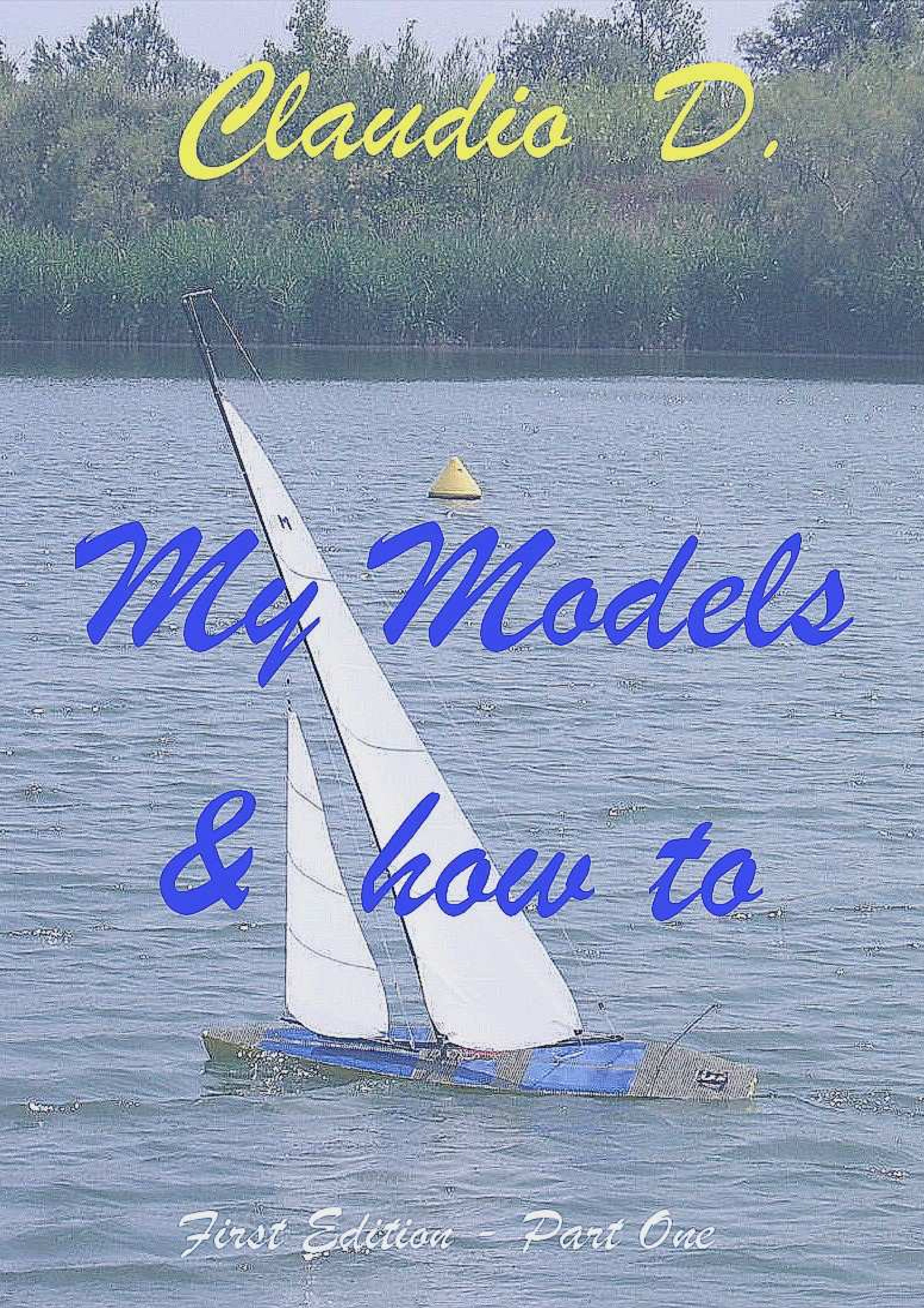

Claudio D.

My Models & how to

First Edition - Part One

Directly published on the Web via Model's Forums

First Edition - December 2019

Preface

At my age, I told myself that was the time to rewind the reel of my life.
I wrote two books, one retracing my life since born and a second one dedicated to my passion of ever the "Sailing Boats"
Fortunately, I met the real Sailing Boats and later the World of Sailing Models.
On my road I met a lot of very kind people, but also many stupid ones,
they will recognize themselves because having met them 'here and there' are not nominated.

This book is dedicated to my RC Sail Model friends:

The first is Pierre Raynaud, my mentor since the beginning, may rest in peace.
and than
Flavio Faloci the Architect from Genova
Dario Aliprandi (Amon) from Milano
Paolo Saccenti (Amon) from Milano
Luigi Ferrario from Portovaltravaglia
Sergio Saba from Trieste
Mauro Folicaldi from Bologna
Gianluca Montecchi from Monza
Raffaele Galardini from Pisa
'Grakula' from Cecina
Toni Clemente from Napoli
Walter Ottavi from Venezia
Tiziano Bressana from Brescia
Dario Motta from New Zealand
Alan Wymer from New Zealand
Gilles Blais from Canada
Eric Sponberg the Architect from Florida/World
Andrew Stansfield from South Africa
Ivor Bittle from England
Mark Smith from USA
Celtic Spirit from Ireland
Dick Lempke from USA
Twister from UK
Larsli68 from North Europe
Thomas Armstrong from Chili
Astute Composite from UK/Spain
Earl Boebert from USA
Bruno Lacaze from France
Antoine Fleury from France
Pascal Delapierre from France

Special thanks to Andrew that assisted me with my Italo-American English !

I do apologize for the "friend names" missing
ClaudioD

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Introduction

Who am' I?

Claudio is my name while D. is the initial of my Family name.
I’m an old man born in Italy in 1936 before the start of World War II.
My hometown is close to Varese, a city in the North of Italy located between various lakes.
Some years after the end of the War, we spent a day visiting one of the local lakes.
It was the first time when I saw a boat moving through the waters without an engine or paddles.

Later I discovered that the engine was the Sail and the fuel was the Wind!

From that moment my love for Sailing Boats began.
Student up to 17 years, being talented in drawing, I was aiming to become a civilian architect, but the life decided differently.
My father car spare parts commerce went bankrupt and money at home was scarce.
A day, back from school, I saw an advert on the wall that read:

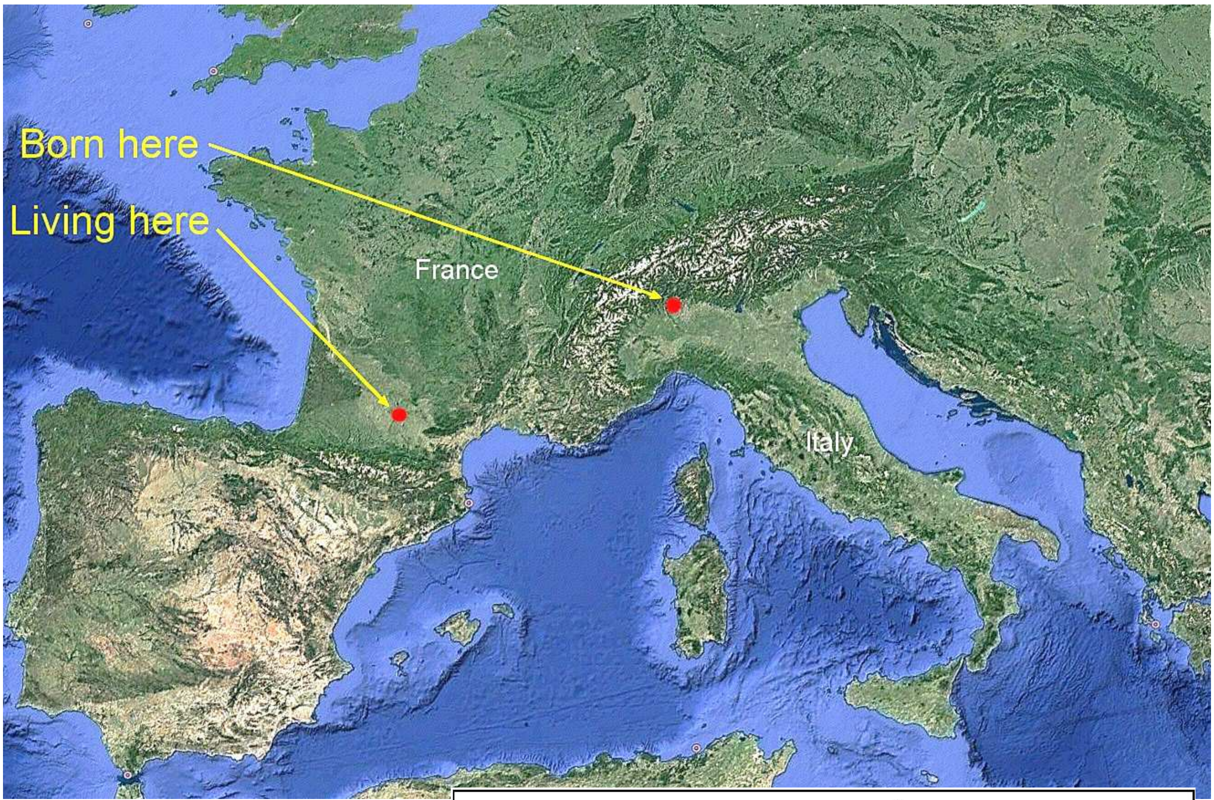
“Join the Air Force, you will start a new career“

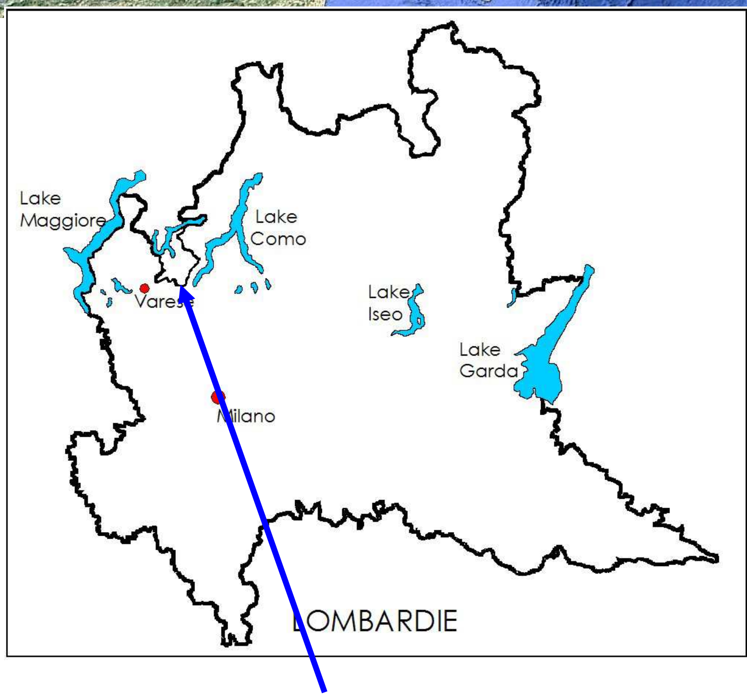
So on that day I decided to join the Air Force.
Became a Radar Specialists, but after 12 years of service I decided to resign from Air Force to join a new adventure with the newly created

“European Space Research Organization”

I spent 33 years in Applied Research, Development and Management tasks for various Satellites Programs.
During these years I traveled around Europe and United States as well in South America during Launch Campaigns.
Salary was good and managed to make sufficient economies to buy Sailing Boats, like a Rival 38 bought as a Kit and finished 5 years

later with the restoration of a Vintage Dragon and Snipe made with Mahogany wood.





Varese and lakes around

Excluding the 60's in Venice, Leisure and Sport sailing went on for about 25 years.

The dreaming image of a Dragon on the Lake of Como

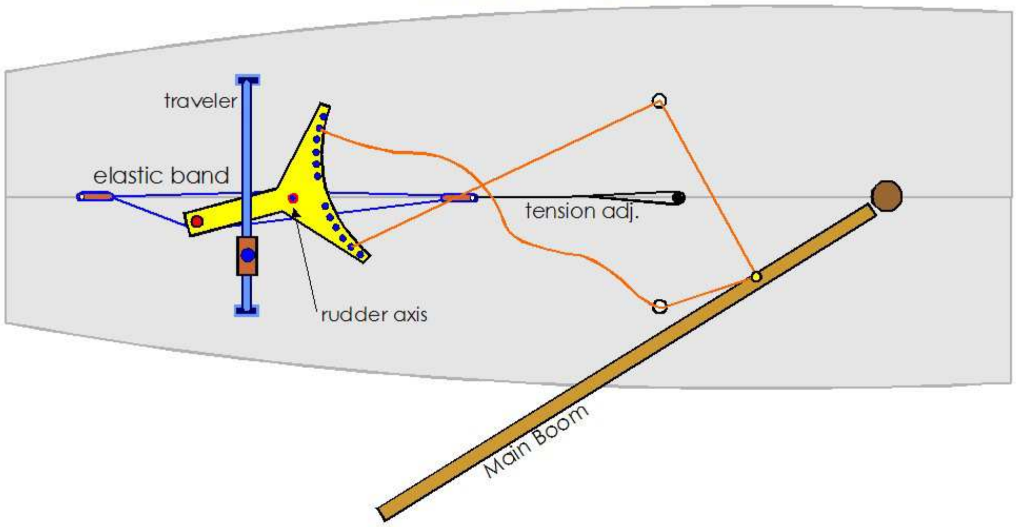
While my brother was waiting his weekly Tex Willer issue, myself I was happy to get my “Sistema A” and “Fare” a sort of popular science magazine.
After building small Gliders and Rubber Band Models all ending into the tree branches, I decided to opt for a more durable model activity.
I knew that a model shop was at half-way from School and father shop and a day I went visiting that Store.
The store was the MO-VO in Santo Spirito Street.
After explaining that I was tired of loosing my Airplane Models,

they proposed to build one of their products a Sailing Model called “Ninfea” a sort of Star of 80cm length and equipped with a Braine Vane.

I was only 12 years old and walking back home; crossing the Town to save the Tramway ticket money to buy the materials needed as well the Models Magazines.

This was my first Sailing Model and rather reluctant to let him free too far and this is why it was attached to a fishing line.

Braine Vane



My first Model in 1948!

71 years ago !

In the 1960's, while in Air Force, I got the opportunity to sail in Venice Laguna with a Snipe.
Another friend was instead sailing with a local centerboard boat called 5.50mt, developed in the North of Adriatic Sea.
Once resigned from Air Force I went living in Holland where the sailing is almost the national sport!
My boss and I we bought an iron chine sailing yacht used only for inland lakes.
During that period it happens to meet many Sailors as well Sailing Ship Yards.
The annual HISWA Exhibition in Amsterdam was the event that I could not miss.
It was in the 1972 when I met people of the Coniplex Factory famous for the Contest Yacht series.
They offer to teach me, during Week Ends, the Glass fiber lamination technique, in turn they asked to reproduce a static model of one of their Yacht production that was the Contest 33 as depicted here in the following pictures.

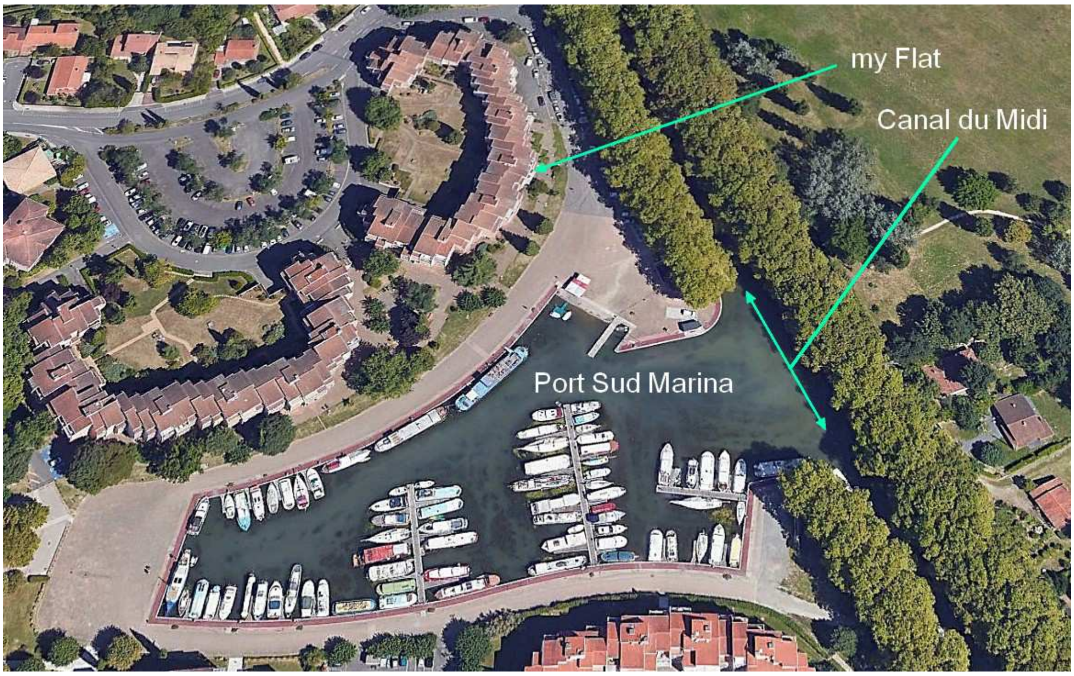
The model was scaled to 1/10 and all interiors were also made including the electrical installation, galley, berths, etc.

At the end two models made one was the Contest 33 and the second was the Contest 29

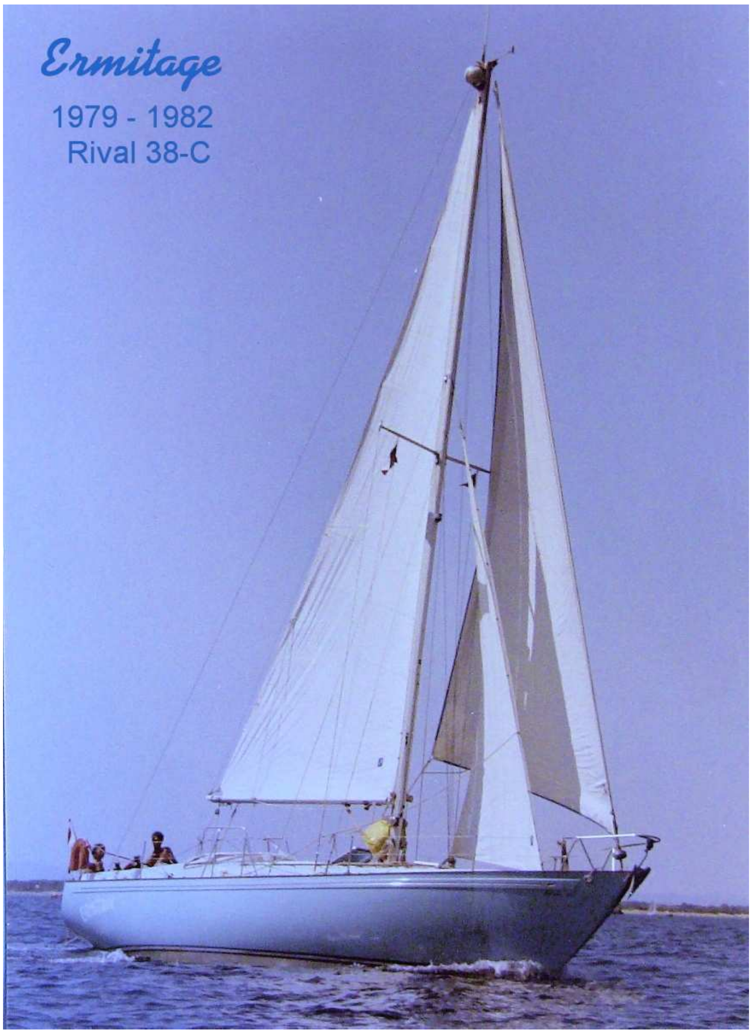
With Werner, my boss, we went sailing for a couple of years in the Holland internal waters, until he decided to buy a Racing Yacht like the Contest 31H.
This boat was too expensive for my budget at that time.
Only in 1978 I managed to order my first boat, the Rival 38C.
It was a sort of Kit where all the interiors where supposed to be built by myself, under those conditions was cheaper then Contest 31H.
Rival Company of Southampton supplied all materials needed.

