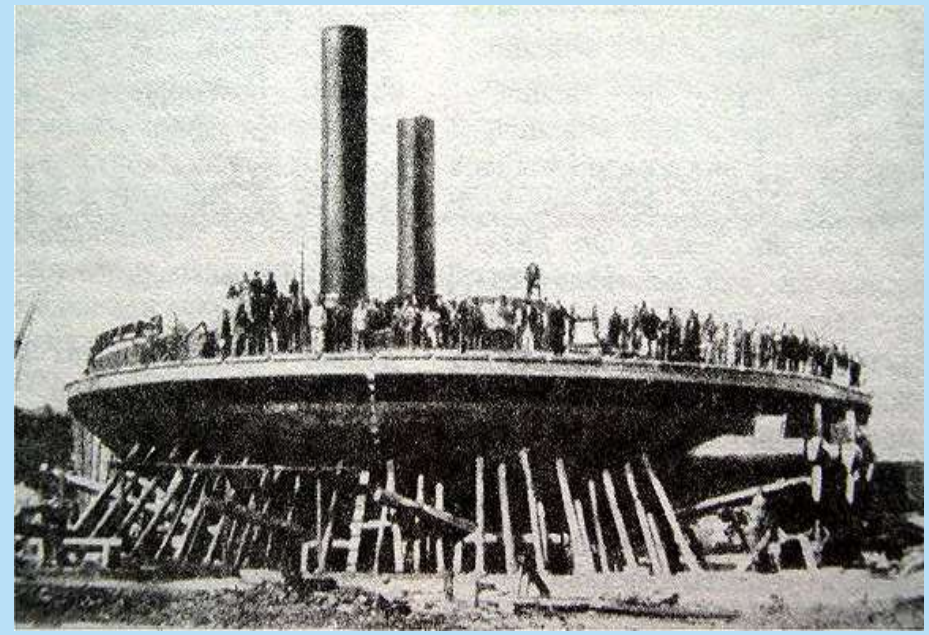
# Lessons from History





- Circular Russian iornclad Novgorod 1873.
- Theory was that a round ship would be very stable.
- Very low draft therefore ideal for coastal defence.
- Steered by 6 propellers but large over steer.
- Almost un-manoeuvrable in practice.

