

CL ELLIPSE

ELLIPTICAL SOLID CARBON RIGGING

MADE IN SWITZERLAND
SINCE 2000

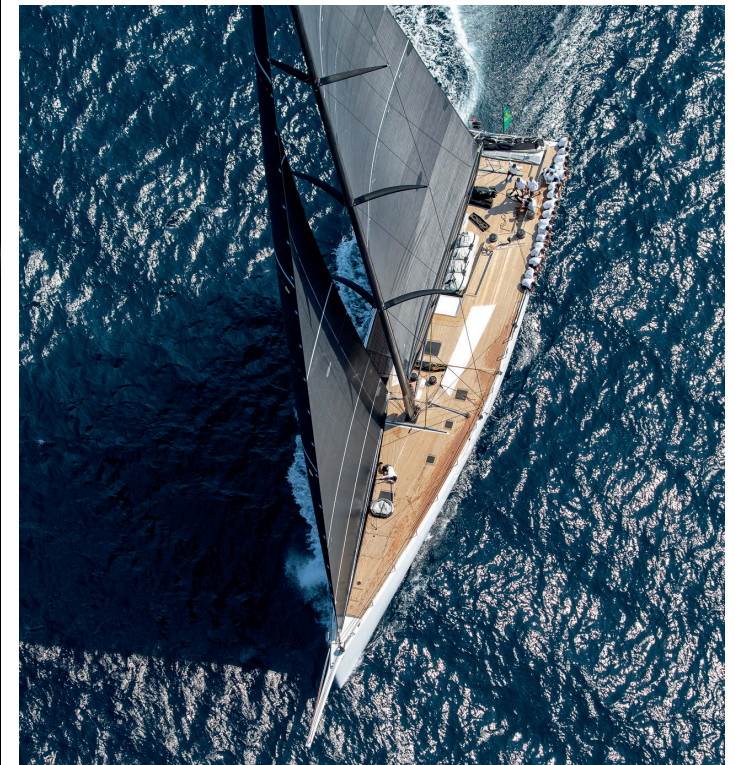
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- 01 CL ELLIPSE PROJECTS
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- 04 NEXT STEPS



01a
CL ELLIPSE
PROJECTS



PRB [2008]



ALINGHI V [2010]



AC72's [2012]



VESPER [EX-MOMO] [2015]



CANNONBALL [2016]



PROTEUS [2018]

01b
CL ELLIPSE
PROJECTS



GALATEIA [2019]



RAMBLER 88 [2019]



CANOVA [2019]



SCORPIONE OF LONDON [2019]



VISIONE [2020]



BOTIN 56 [2020]

02 KEY VARIABLES

#1 SIGNIFICANT DRAG REDUCTION

- Small curvature around the maximum thickness results in a more distributed pressure peak and therefore more efficient flow separation

#2 PROVEN RELIABILITY

- Elliptical cables in action since 2003 inshore & offshore [60ft to 40m+]
- Structural production process exactly the same as CL SOLID rigging

#3 SUPERIOR DURABILITY

- Unique toughened resin system as with all Carbo-Link CL SOLID rigging
- High resistance to chafe and impact on leading & trailing edges

#4 OPTIMISED ELLIPSE RATIO

- Able to mould rigging into any ellipse ratio, plus variations in angle along length
- Real life applications & modelling suggests optimum aspect ratio of 2:1 or less

#5 SIMPLE INSPECTION & SERVICE

- Rigging health monitored with simple visual inspections and NDT if necessary
- No need to send rigging anywhere at anytime for inspection or service

#6 REDUCED LIKELIHOOD OF VIBRATION

- Ellipse cross-section results in improved flow attachment and less turbulence
- These flow regimes do not excite rigging at its natural frequency
- Proven to be highly affective under sail, at anchor and when moored



03 ELLIPSE ASPECT RATIO



OPTIMUM PERFORMANCE BALANCE WITH ASPECT RATIO [2.0:1] OR SMALLER

#1 ROBUSTNESS & RELIABILITY

- Rounded leading and trailing edges
- Therefore reducing exposed edges to chafe, impact damage and point loading
- Consolidation of CL SOLID rigging ensures shape is fixed. Aspect ratio and shape will not change over time
- CL SOLID rigging meets your exact stiffness demands, meaning all fibres distribute load evenly at all times

#2 REDUCED FLUTTER (VIBRATION)

- Flutter = lift induced torsional vibration
- Elongated aspect ratios [2.5:1 or more] reduce torsional stiffness
- Therefore increased lift can cause deformation, resulting in earlier flow separation
- This creates a 'loaded-spring' in the cable, resulting in aggressive fluttering and vibration

#3 BALANCE OF WIND ANGLES

- Performance gain is not all about drag – it is vital to consider side force (negative lift or leeward lift)
- Ellipse aspect ratio is determined primarily as a function of wind speed and wind angle
- Combined with the type of sailing and/or racing the yacht engages in
- The longer the ellipse, the greater the side force (negative lift) upwind and increased drag reaching/downwind

04 NEXT STEPS

RAMBLER 88



- Assign designated Project Manager
- Explore specifications & deliverables
- Explore mast & deck interface solutions
- Assess polars, apparent wind speeds & angles to determine most suitable aspect ratio
- Finalise specifications, project deliverables, location & time frame
- Engineer the rigging package
- Send drawings for analysis & approval
- Produce rigging, deliver and finalise
- Dress, step & sea trial
- Ongoing collaboration

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