In 1979, I was transferred to the city of Toulouse in the South of France where I was supposed to join the Satellite Team of Sirio-2.

In that occasion with the help of a couples friends, including Werner, we sailed down the English Channel. One week later we where



mooring in the Port Sud Marina close to Toulouse along the historical Canal du Midi.



This is the Rival 38C. 'C' stay per Cutter Rig. This image was taken in the Mediterranean Sea close to city of Sete.

The Ermitage was sold 5 years later when Françoise, my wife, decided that she could not overcome the issue of sea sickness.
Recent news indicates that the Ermitage is sitting in Barcelona in Spain.

Thinking that Ermitage was going on to a new life, I convinced myself that I could not continue without a sailing boat.
The wonderful souvenirs from Venice pushed me to search for a Snipe.
During a Holiday break in the Como Lake in 1996 I met people that indicated a Nautical Club where I could eventually find a Snipe
Finally, the old vintage Snipe was found and it was really in bad conditions under a pile of automobile tires.

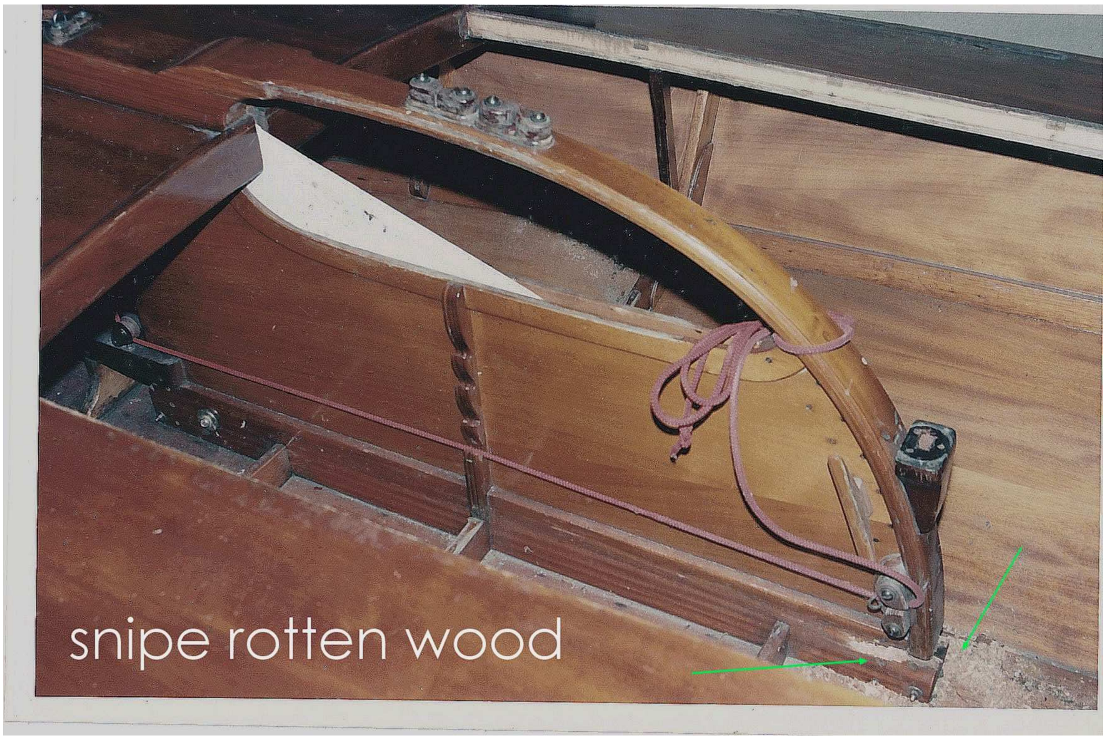
Apparently was standing there since the 70's according to the ship yard. Not discouraged, I went buying a Trailer and soon had the hull in Toulouse.
I was unaware of the adventure to come; I decided anyhow to do whatever was needed.
I began to search Marine wood suppliers.
This was not an easy task so far inland, but eventually succeeded.
A ply-wood factory, near the city of Bordeaux, delivered the sheets needed for the Deck restoration.
The Stern and centerboard case where both rotten through.
The mast was in very poor condition and a new one was needed.
Sectioning the mast has found a peculiar thing.
One of the pieces had very close growth rings and someone informed me that this was probably a Heart Pine from Siberia.

I build up a flat base to assembly a new mast.

After 900km drive, the Snipe called “TIVAN” arrived home

TIVAN is the name of one of the two dominant Winds on the Como Lake, the one blowing from North in the morning and the other is the BREVA in the opposite direction in the afternoon.

Some days later the TIVAN look that way and below a couple of months later almost finished!




deck under asssembly


New Centreboard Box

Snipe single handed sailing in the Como Lake in 1998

Below, in August 1997, while sailing in the Colioure waters in the south of France

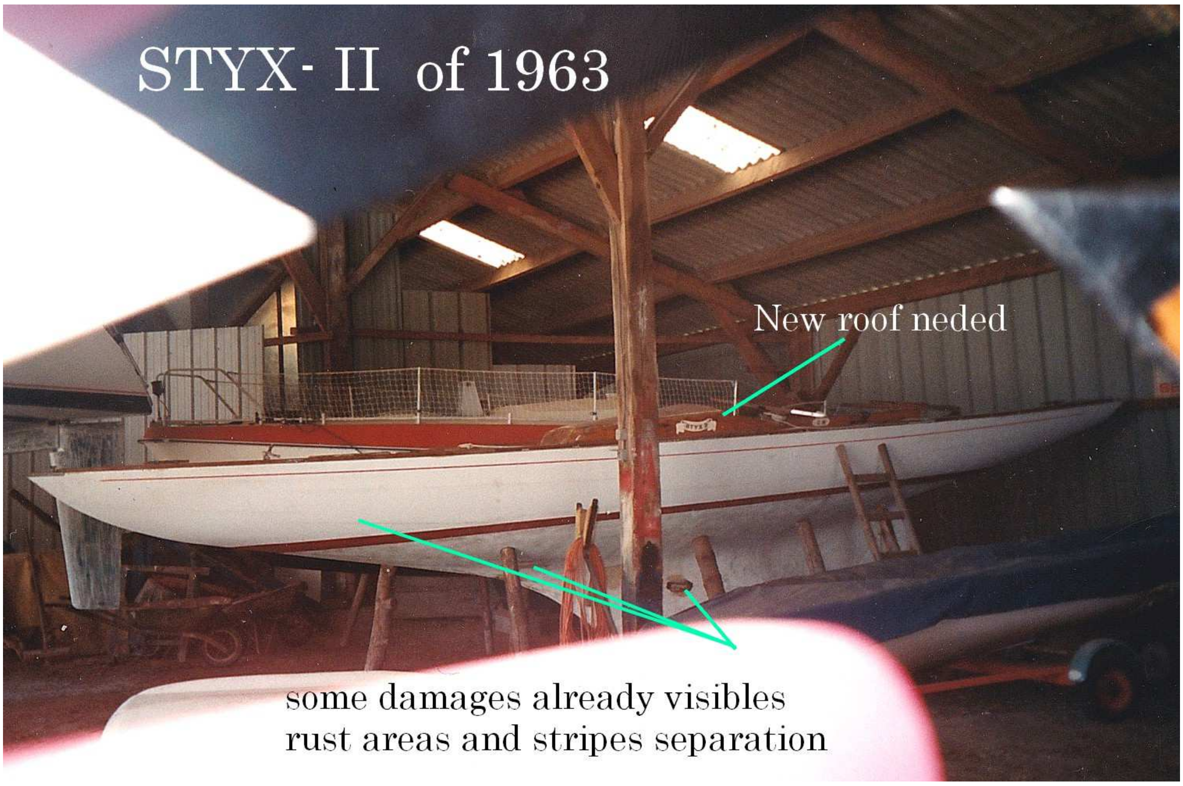
Some time later the Snipe was retired to the garage since a new adventure was a challenging my mind.
I was eventually thinking about the Star, the same boat often seen in the Venice Laguna racing during weekends with the Snipe.
Finally the answer came during a holiday break when I was on the Ré Island close to La Rochelle in France.

I was reading a Sailing Magazine and happened to come across an advert for a mahogany wooden Dragon of 1963 that was for sale in the Brittany Region.

Since it was close, I visited the Yard the following day.

The Dragon was apparently standing there since long under a shelter.
The funny thing was that the owner had put it up for sale because he

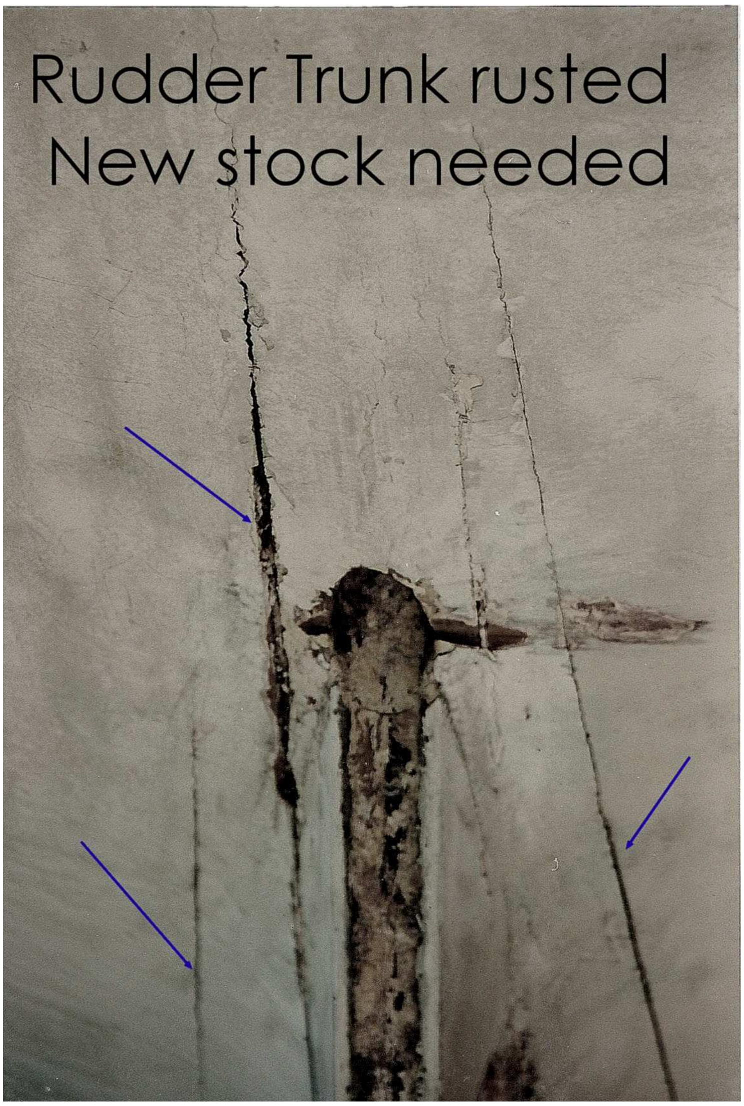
was 65 years old like me, that at the contrary, wanted to start sailing with a Dragon, a mythical Sailing Yacht



The Dragon as visited under the Shelter and below at the arrival at home

Once at home I started with the total removal of the Deck and replaced by Marine Plywood of 8mm.
I managed to build a new Roof and the deck covered with teak stripes of 7x1 cm = 8mm and with Sikaflex for the black joints.

A lot of rotten wood needed replacement



During restoration process with my lovely cat


almost finish
winch still to
be mounted

Here after water tests in Port Sud Marina

The Dragon, alias Styx-II, was finally ready, having take almost 2 years and about 1870 working hours.

Here on the Lecco Lake while waiting for a mooring place in Cannes

Being a wooden boat required a lot of maintenance

Here after antifouling in Cannes Yachting Club in 2001

Out of some 14 or 15 Dragons, the Styx-II was the only wooden hull.
Styx-II was heavier than the fiberglass version.
At races, the best placement was in general the third-last, only once it happens to came second at 30cm from the first.
Why?
Was a windless day and we managed to create our own wind by "rolling" the boat and "pumping" the jib as well the rudder.

With the team on board being about 350kg heavier than others, the inertia did the rest.

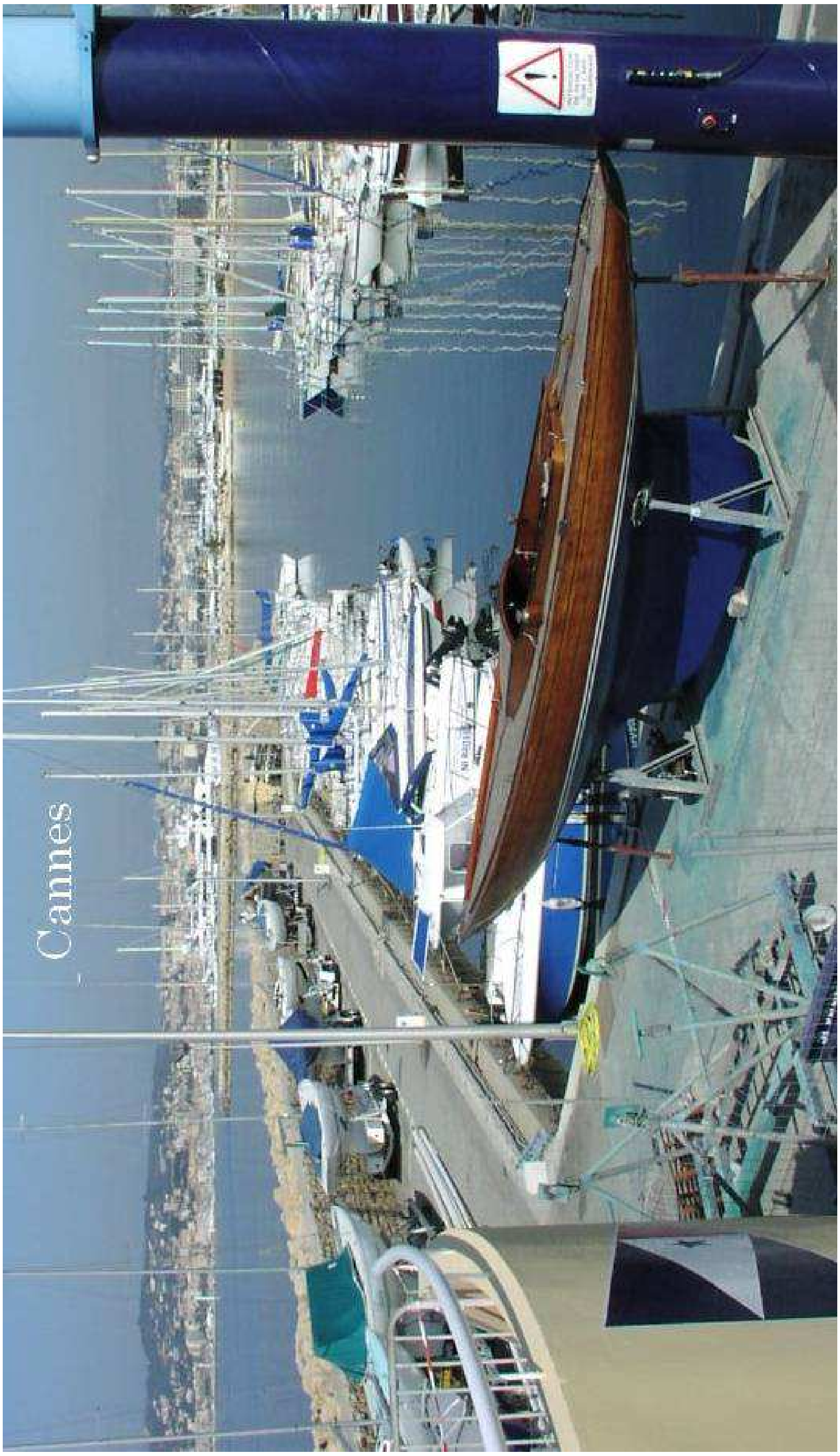
During my stay with the YCC- Yachting Club of Cannes, I participated in about 20 races per year including Christmas.
We were participating just for the pleasure of sailing since we knew that Styx-II was not a competitive boat.

The chance to race lasted for about 4 years when the first asthma crisis appeared at the age of 69.

Doctors never found the causes of the allergies, but I suspect the wood dust accumulated by my lungs during restoration.

A Vintage Boat Amateur offered to buy the Dragon as well the Snipe that I restored some years before.

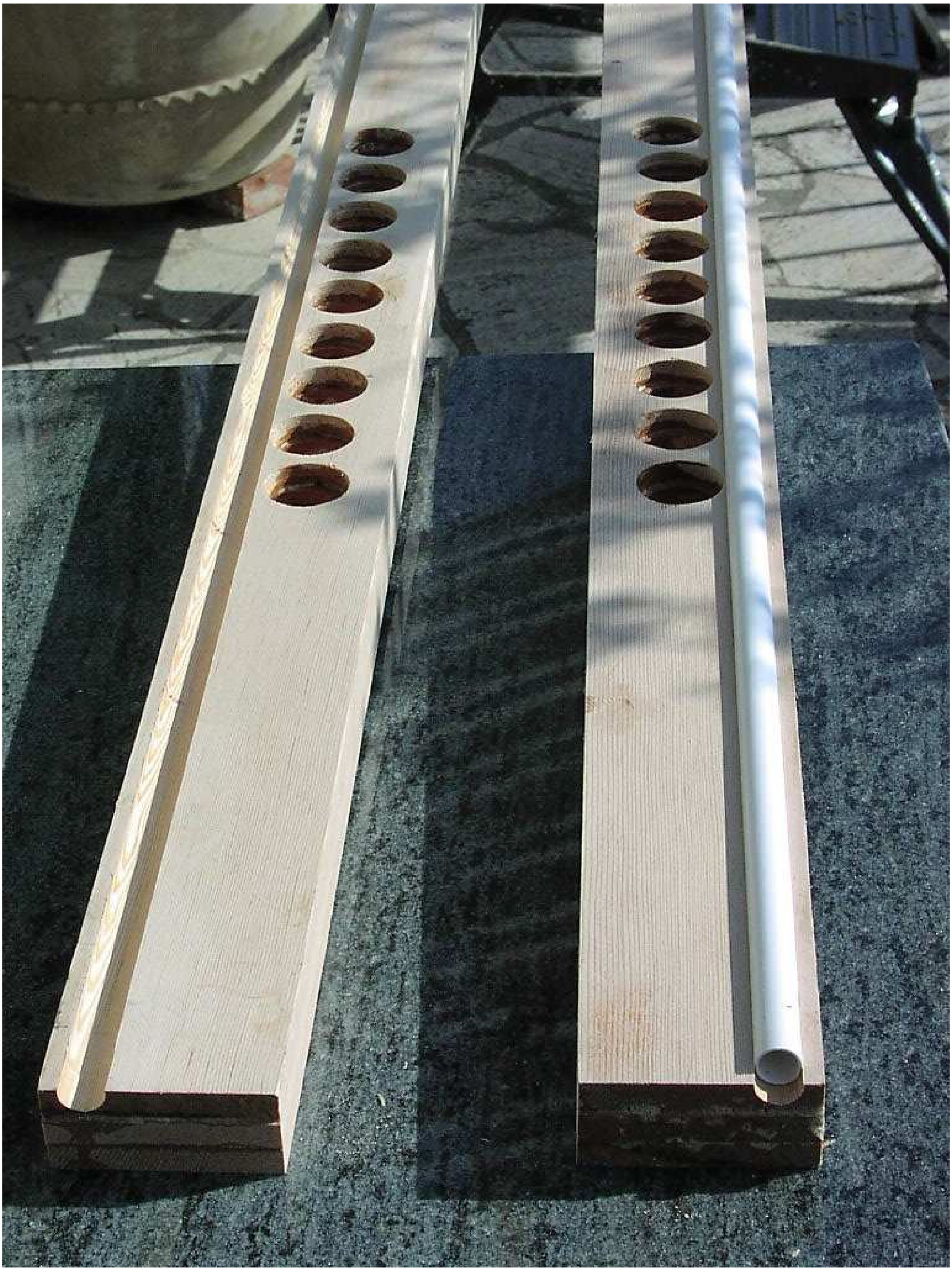
Here during a pleasure sailing in front of Cannes "la Croisette"



In 2003 was necessary to change the Main Boom.
All enquiries aiming to Spruce wood ended up with excessive costs.
So I managed to find some Red Cedar wood cut to the size I wanted.
The Boom consisted in 6 layers according to my design technique.