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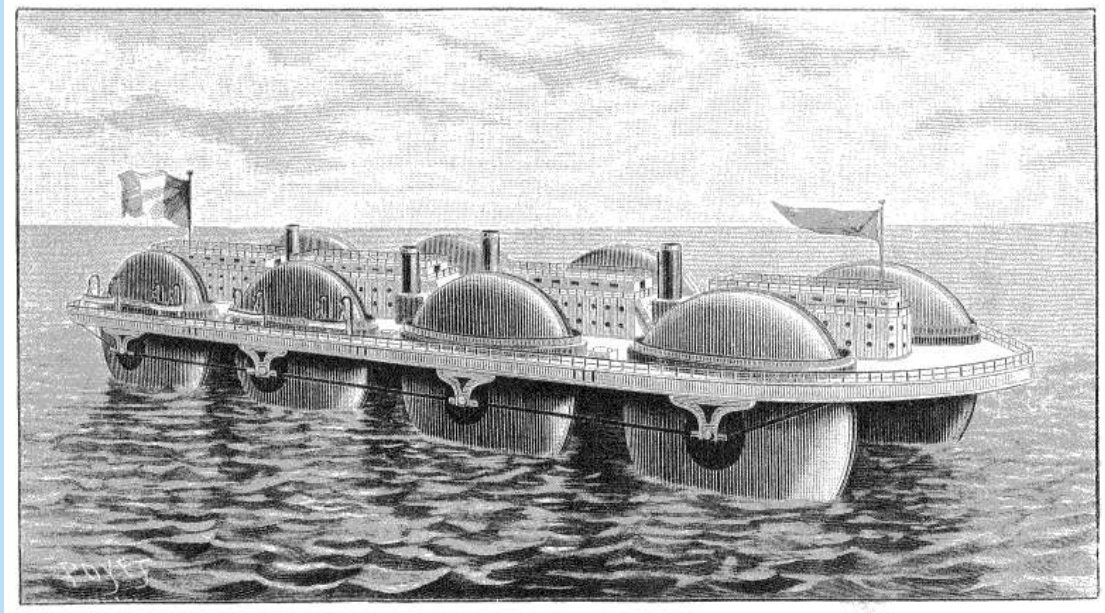
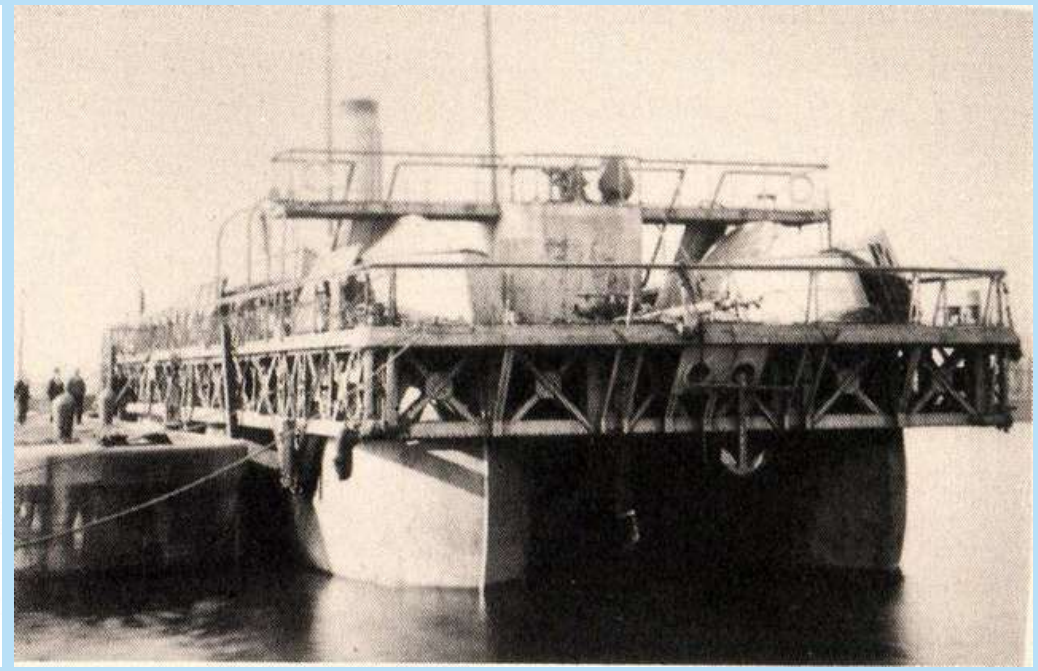
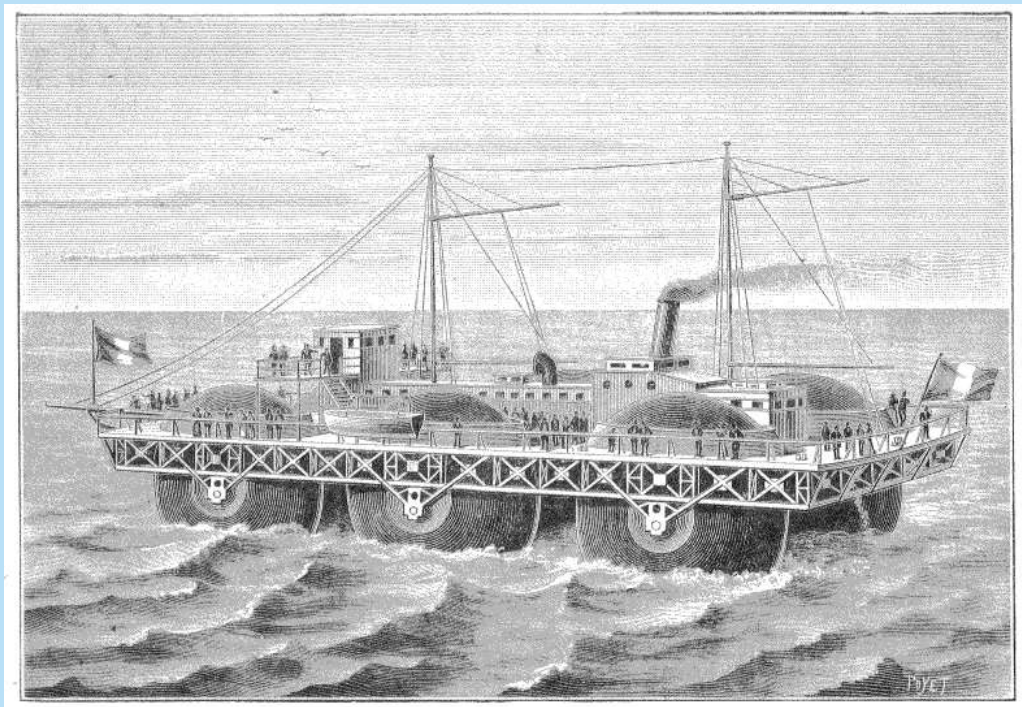
# Lessons from History



Bateau à roue de M. Bazin, représenté d'après un modèle en petit.



- Roller ship 1896.
- 33ft hollow wheels/rollers.
- Reduced apparent flow speed = lower friction.
- Several built.
- None successful.



Vue d'ensemble du bateau rouleur terminé.