Finishing the Main Boom

The plastic tube was integrated and bonded to allow a smooth sliding of the Main Sail Luff



Foreword

In previous pages, I did introduce myself where it can be seen that I'm rather enthusiastic about the Sailing World.
Going further, I will trace the path that has led me to discover a new aspect of the same World.

When I was 12 I did not realize how much was complex and fascinating the Science of Sailing.

Was just a newly discovered passion as a child while assembling a Sailing Model Kit.

This book is not supposed to be a Construction Manual, but a collection of several ideas around my understanding of the RC Sailing Model as compared with the Real Boats.
Those persons who are familiar with this hobby will find useful graphs that often are left in the corner.
Certainly, the graphs are representing the results obtained by the architect's research and study but referred to the Full-Size Sailing Boat.

The Data shall thus be used with care since some graphs may not be fully applicable to RC Models, although Models has been often used for theories verifications.

It is not intended to enter the complex discussions about the Hydrodynamics and Aerodynamics, also because of my limitations, but I will try to expose my findings and understanding.

It is nevertheless clear that Full-scale Models and RC Models, while responding to the same physical rules, the scale factors will force the RC Models to behave differently when facing Wind and Waves.

I do consider having acquired, as an amateur, a rather long experience as a skipper with real boats, particularly in Holland where the weather conditions are difficult to control, but RC Models are another story also because I was thinking more as a Designer than being a Skipper!

In 2005 racing with RC Models was not my "Cup of Tea"…
Surprisingly I met an Italian living in France like me, he was Luigi, another RC Sailor with a glorious past in dinghy races.
He pushed me for some months in trying to involve my participation in designing new models.
Luigi brought me to a lake where RC Models where racing.

That day was a Regional Championship for Marblehead Class on the Villepey Pond close to Frejus in the “Cote d’Azur”.

Probably was that image of a Marblehead race that invites me to enter more in-depth in this field left many years before when I was a boy and the Radio Control was not yet in use.
I went to Villepey almost every weekend for a year-long to see RC Sailing and discussed with several skippers.

One, in particular, was Pierre; found later he was a Nautical Engineer.
We became a very good friend, with a lot of empathy when discussing about Model Design
He became my Mentor and his company lasted until 2 years ago when God decided it was time!
After 12 years of a beautiful friendship, he left at 93 with all is brain at the right place.
Most deeply regrets his departure.
Still today I’m thinking about and remember him as one of the best people I met in my life.
He was also one of the Jury when applied for the Guinness Record.

Pierre a brilliant Engineer!

Understanding that sailing was still possible with smaller boats, in 2005 I started learning about Naval Architecture on my own while following various Forums on the same subject.
In the learning cycle appeared also the necessity to study the use of materials and the Radio Controls electronics as well the sail making techniques.

Dragon image during a race somewhere and the Marblehead's racing in Frejus
All proportions considered there is no much difference in the concept!

I have soon understood that all these models were manufactured with composite materials that required my attention again from the time I was learning in Coniplex how to use glass fiber and resin for the static models.

I can not deny that I was entering a new domain since my experience was limited to the Sailor with Full-scale boats except a couple of models made at 12 years old and a static model later in the 70ties

Learning a new matter was anyhow very challenging although the school-time was behind me since several years.

Soon I started comparing the contents of various books when often the same matter was treated differently or being contradictory.

Probably, pretending too much, but Sailing Boat Design is often left to the intuition more than computer analysis.

Too many variables are concerning Sailing Boats in order to accommodate between two fluids, the Air and the Water.

After about a year studying on the books and watching sailing and talking with skippers as well, I came up with various considerations that I needed to take into account when facing a blank sheet.

Time to time a new book is added, how many I do not count them anymore…

The ideal sailing Boat does not exist!

Learn lesson n° 1

Resuming my understanding after book reading so far is that drawing an RC Model is one of the most fascinating things that one Modeler could aim.
This activity can develop the proper creative instinct.
For those wishing to participate in competitions shall obey to Class Rules.
This concept is valid also for other modeling subjects, nevertheless, Boat Models are responding to the physics of Aerodynamics and Hydrodynamics that other hobbies may not need.
Sailing models technique should be, in my opinion, taught at school with young scholars.
Fortunately, an RC Model does not need to respond to criteria used for real boats since no team is required onboard including his weight as well the safety criteria needed for heavy sea conditions.
The Modeler does not need to cope with important Custom Budgets.

The modeler may be induced to follow fashion in particular when a performing Model appears on the racing scene.
The temptation to modify a winning design may produce the opposite result of what searched.
The good results obtained with a Model, cannot be reproduced on a real-scale boat. The contrary is also true without considering also the need to introduce the Scale factors.

The wind is not "bending" to the designer hope and shall accept the Real Wind.
Water conditions are also not scaled down.
Not rare that the Model shall face water conditions (waves) that generally are met under severe meteorological conditions, in other words, the Models is almost sailing under "storming conditions".

It is anticipated that the weather conditions are dictating the type of design to be adopted, certainly an "All Round" Model will better performing under a wide range of Weather Conditions although not pretending to be a winner all the time.

This is my first list of things I need to consider:

1. The Sailing Models are not real-scale boats although responding to the same physical elements: Air and Water.
Books are most referring to real-scale Boats and care shall be taken when using formulas or diagrams.
2. A scale model is facing elements that are not scaled down like Wind and Water.
3. Before starting a new design, I should ask myself where the Model is supposed to navigate, Inshore Pond, Open Sea, Windy areas, etc.
These same questions are also raised when it is intended to buy a Full-scale sailing boat.
Sailing in the Venice Laguna water is not the same as to sail in the English Channel or in the Open Ocean, see some examples below.
4. Leisure sailing Models do not require sophisticated design as the one used for Competition.
5. Analysis of the Local Met is the first thing to check, here an available Service I use often :
https://www.windfinder.com/windstatistics/toulouse_blagnac (France)
From the annual Statistic Map of Toulouse, an inland city in France, two Wind directions are predominant: the West-North-West direction and the South-east direction. The average Wind speed is around 8kt from June to December.
Similarly, in Genoa a Mediterranean city:
https://www.windfinder.com/windstatistics/genova (Italy)
It can be noticed two predominant wind directions from North-East and South-East. Average Wind speeds 8kt between April and September. Nevertheless, in February the wind speed can be over 20kt for 25% of the time.
The Amsterdam conditions are more severe than in the rest of Europe
https://www.windfinder.com/windstatistics/amsterdam-schiphol
(Holland)
The average Wind speed in Holland is 11kt, but often above 18kt.
https://www.windfinder.com/windstatistics/miami_airport (Florida)

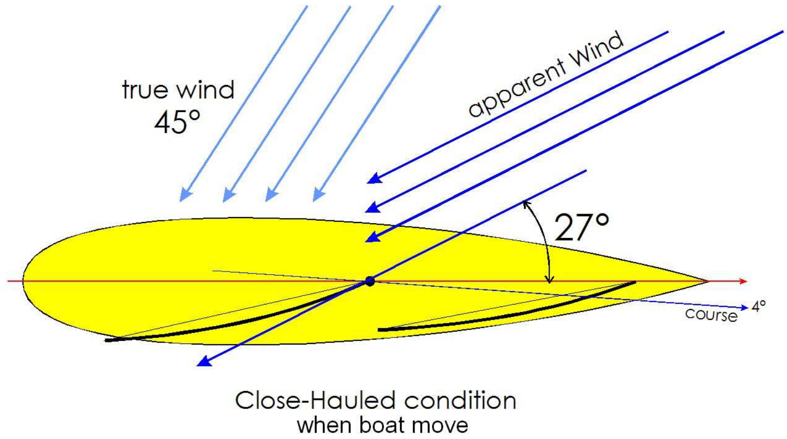
The average Wind Speed conditions in Miami Airport are between 8 and 9kt
https://www.windfinder.com/windstatistics/san_diego_yacht_club (California) where the average Wind speed is between 3 and 5kt and the Max Speed is less than 12kt.
https://www.windfinder.com/windstatistics/southampton_port (England) with average Wind speed is around 5kt
Interesting situation in New Zealand
https://www.windfinder.com/windstatistics/devonport-torpedo-bay where the Wind average is rather low but coming from various directions.

It is not excluded, according to my point of view, that skilled skippers may use more than one RC Model Boat racing being tailored for the Weather Conditions expected.
I do not go any further about the weather forecast because I suppose all amateurs are already aware of the importance of this factor.

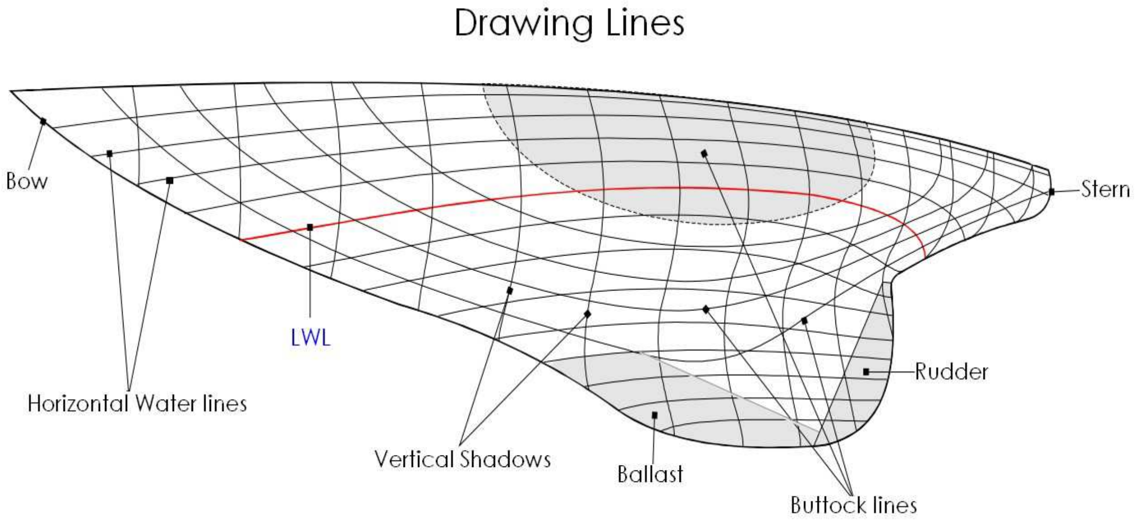
Learn Lesson 2

Why a Sailing Boat is moving without Engine?
Three elements are composing a sailing boat:
The hull
The Sail Plan
The appendices as Fin, Rudder and Bulb
When I was 12 years old the way things were ongoing was a mystery. Growing up my understanding was getting better and better.
Nowadays the matter is a bit different since I'm concerned with the Design and Development of an RC Sailing Model Hull.
The Sailing boat is mowing because the wind is blowing into the sails and not only, is it capable to move up-wind to a certain angle close to 45° for the best models.
The apparent wind is created by the boat movement.

The force developed by the sails is counteracted by the immersed surface of the Hull.



Just taken a nice drawing showing up the various lines composing the Hull.

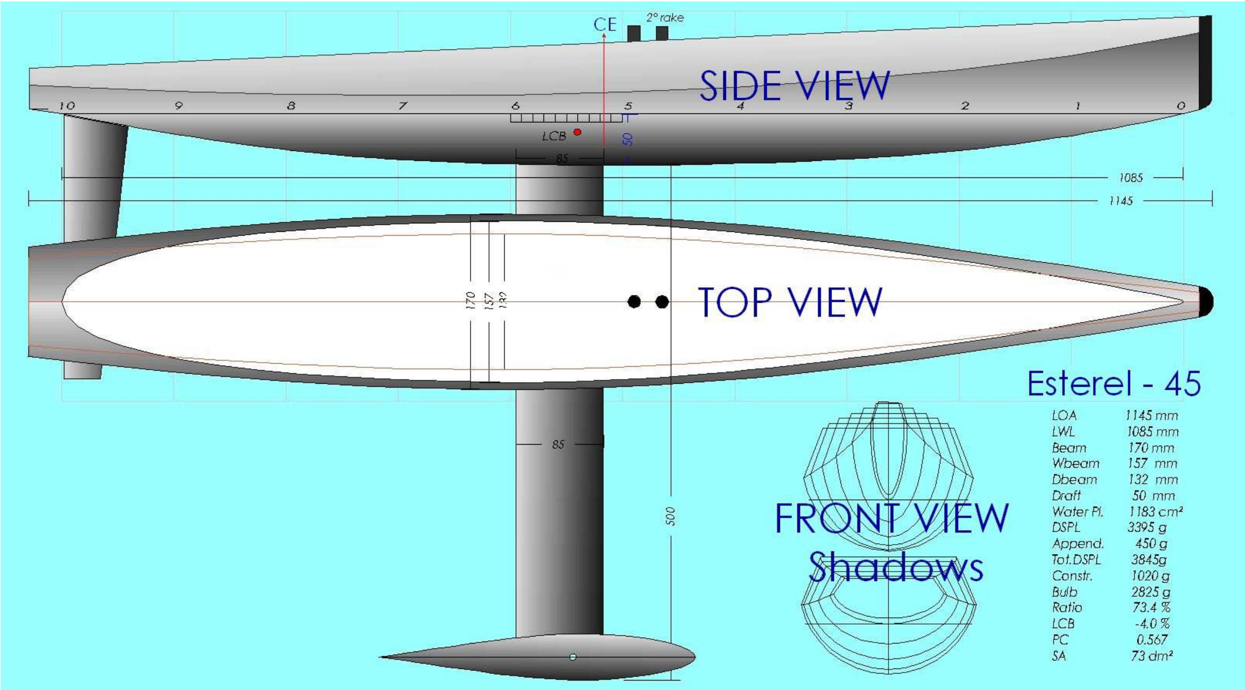


The above drawing is representing a typical long keel hull, this configuration is used often with AC and 12metre Class Sailing Models or when the Model is a "replica" of a vintage like the 15mt Class.

The modern RC Models Class governed by the IRSA https://www.radiosailing.org/ some are depicted here in the above images.

Generally the Hull is identified by 3 drawings Views :

- Top View
- Side View
- Front View - Shadows

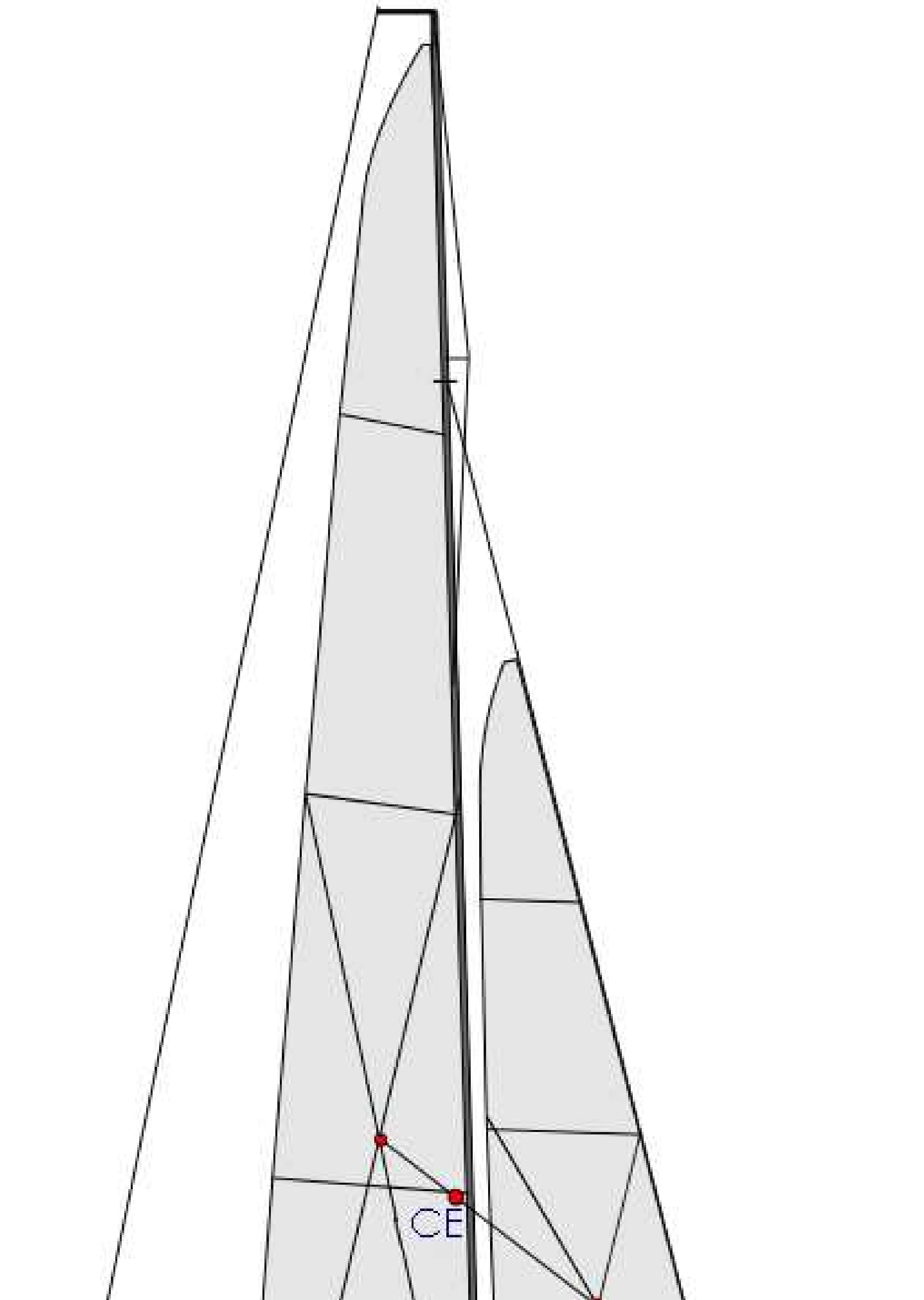


Among the above typical views there other detailed drawings for the Appendix as per Rudder, Fin Blade and Bulb.

To the above Drawing is also added the Sail Plan that will be seen next page

With the Side and Top Views the following parameters are identified :

- LOA - Length Overall
- LWL - Waterline Length
- Deck Beam
- LWL Beam
- Fin Length
- Fin width
- Bulb length
- Rudder shape
- Bow height
- Stern height
- Hull draft



Typical Sail Plan - Class M

Learn Lesson n° 3

From the Books and drawing I discover various "Centers"
all participating statically and dynamically to the boat sailing :

CE	-	Sail's Center of Effort, each sail has one, is the static geometrical center of each sail Dynamically under wind pressure, the CE will move generally forward
LCB	-	Is the Hull Longitudinal Centre of Buoyancy
LCF	-	Is the Hull Centre of Flotation or Water Plan
CG	-	Is the Centre of Gravity of the Boat
CLR	-	Is the Centre of Lateral Resistance that is the center of the immerged surface opposing to the lateral drift when sailing

Among the above Centers other definitions are recorded

DSPL	-	Displacement
SA	-	Sail Area
LOA	-	Length Over All
LWL	-	Length at Water Line
Sheer Line	-	Intersection between Deck and Hull Sides
Draft	-	Deep of the Hull and Fin/Bulb
DEPT	-	Deepest Keel point from LWL
CP	-	Prismatic Coefficient
COA	-	Curve of Area
LWL/BWL	-	Ratio

There is also a long list of “Ratio” that will be taken into consideration during the Design and Development discussion of a Model.

Learn Lesson n° 4

When a boat starts moving in the water it will meet various forms of Resistance.

Interesting to know that the Air density is 1.20 kg/m3 at 20°c and freshwater is 1000kg/m3, therefore, the Water is weighting 833 times the Air.

According to scientific analysis and measurements the following resistances are :

- Friction resistance - 37%
- Wave resistance - 36%
- Pressure resistance - 4%
- Heeling resistance - 6%
- Induced resistance - 7%
- Added resistance - 8%
- Eddy resistance - 2%
- Air resistance - ?

Friction resistance

The water flowing along the edges of the boat seems to move away towards the stern.
A thin film of water of some tenth of a millimeter, invisible to the eye, travels at the same speed of the boat because of its molecular adhesion.
Increasing the distance from the boat skin the water layers will loose more and more speed up to the point that water will become totally insensitive to the passage of the boat.
The set of layers very close to the surface of the boat is called "Boundary Layer".
It is well within this boundary layer that the flowing forces generate the frictional resistance.

The Friction Coeficient is also dependant of the body speed according to the Reynolds number.
On the Web can be found Reynolds number Calculators.
RC models shorter than 2 mt sailing at the Relative speed of 0.5, the water flux could be considered in the theory of laminar type.
The laminar flux is nevertheless dependant from the surface roughness.

Some data:

New Gelcoat	- 0.2µm
Sprayed paint	- 5.0µm
Brush Paint	- 20µm
Rust surface	- 250µm
Dirty hull	- 5000µm

Friction will increase with speed.
I did an experiment called the Coanda effect as found on the Frank Bethwaite "High-Performance Sailing" book.
The idea was to verify the surface roughness effects using various grades of abrasive paper bonded onto a plastic tube of about 60mm of diameter.
The abrasive grade used was of 400 grain up to 2000 grain (~10µm).
A water abrasive paper of 5000grade has a roughness of 5µm.

I also tried the Aluminum roll sheet I found in the kitchen and ended up with a beer glass bottle.

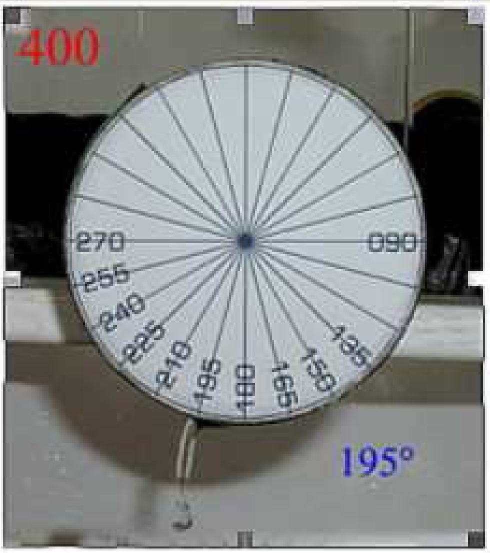
Water tap open to get undisturbed flow.

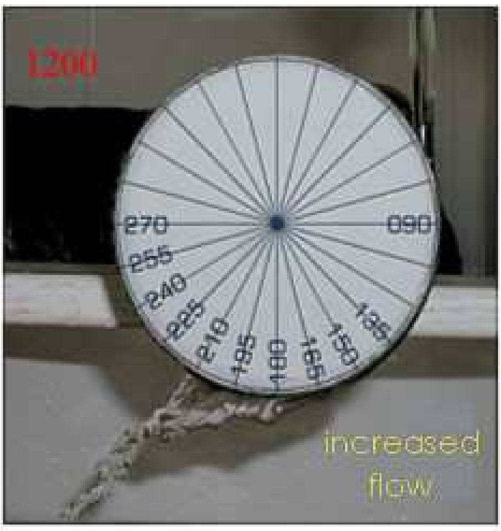
I was very impressed by the results obtained with the Aluminum sheet.

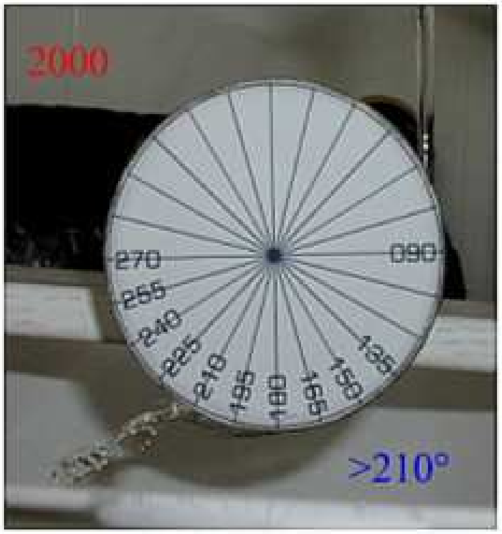
I do not know what could be the roughness of that aluminum film but the experiment shows that the aluminum sheet and glass bottle presented similar results and the best overall.

Here the image of that experiment where it can be noted that the water flux remained attached to the aluminum surface up to 230° of rotation as well with the glass bottle.

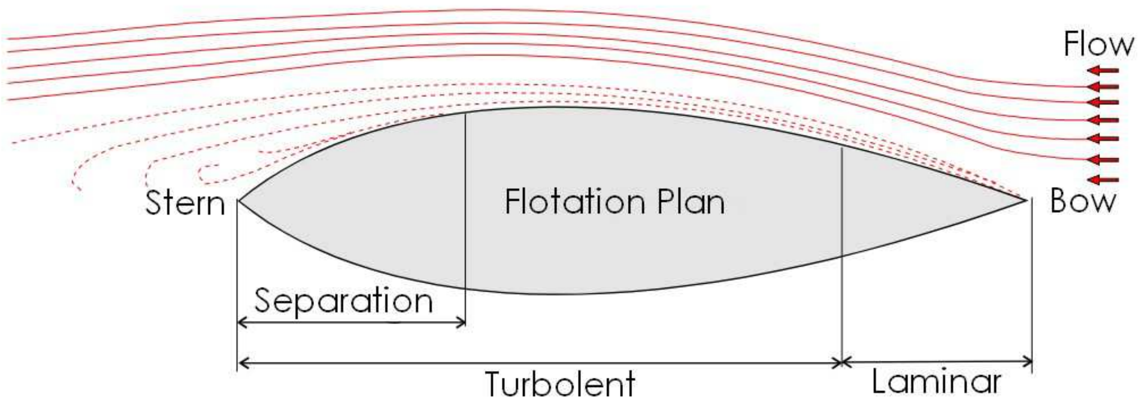
RC Model hulls should be close to a mirror-like surface for best performances.







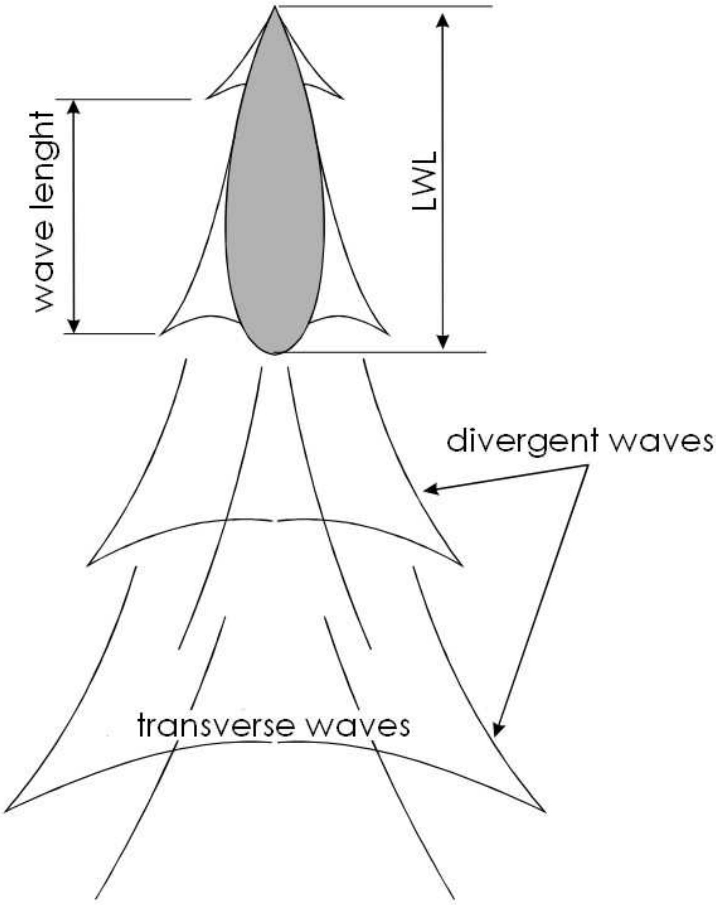
Boundary Layer



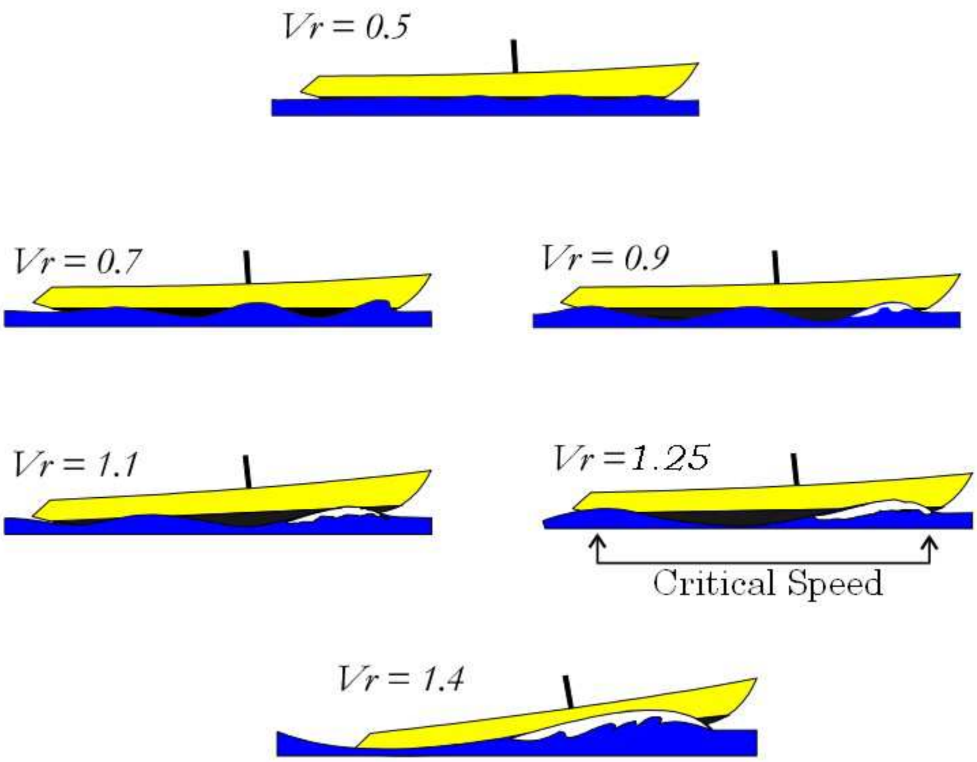
Wave resistance

The hull, when moving in the water, generates various type of waves.

The bow will displace the water toward the front and to the sides. The water will then slide toward Stern occupying the volume left by the boat movement.
This implies that the boat energy acquired with speed shall be partly lost with the wave generation.



Waves generation



Speed & waves

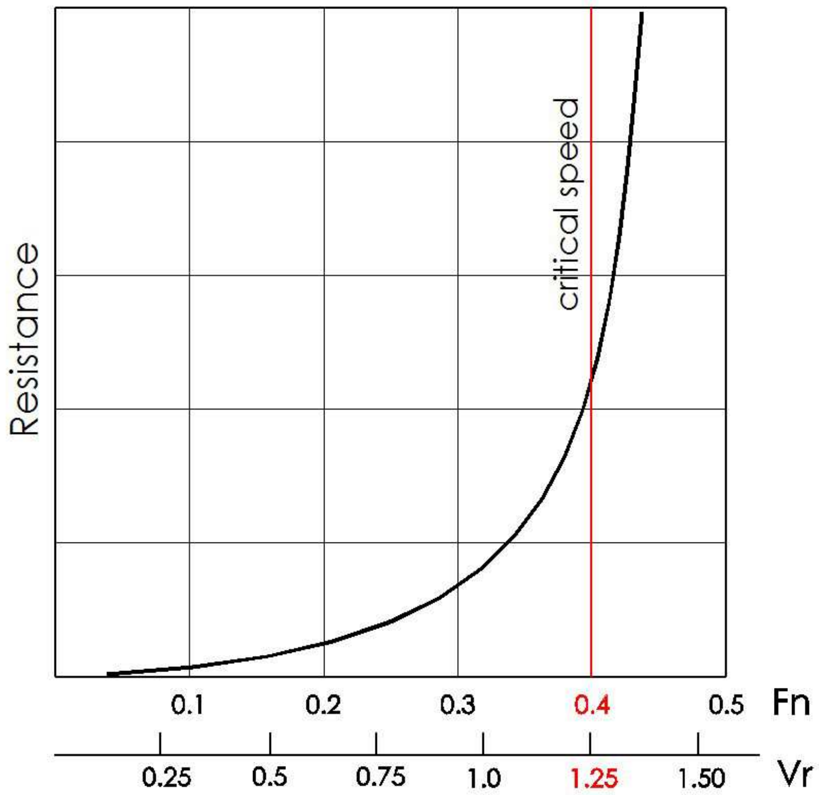
William Froude analyzed the wave's effect and defined the Froude number Fn.

Fn = Boat Speed (m/s) / √ 9.81 x lwl (mt)

There some analogy with the Reynolds Number that studied the Friction resistance as such that the Relative Speed is:

VR = V / √ LWL

Vr =1.25 is also considered the "Critical Speed" of the boat or the maximum speed that the sailing mono-hull boat can reach.



Relationship between Froude Number and Relative Speed

<u>Heeling resistance</u>

When the boat starts heeling under the wind pressure on the sails, the flotation plan is changing form according to the Hull shape.
A book is reporting that the resistance can raise up to 25% at 30° of Heel.
From that data is evident that in order to keep good sailing speed, the boat shall not hell more than 20°/25° where the resistance is reduced to about 10%

The book I'm reading also mentions that the healing effect does not modify the displacement.
Personally, I'm not very sure although a Naval Architect confirmed what I was reading is correct.
My "mentor" a day showed to me something different where the heeling caused by the wind pressure on the Sails tends to "push down" the hull.
Since then I decided to draw my RC Models differently!

Induced resistance

It is a combination of Heeling resistance a boat Drifting effect.

Added resistance

It is the one that is provoked by the Hull movements in the water like pitch, roll, and yaw.

Eddy resistance

Called also Drag is produced by the appendages and by the irregularities of the skin surface.
The eddy is represented by turbulent water flow.
At Model-level, I assume that this percentage could be higher than 2%.
In the Eddy Resistance, I would add the resistance created by the water turbulences at the junction of the Hull with the Deck when the boat is heeling over.

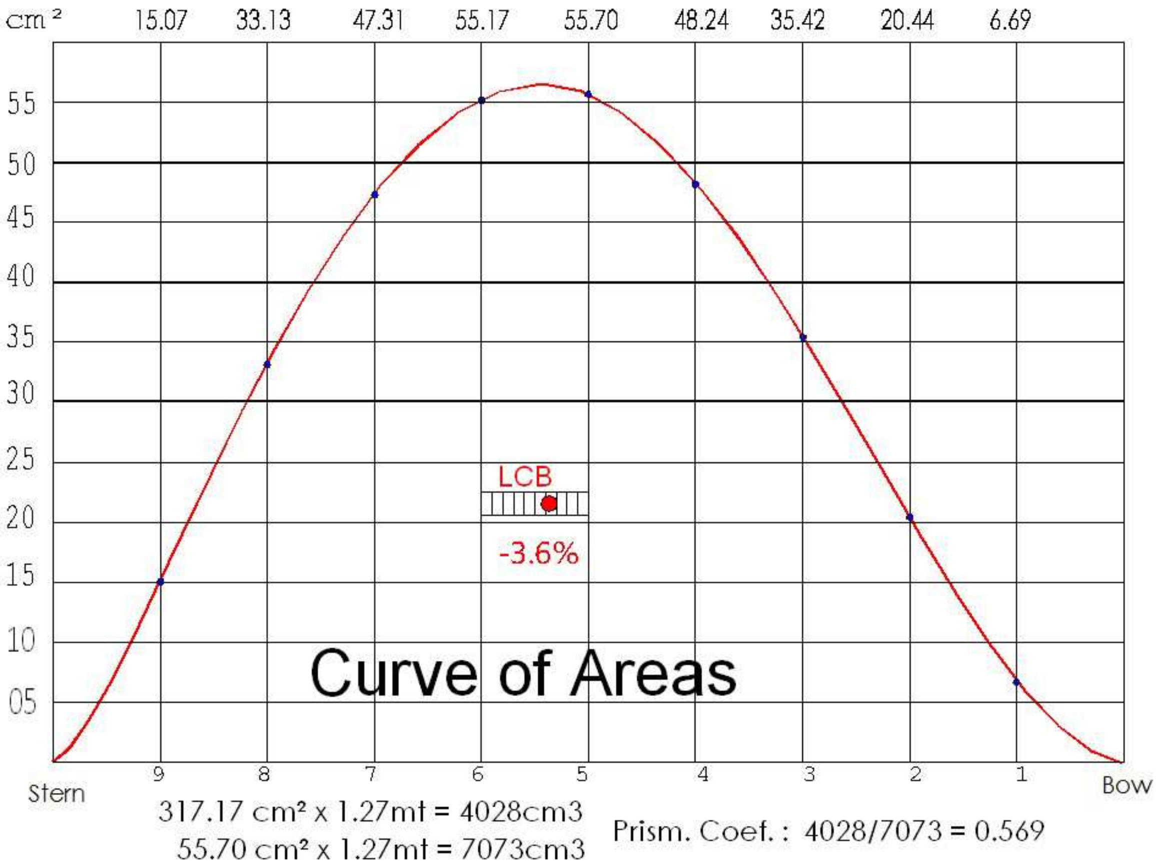
When designing I will try to avoid that the deck sheer line is going underwater at 30° of heel.