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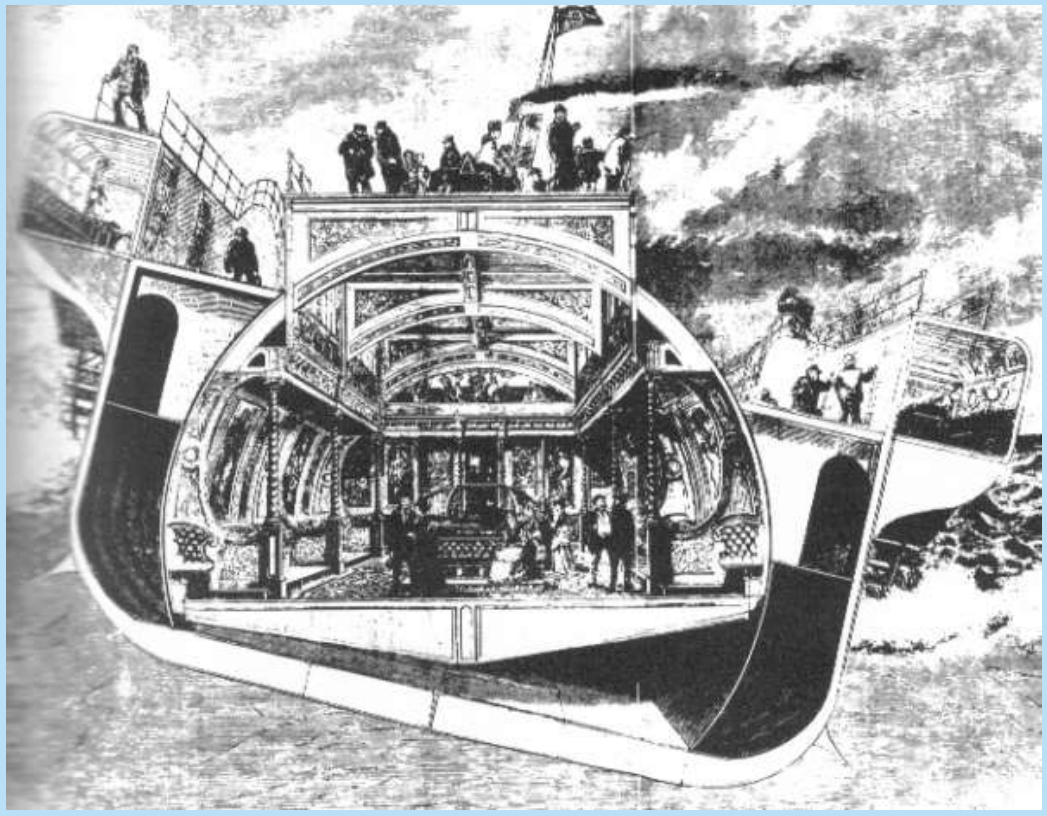

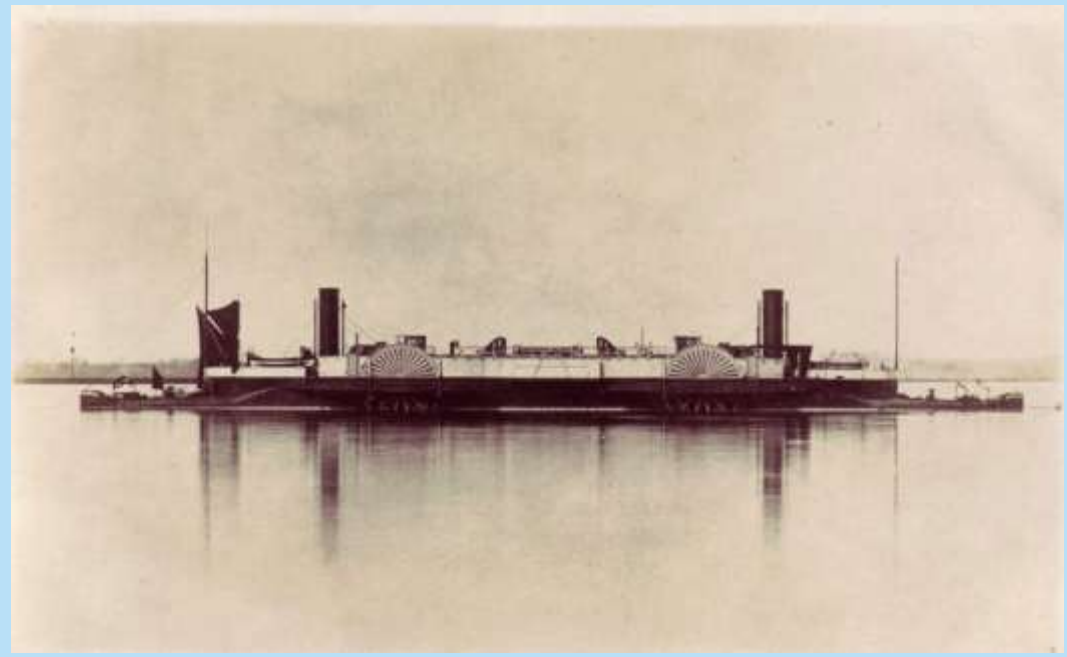

- Bessemer 350 ft with a swinging/gimballed saloon.
- Launched 1874.
- “Swinging saloon” was intended to prevent sea sickness.
- Complex hydraulics never worked.
- Not successful.

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# Lessons from History


- **Jointed Iron Ship Connector**

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“Creativity is the residue of wasted time”

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# Questions

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