Remark:

The sum of the two major Resistances is equivalent to 73% of the total resistance.

Learn Lesson n° 5

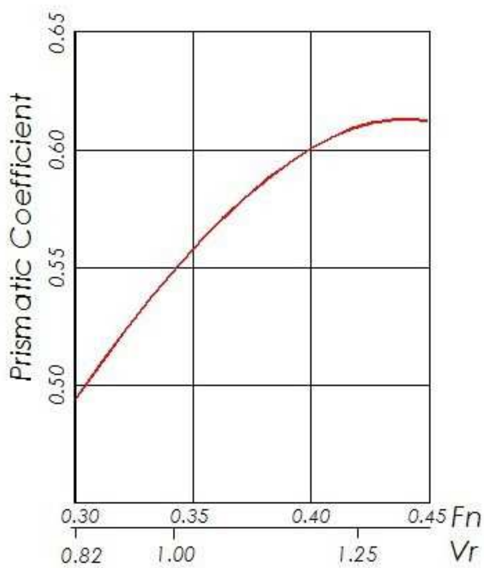
The graphics that are important when starting drawing a Hull.

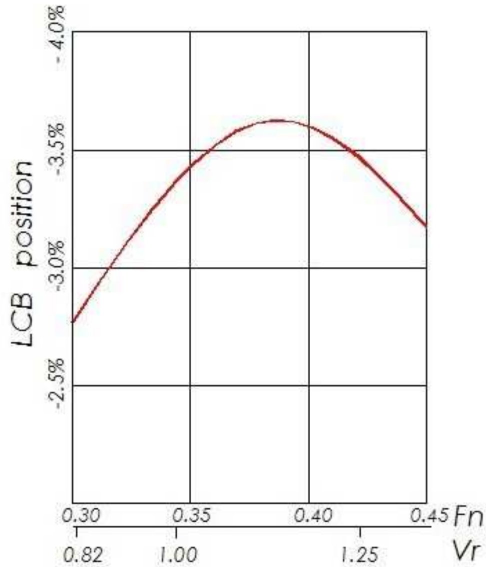


Being in my opinion the Identity Card of the Hull

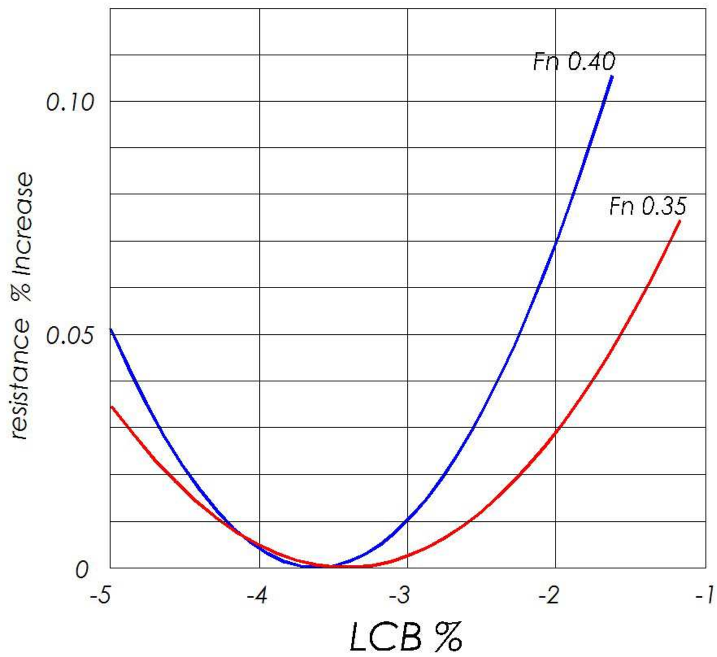
This is a typical COA of a Class M Model
The sum of all sections area is 317.17 cm²
The LWL is of 1.270mt
The Displacement is of 4028g or cm3 (fresh water)
The Prismatic Coefficient is 0.569 (0.57)
The LCB is at 3.6% of LWL afterward of Section 5

Other useful Diagrams derived from tests carried out at Delft University are the ones I use as design guides most of the time.





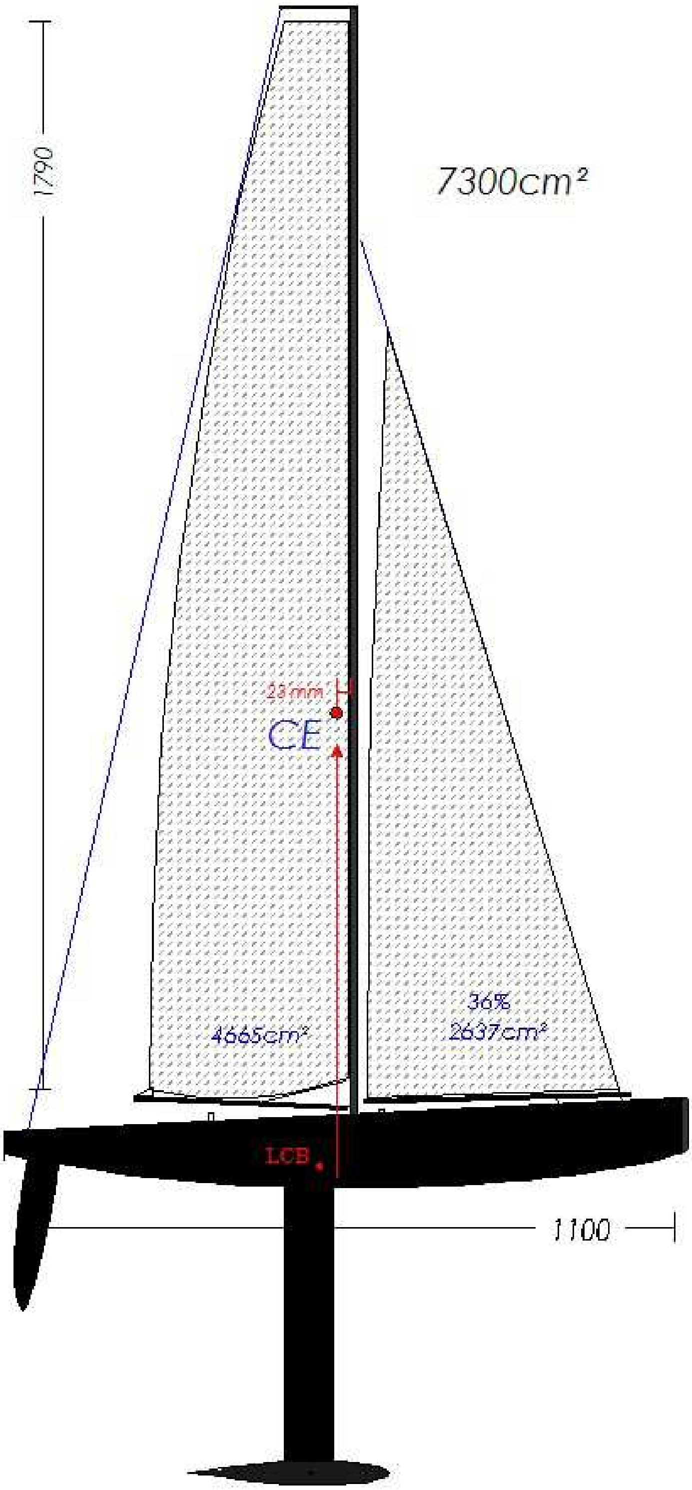
Assuming a relative speed Vr of 1.1, the Prismatic Coefficient should be around 0.57, the LCB position should be around -3.5% from central shadow.
These data are confirmed by the second Diagrams edited in another book where the LCB of -3.5% shows the lowest resistance versus speed coefficient (Fn)



LCB position as function of resistance

Learn Lesson n° 6

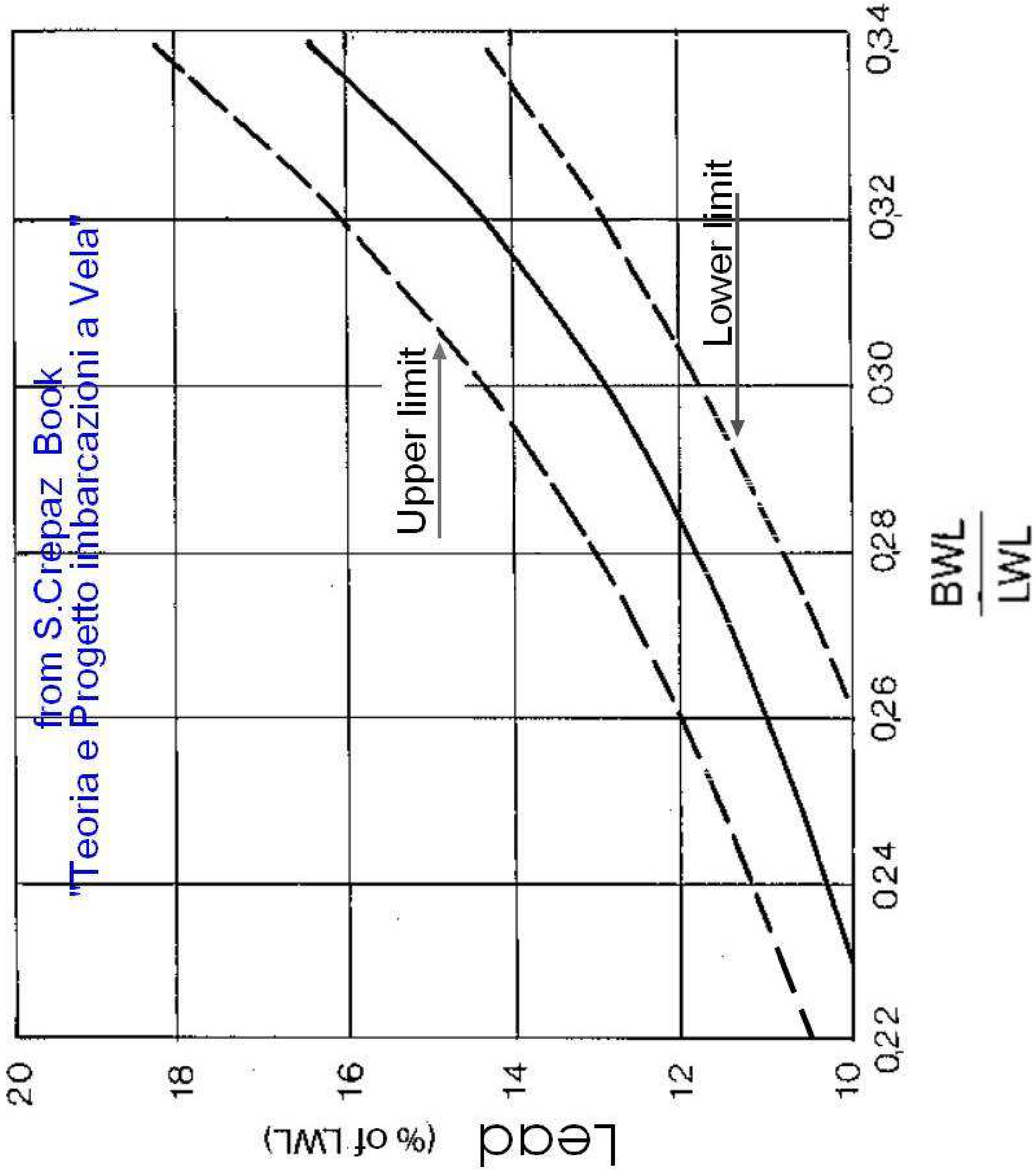
Inside the books, I understood that the boat directional stability is a function of various parameters that include the Hull, the Sail Plan, the Appendices and also the ratio between water plan width and length, BWL/LWL.

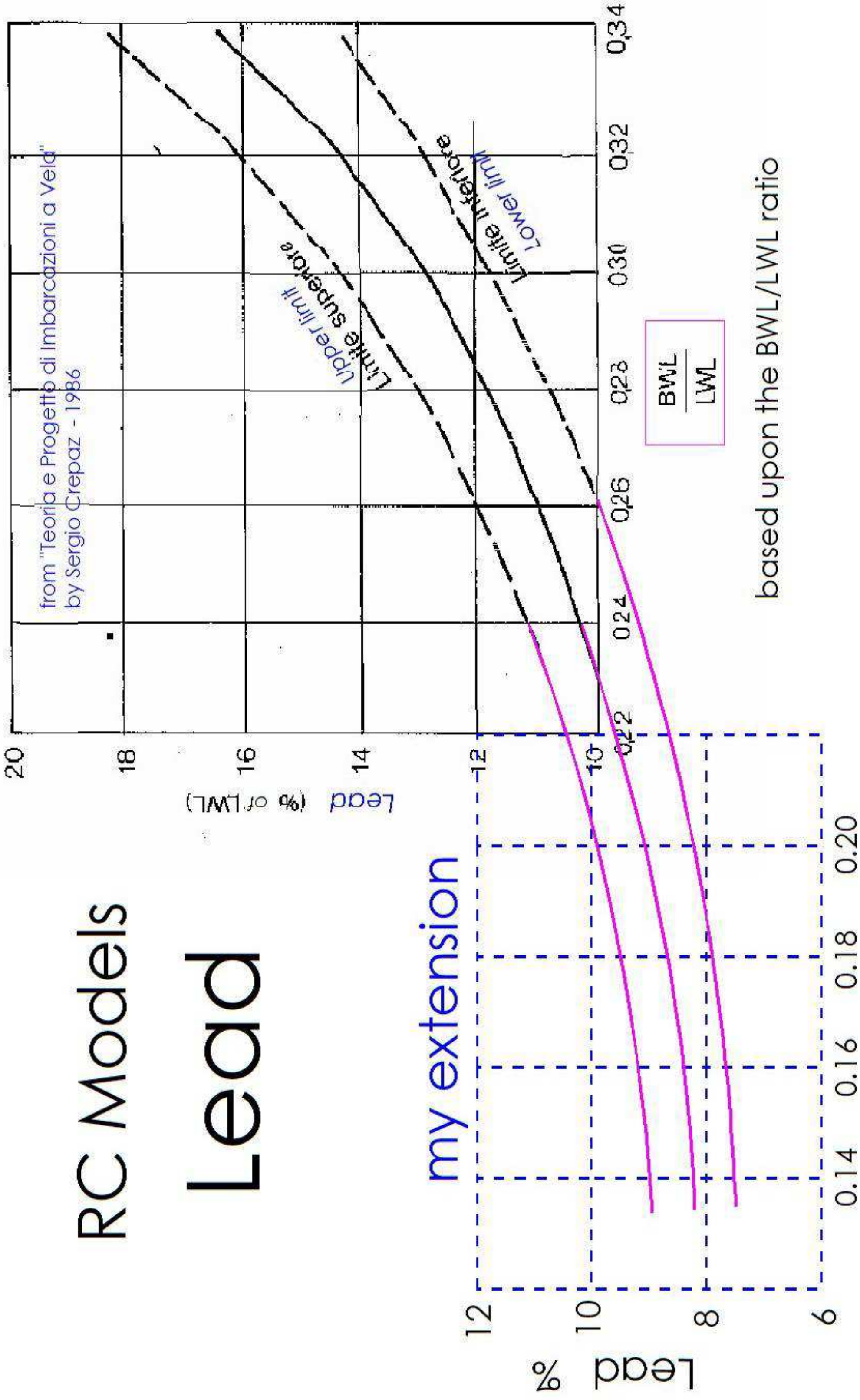


The sailboat performances are often dictated by multiple empirical observations. In principle, a "dynamic couple" shall be created between the Center of Effort of the Sail Plan and the Center of Lateral Resistance of the Immersed Plan. Because two Centers are variables under wind pressure and speed conditions, some vertical spacing percentage of the LWL shall be allowed. Manuals are suggesting for a fractioned Sail Plan Lead percentages from:

6.5 to 10% of LWL.

This diagram was picked up from Sergio Crepaz book an Italian Architect.
I tried to get in touch to get an explanation since never seen before this kind of Diagram without success.

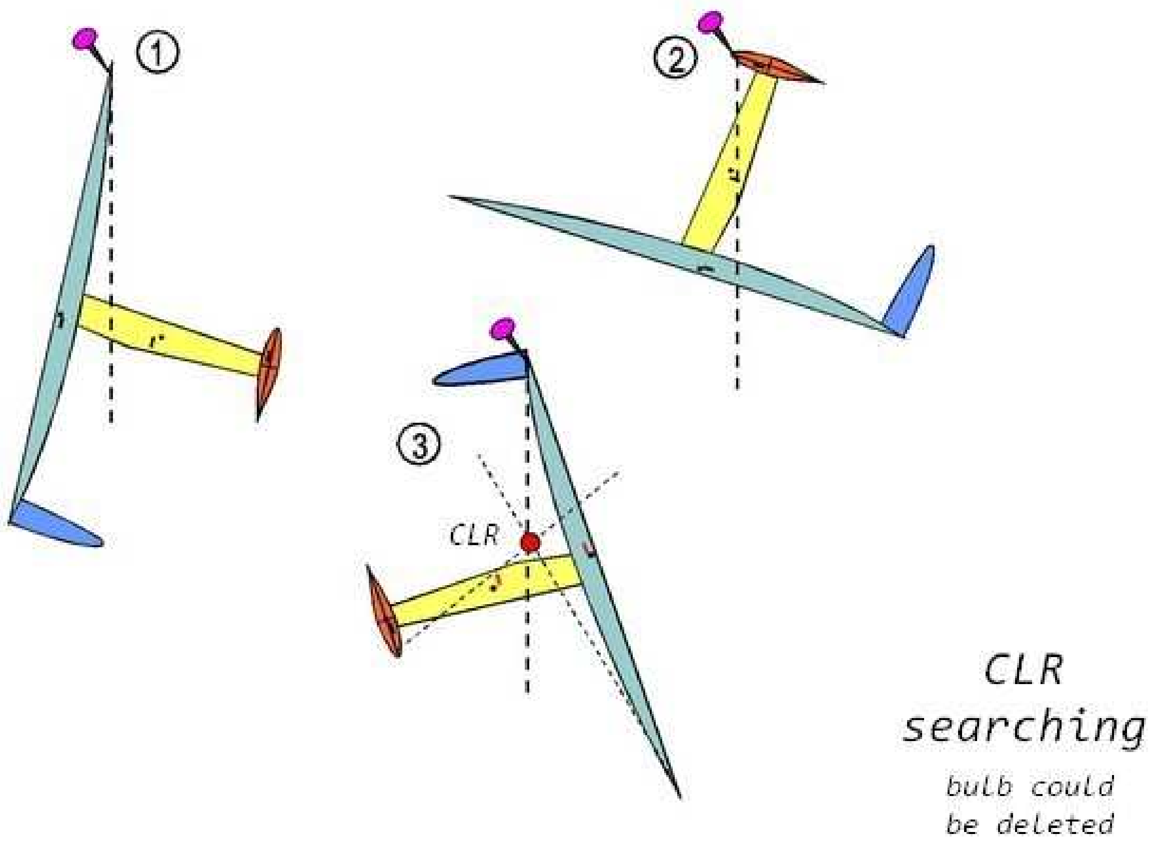




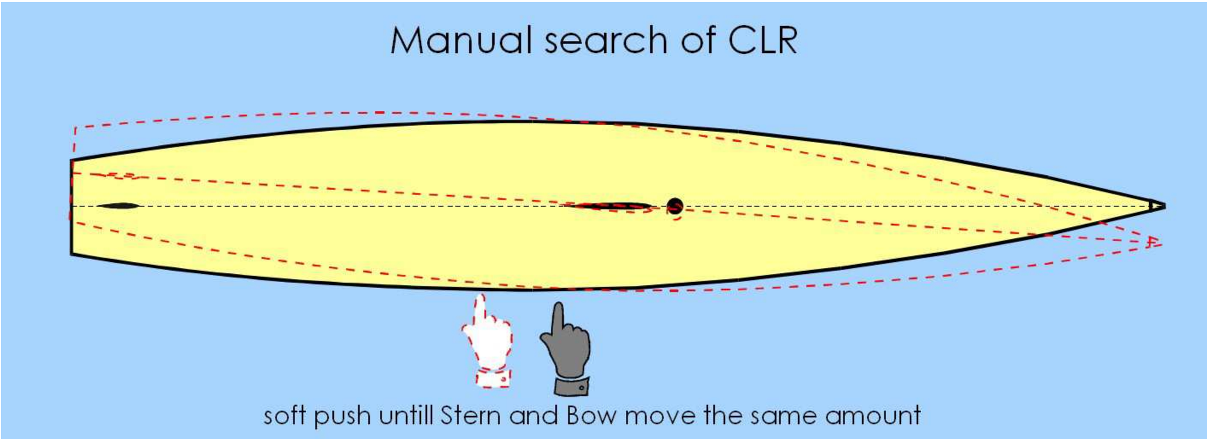
I have extended the Curves as such to integrate BWL/LWL ratios below 0.22 down to 0.14 often met with our Models.

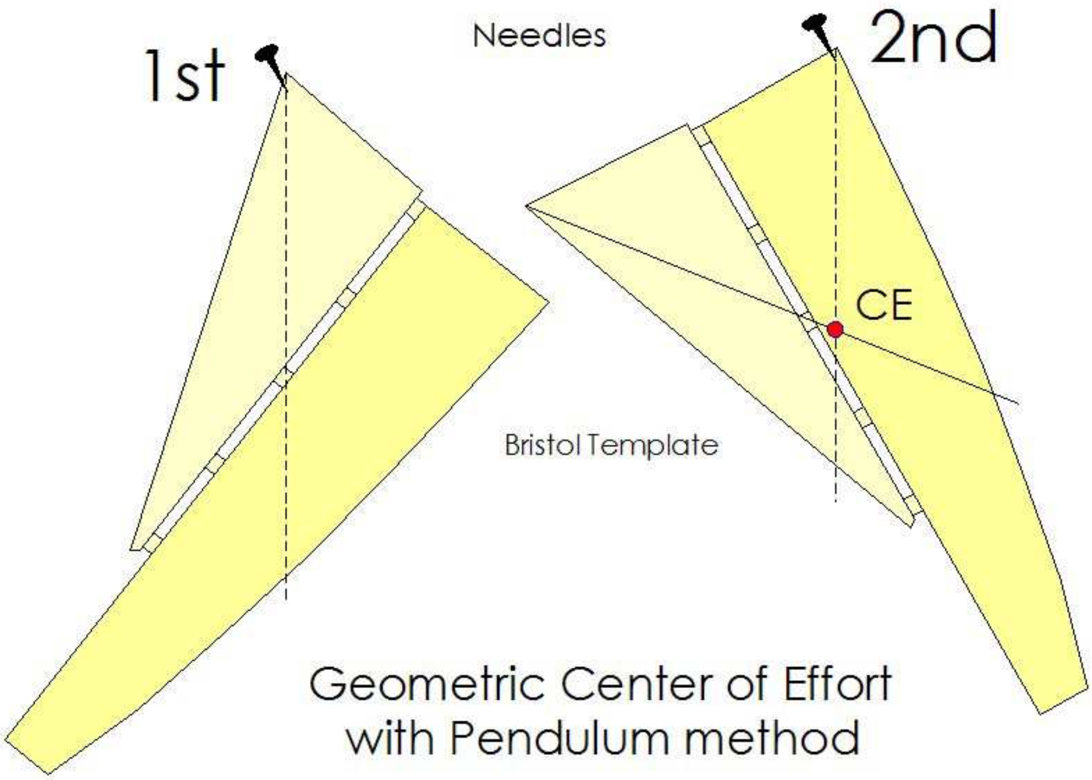
I have understood, unless mistaking, that the balance of the sailing boat is the most critical aspect of the Design.
More often the data available are the sum of various trials and errors on several successful real-scale boats.
How much all that can be applied to RC Models is still rather vague.

One parameter that often it is mentioned for the balance purpose is the CLR "Center of Lateral resistance"
The CLR is the geometrical Center of the Lateral Vertical Plan of the Boat.
The most empirical method found with the use of a Bristol paper template representing only the lateral immersed surface:



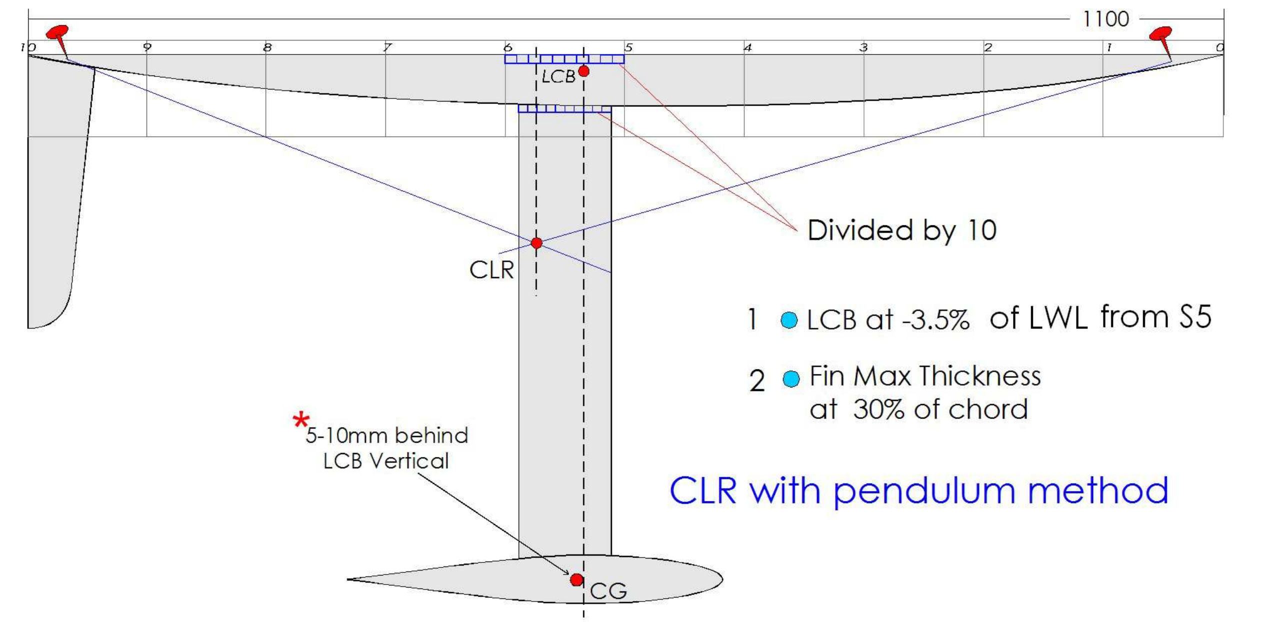
Another empirical method is the one used with the immersed hull and appendices in calm water like a swim pool.





The CE is at 23mm from the rear surface of the Mast
Similarly the Center of Effort of the Sail Plan is founded with a Bristol template representing the Sail Plan
The Geometric Centers are not the Dynamic ones, where CE will move toward the Bow.
CLR and CE are two Centres that will stay all the time together and set along the LWL centre line.
A precise Rule is not well identified yet.

Nevertheless, some help is obtained by the Bulb Position that shall stay under the LCB for longitudinal stability.
The Fin, in turn, is supposed to sustain the Bulb; therefore, the Fin will be positioned to cope with the above requirement.



1. The Bulb shall stay* under the LCB (in this case is at -3.5%of LWL)
2. The Fin is positioned under the LCB as such that his 30% chord line is matching the vertical LCB line.
3. The CE, from sail Plan Drawing, is at 23mm behind the rear face of the Mast (page 50)

* The Bulb would be better if positioned behind the LCB vertical line in order to let the Stern a bit closer to the Water level.
Once the boat will start moving, the Wind pressure on the Sails will recover the normal hull horizontality.
Next page the Model assembled with Sail Plan.

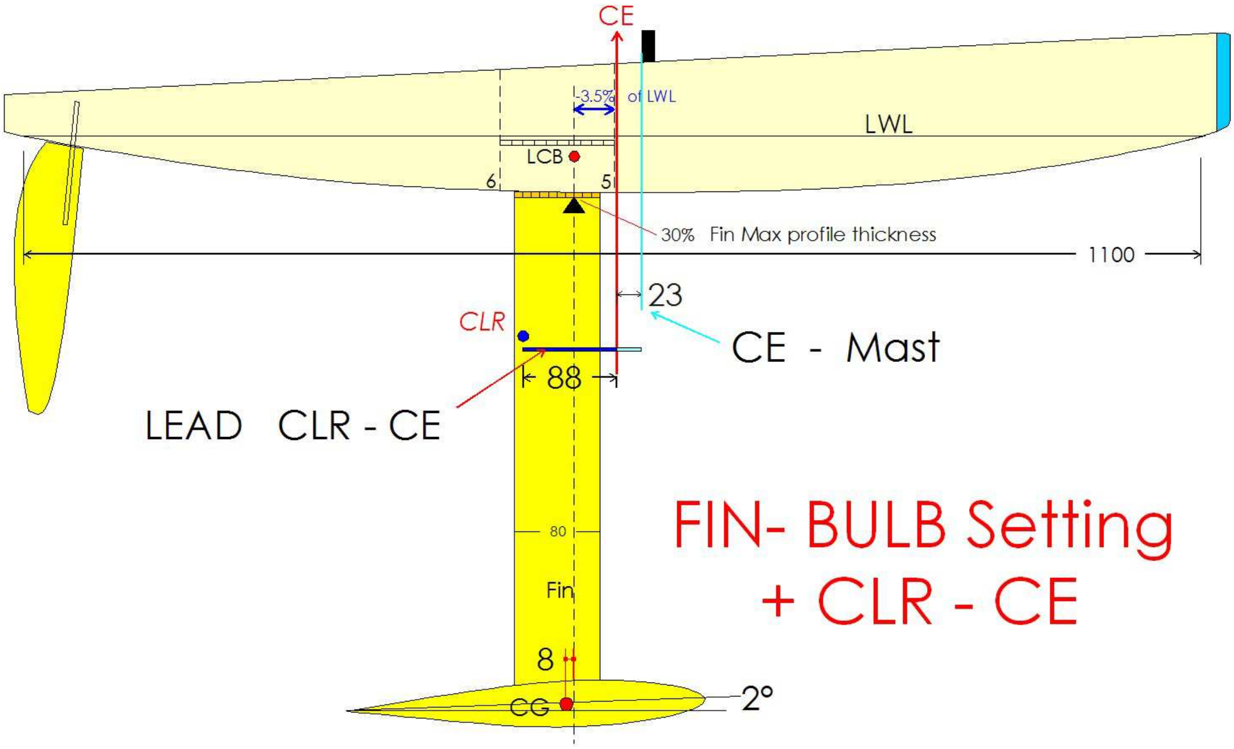
On page 45 was presented the Diagram I use to identify the LEAD from the CLR to the CE.

Taking one of my recent design, the BWL is 157mm and the LWL is 1100mm, therefore :

157/1100 = 0.142

Cross-checking with the diagram it can be said that the Lead percentage could be sitting between a minimum of 7.5% and (low wind condition) up to 9% (for heavy wind condition).

Assuming an average LEAD of 8%, the Vertical line going to the CE will be at 88mm from the CLR and since the CE is distant 23mm from the rear face of the Mast, this late will be at the sum 88+23= 111mm from the CLR.



The CLR and CE are moving all the times, difficult to establish the correct Lead percentage, I shall, therefore, consider the diagram issued by Crepaz that uses the BWL/LWL ratio a valid choice.
It is known that a wide hull has the tendency to go up to the wind more than a narrow hull.

Learn Lesson n° 7

While on the subject, Sail Area and Immersed Areas have a dimensional relationship.
The air density is about 830 times lower than Water density; therefore, the balance between the Sail Plan and Immersed plan shall obey to an empirical ratio.
Hull lateral immersed plan and bulb side plan are not considered anti-drift surface due to the efficiency of their round shape.

According to a "Rules of Thumb" the following proportions apply:

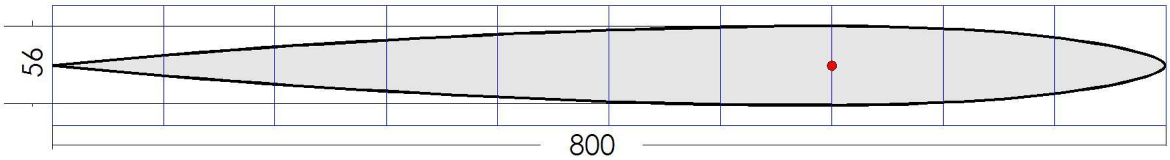
Appendices areas = 5.5% to 6.5% of Sail Area.

Appendices are intended as the FIN Blade and the Rudder.
Generally, I divide the surface by 4, where 3 parts will be applied to the Fin Blade surface and 1 part to the Rudder surface.
The percentages are due to the expected speed of the boat.
Deeper Fin Blades are more efficient due to their Aspect Ratio, therefore, their surfaces could be smaller.
I use that lesson to indicate that the lower the Wet Area is the better it is.
This aspect will be met when describing Hull Design already developed.
Efficiency is also dependant on the Fin and Rudder profiles.
Modern designs adopts Fin Blade Profile at 7-7.5%
And Rudder Profile at 10%.
As an example, a FIN Blade 80mm wide will offer a thickness of :

80 x 7% = 5.6mm

5.6mm thickness is well compatible with the Bulb retaining stud of 4mm.

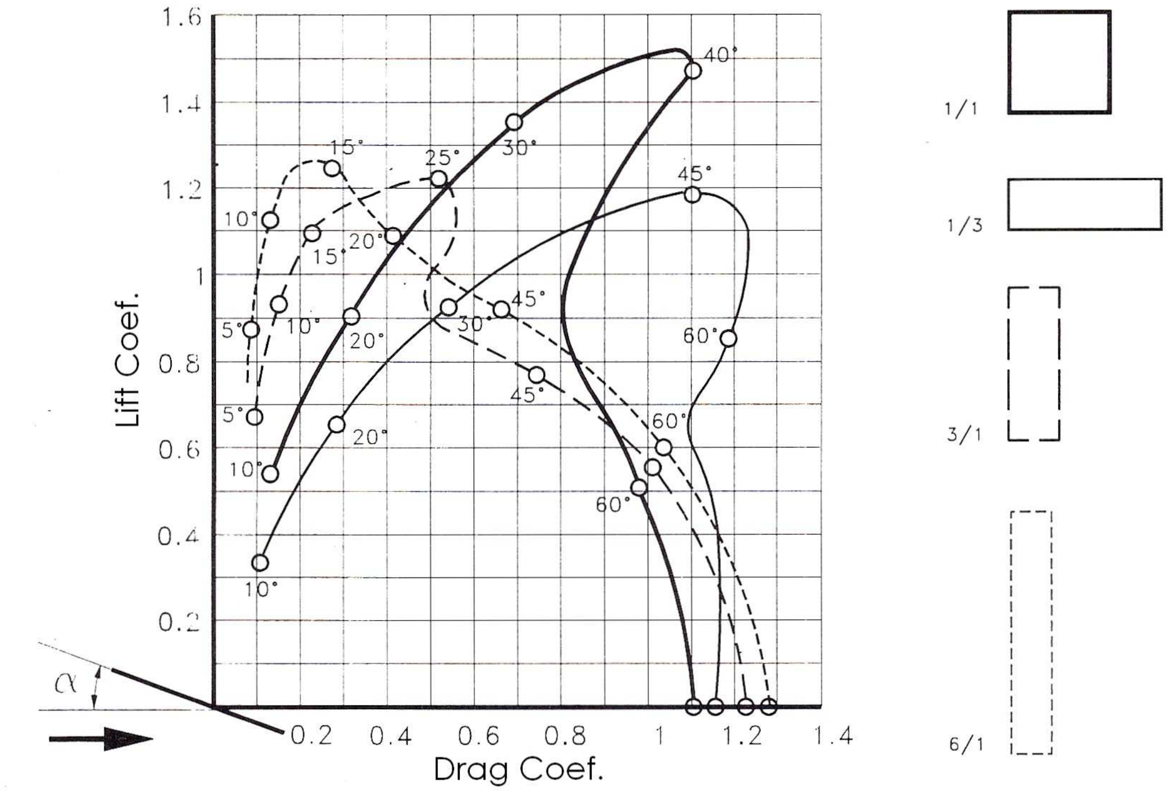
FIN Profile



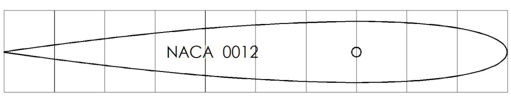
GOE or Naca at 7%

Remaining on the appendices subject in the books is often reported this digramme :

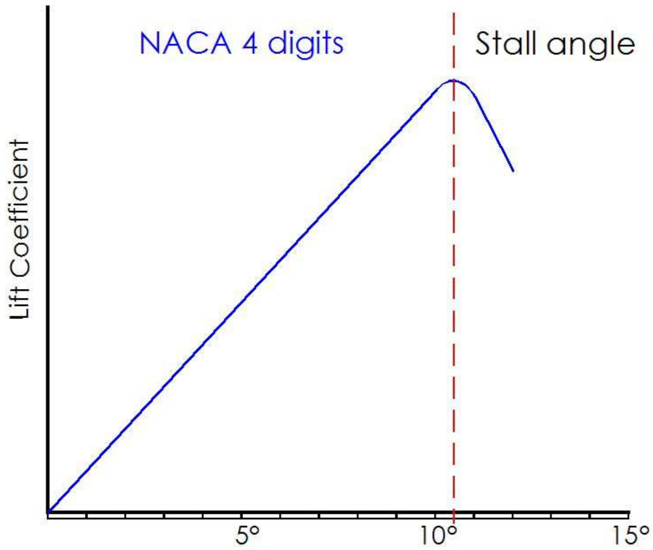
From Lodigiani Book



It is evident that the shape of a Rudder will take advantage if the Aspect Ratio is above 3/1 at the condition that the rotational angle is below 10°.



Too often I have seen on the water pond sailors (skipper) moving continuously the Radio Stick will induces an increase of Drag.
The same sailor complaining that the boat was losing a lot of speed when turning the Buoy without suspecting a Stall effect.



Assuming a low-speed equivalent to 0.5m/s and a Rudder chord of 4cm, the Reynolds Number will be rather low :

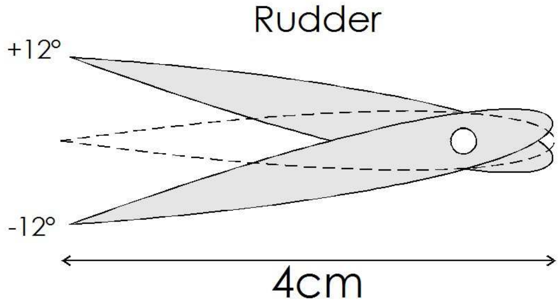
$$\mathbf{Re = VxL/\ \nu = 19801}$$

Recalling that the Boat speed is :

$$\mathbf{V\ boat = Vr\ x\ \sqrt{LWL}}$$

I do not knows if the above Eiffel Polar is still applicable to the RC model !

This the sweeping angle of +/- 12°, it is not very much when compared with the Radio Joystick maneuvers seen.



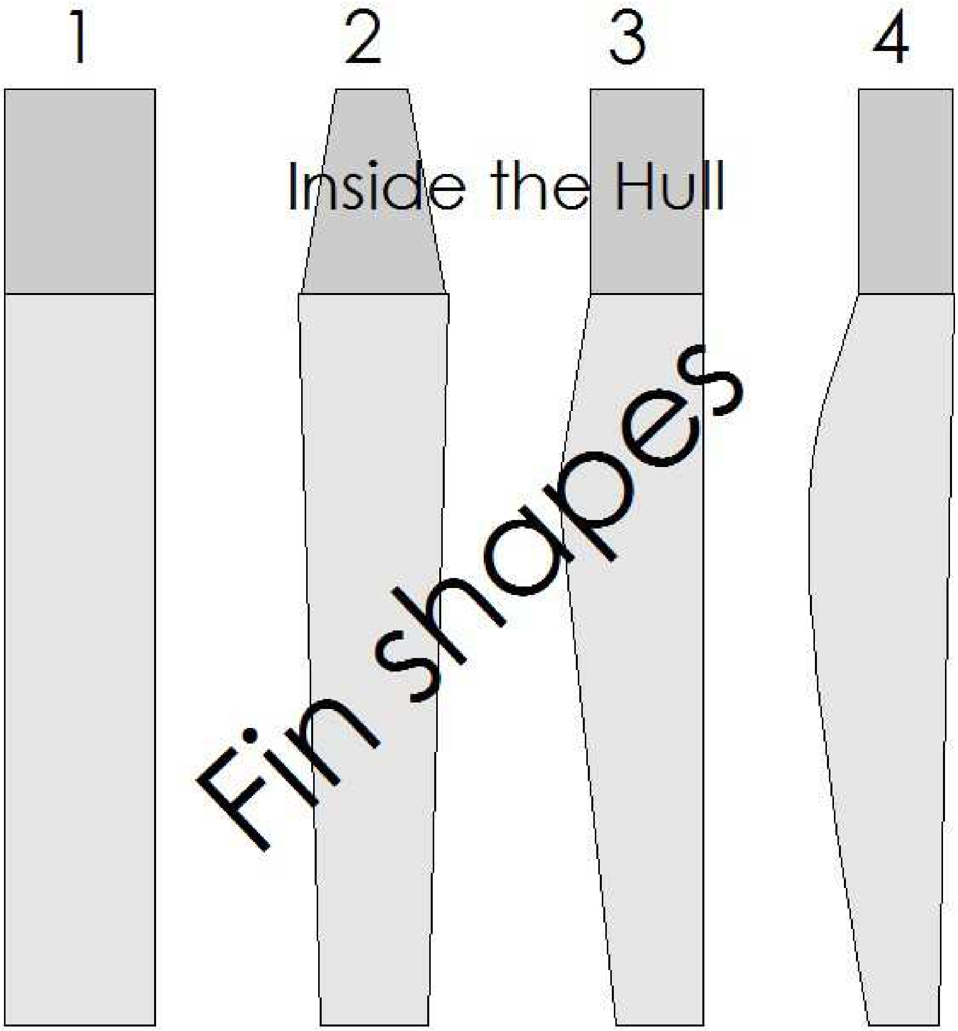
Appendices

Here few words about Fin and Rudder.

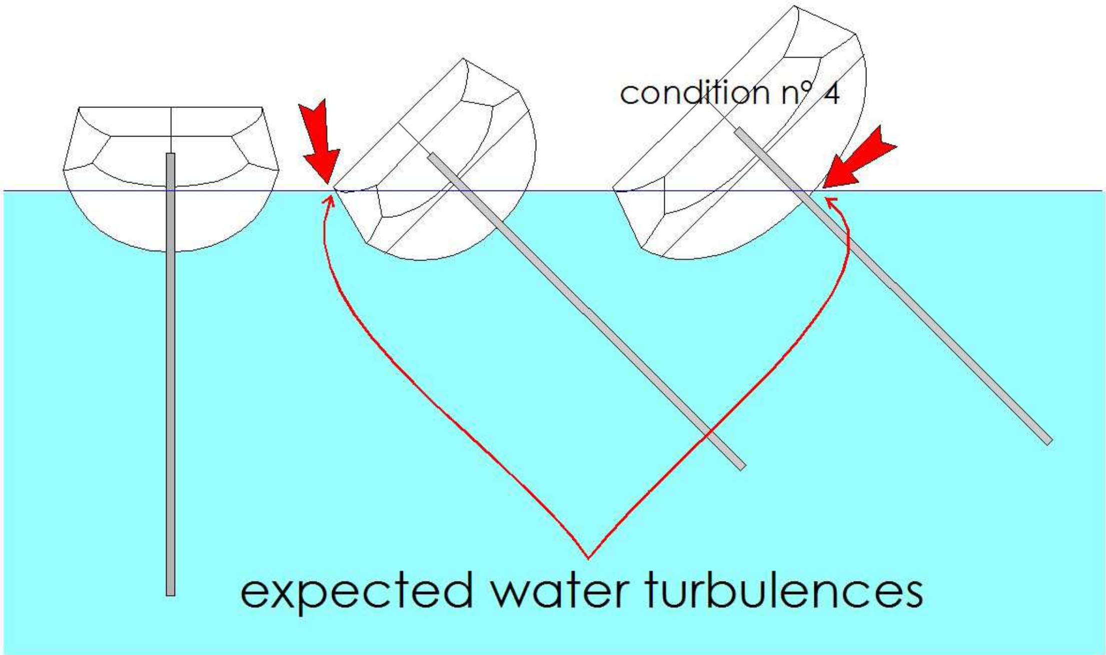
The Books I have, do not help me to better develop Fin and Rudder for RC Models, therefore I went to see what others have done.
The Web is a useful place as well as the RC Model Clubs.

The Fin

Various shapes are used:



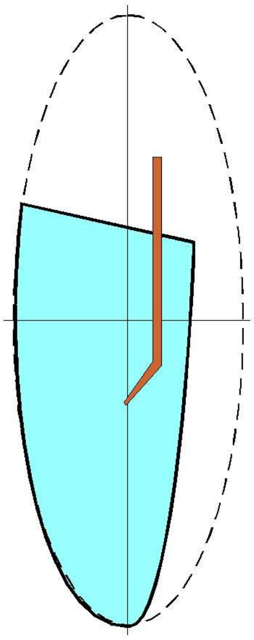
The "aspect ratio" is the most important issue (see page 61)

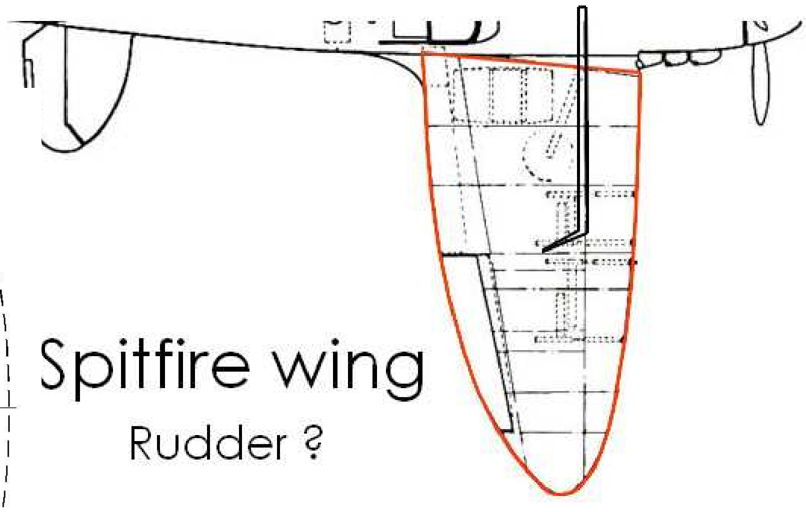


The shape choice is a matter of acceptable wet area and construction technique.
The example n° 4 is particularly of concern when the Hull tilting may expose the Fin attachment to the hull.
This solution is aiming to reduce possible water turbulences with wide hulls.

The Rudder

Also the rudder may have various shapes the most efficient is the one issued from the elliptical form like the Spitfire wing!





Learn Lesson n° 8

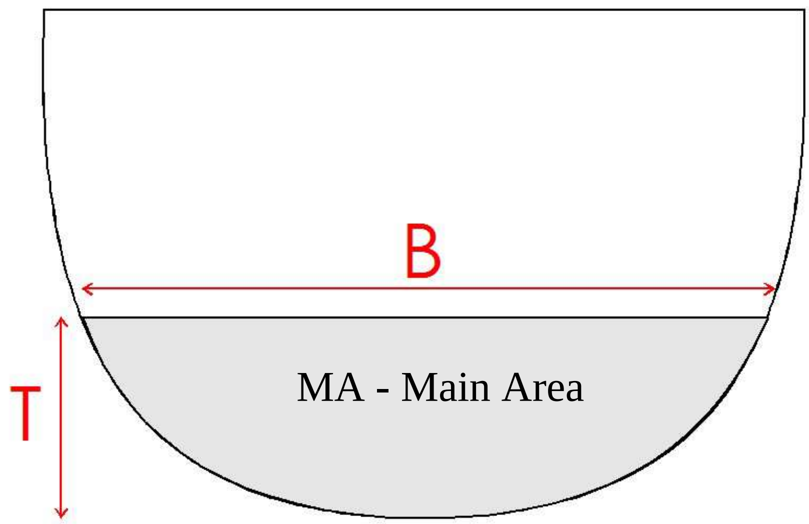
Throughout the readings, one ratio has taken my attention also because related to the Wave-making resistance.

Wave-making resistance factors are dependent on the Main Section shape, Water Plan shape, Curve of Areas and Prismatic Coefficient.

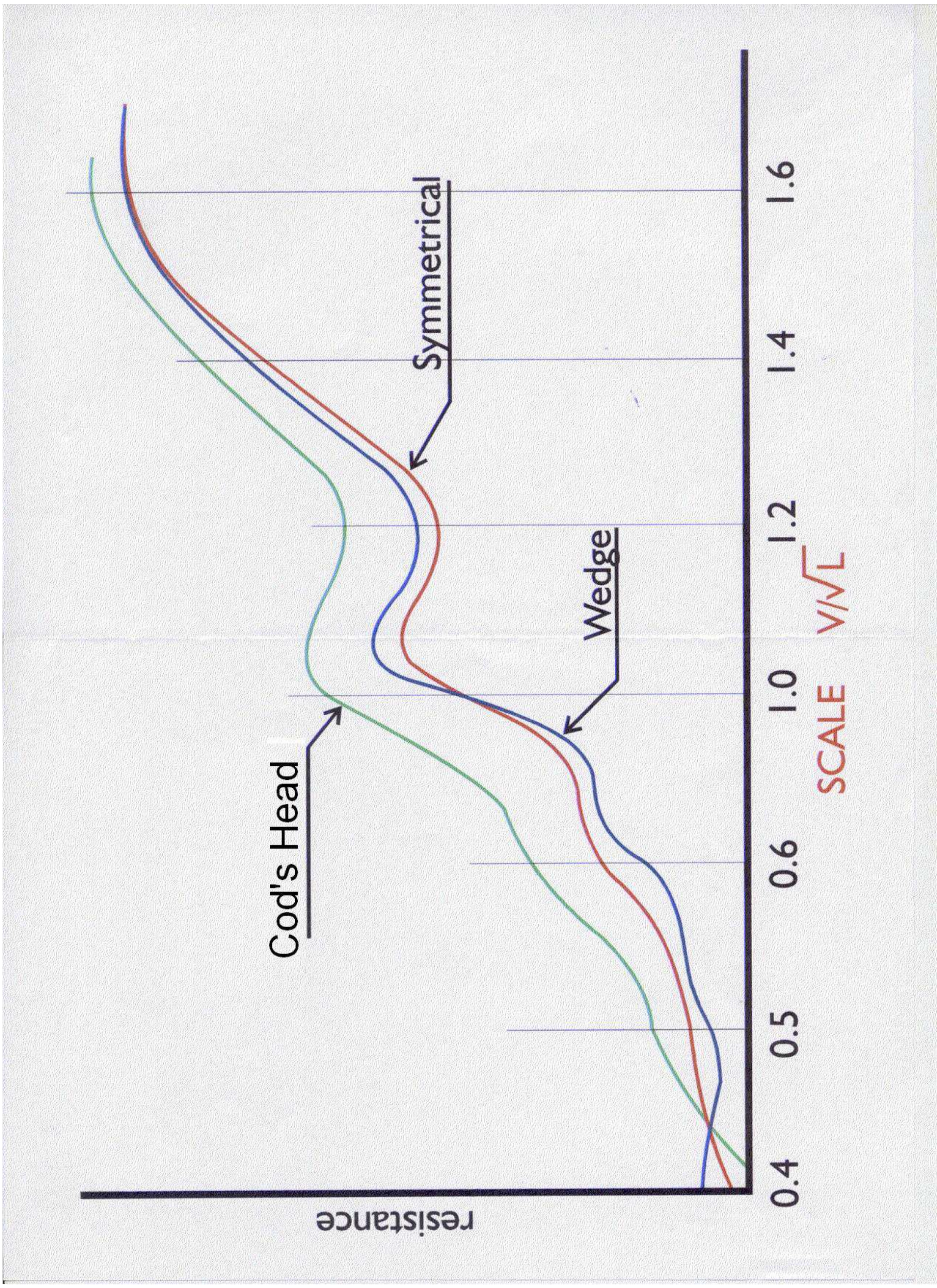
Main section shape is considered here.

The shape of the Main Section is defined by the B/T ratio and by his Coefficient:

B/T = from 3.2 to 5.1
Main Coef : MA / BxT = 0.55 to 0.75

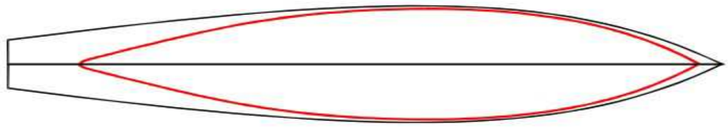


About the Water Plan shape graphic it can be shown in the diagram next page

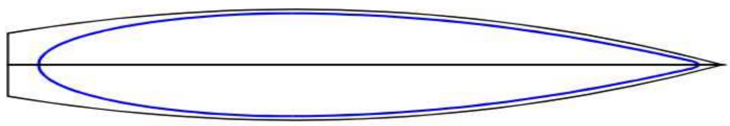


According to this diagram, the Wedge type hull presents the lower resistance at the Relative Speed of 0.5 up to 1.0, above that speed the symmetrical shape is a little better.

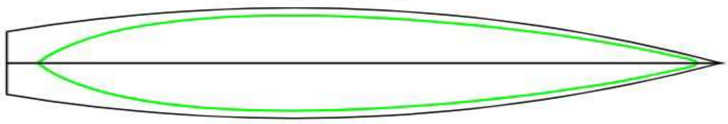
Cod's Head

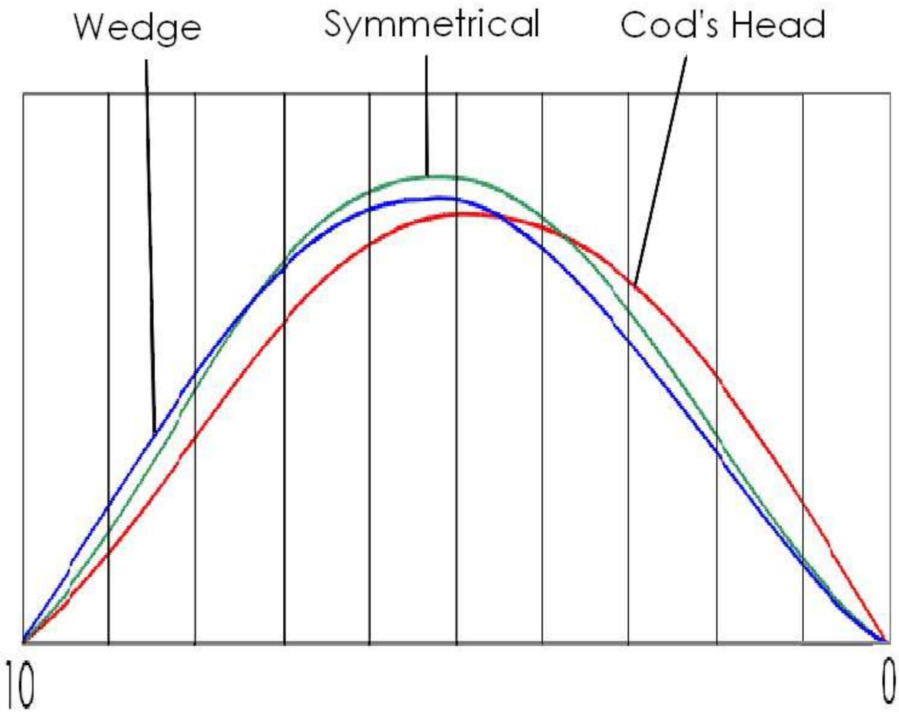


Wedge



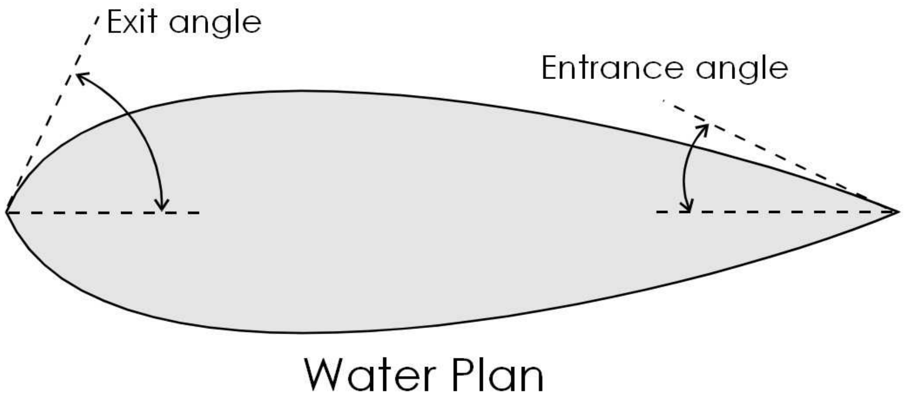
Symétrique





Curve of Areas vs Water plan shape

For our Models, I would exclude the Cod's Head shape.
Personally, I have acquired a preference for the Symmetrical Water Plan because of the narrower Angles of Entrance and Exit although the Wedge type exhibit lower resistance below Speed ratio of 1.0



Entrance and Exit Angles of the Water Plan, curve of Area and Prismatic coefficient will be discussed within the Model Designs.

Learn Lesson n° 9

Displacement can be calculated in various modes:

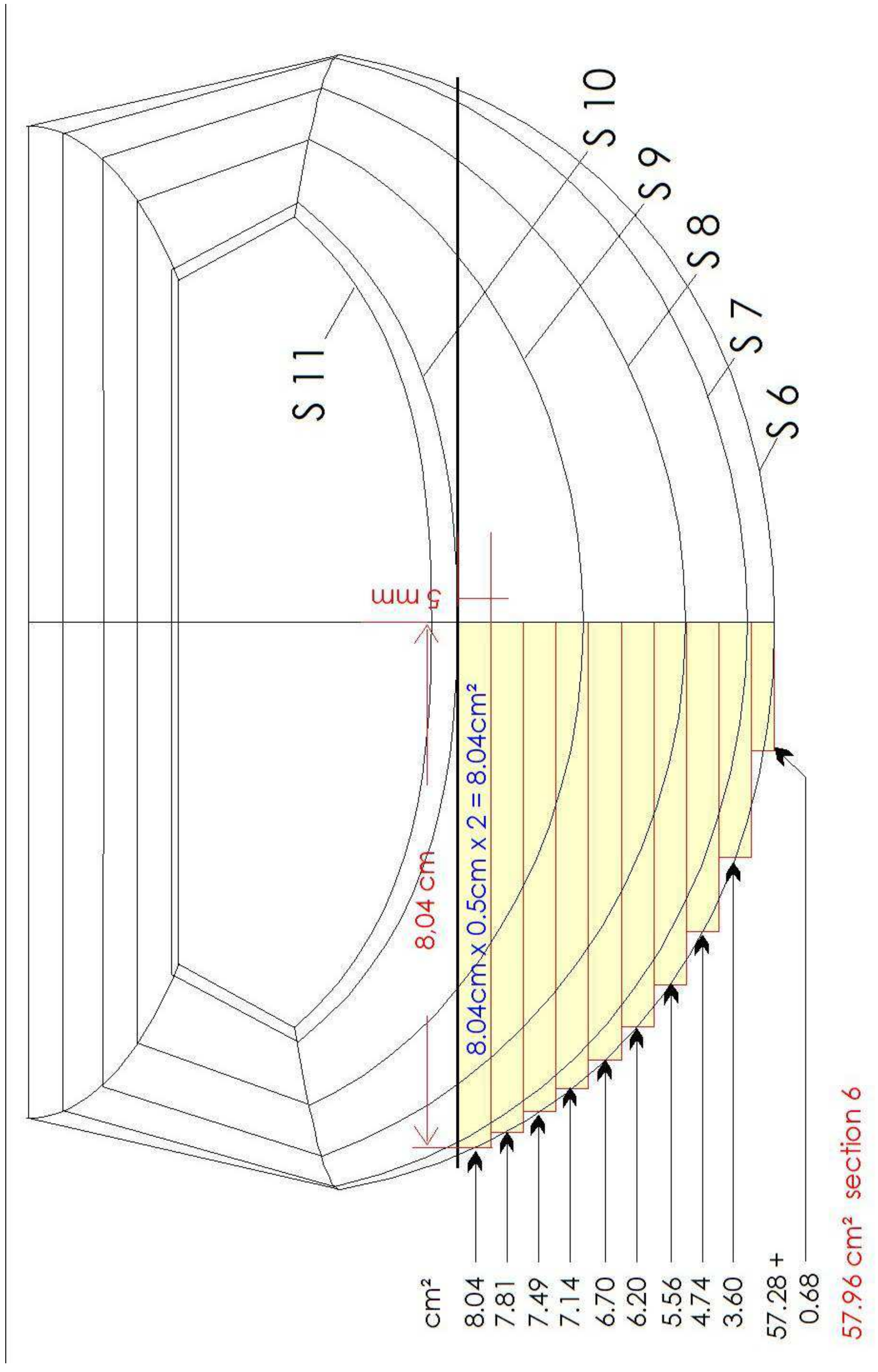
- Simpson Rule
- Trapezoidal Rule

The above rules can be found in various books, will be included at the end of this book.

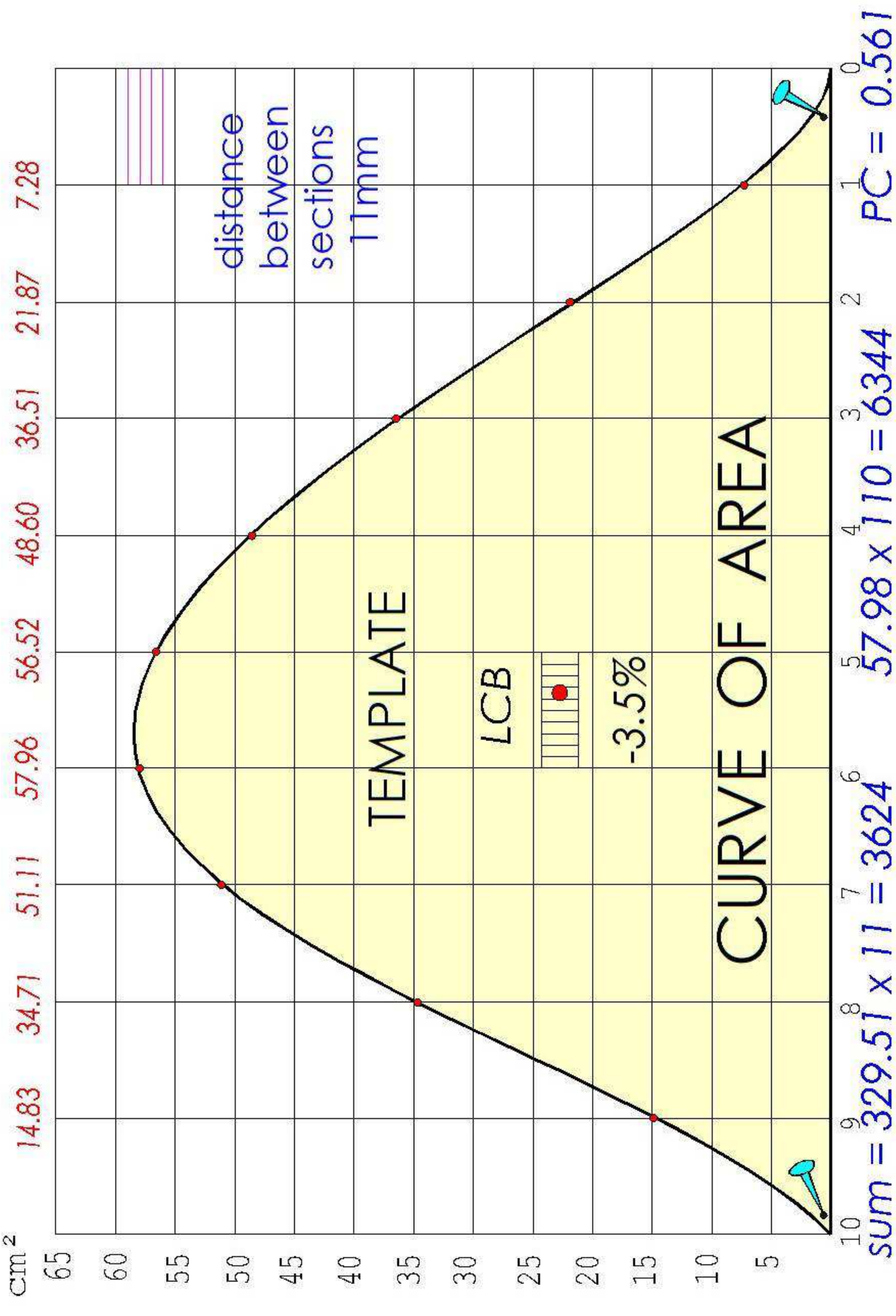
- My method

Personally, I have developed another method based upon a graphic drawing since my Drawing Tool is the Corel Draw.
I suppose that a similar method can be implemented with another program or even drawn by hand on a Drawing Table.
Here the Section 6 surface calculation where the width of each template is measured and reported for the Sum = 57.96cm²

5mm wide templates used are applied to half-section and than multiplied by 2.



Here, instead, the complete Curve of Area calculation.
The needles are used to hang the cut-out template to search for LCB.

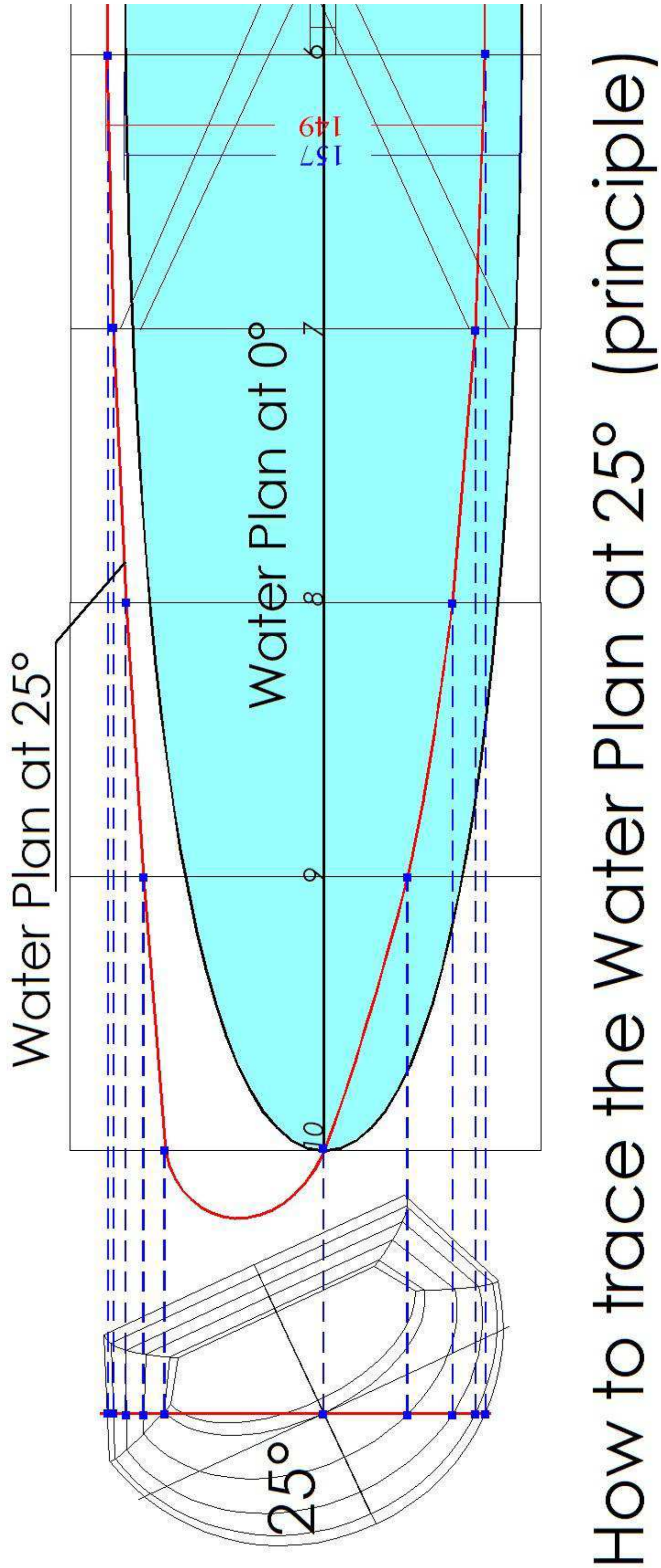


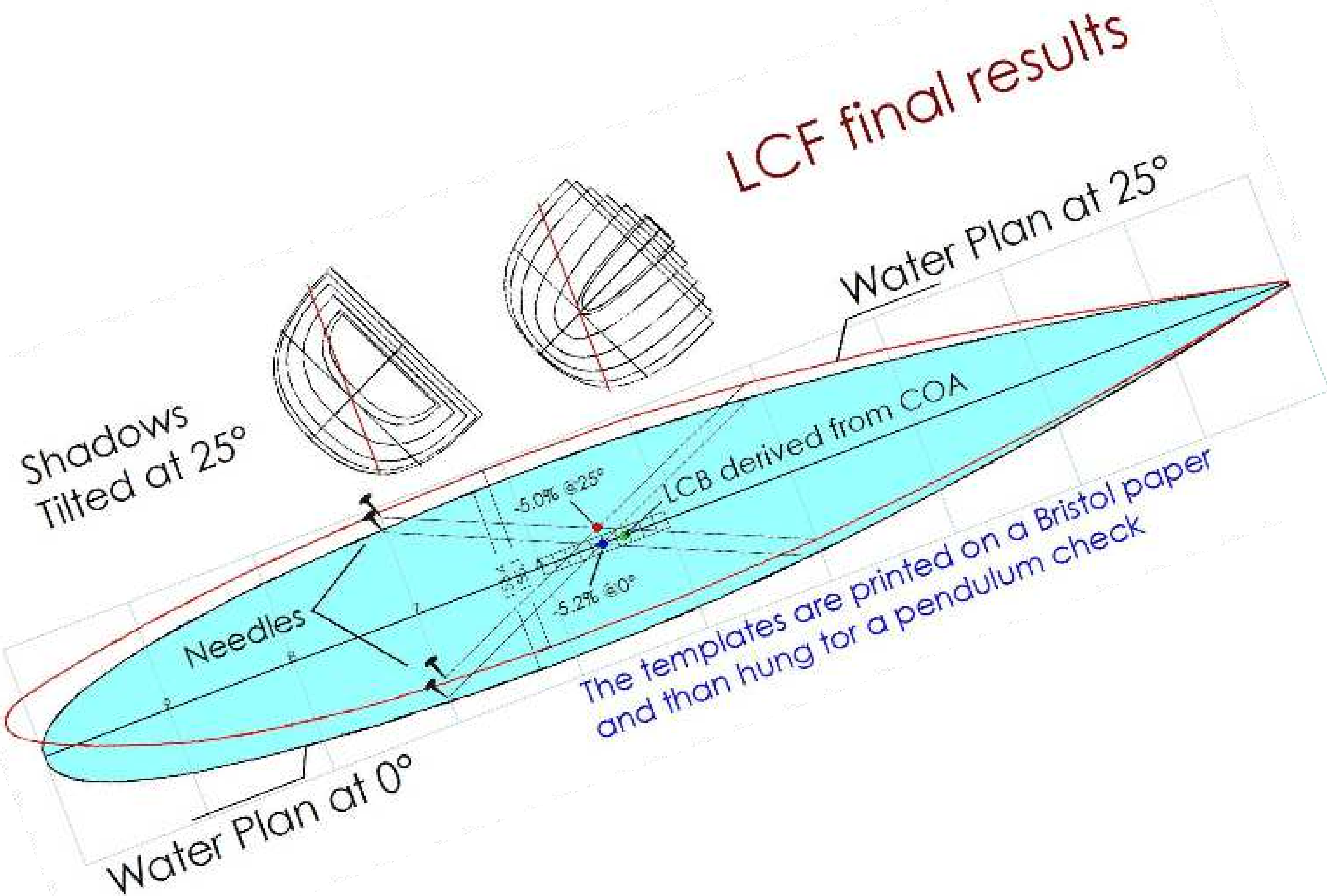
One of the most important parameters to my eyes is the Lateral Centre of Flotation: LCF
Here half plan depicted.

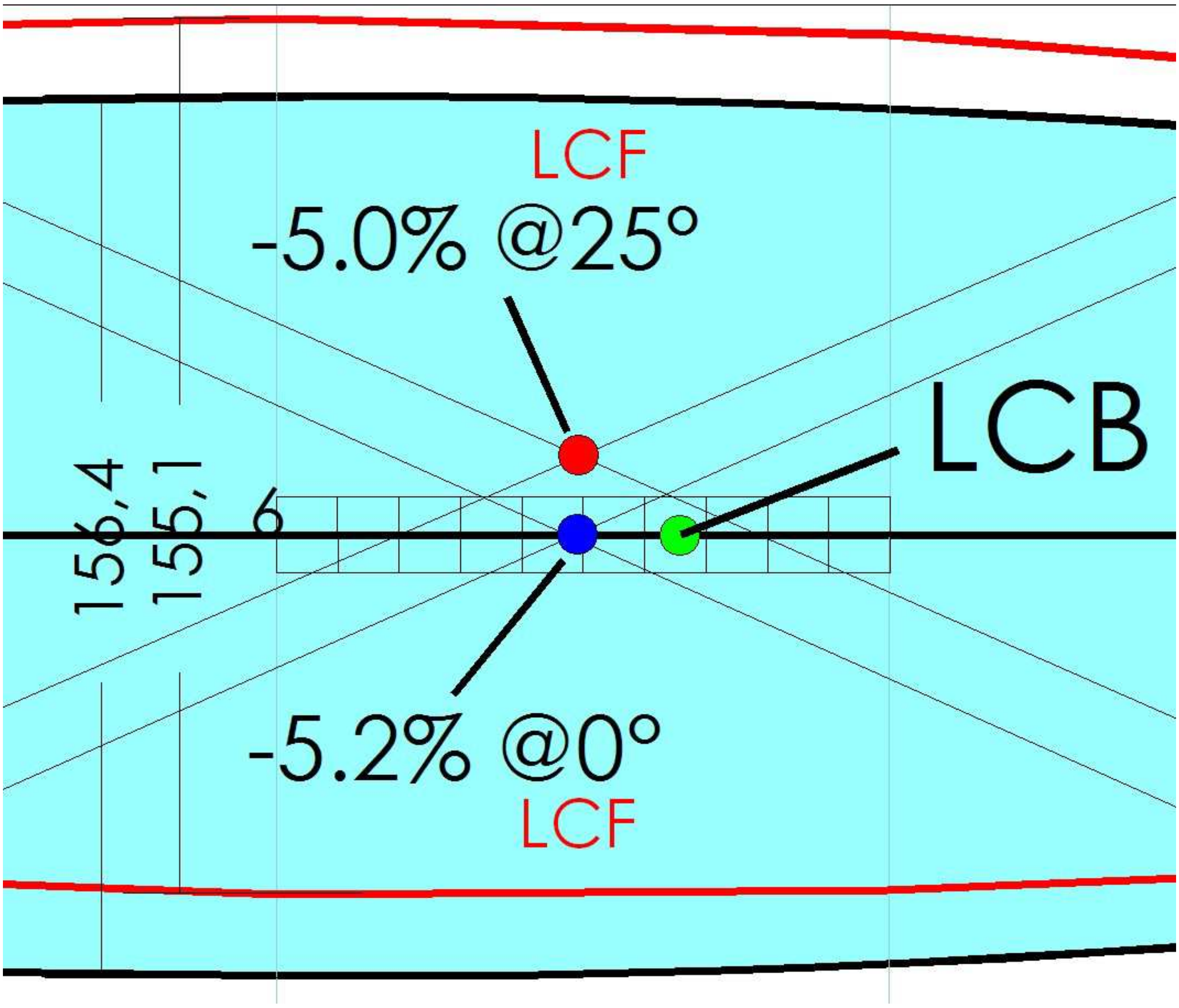
The LCF shall be somewhat behind the LCB, while this Center at -25° should stay always head of the center at 0°.

This condition is necessary to obtain a balanced hull.

Next page the image of the finished result.




LCF final results
Water Plan at 25°
Shadows
Tilted at 25°
LCB derived from COA
-5.0% @25°
-5.2% @0°
Needles
The templates are printed on a Bristol paper
and than hung for a pendulum check
Water Plan at 0°



From previous images an enlarged view where it can be seen the relative positions of the interesting parameters for the Hull Balance.

It is noted a slight ahead position of the LCF at 25° compared with the LCF at 0° and both behind the LCB by about 1.5% (each square division = 1% of LWL).

My experience with 123 design, proved to help a lot against "Nose down", almost to produce the opposite movement with a "Nose Up" !

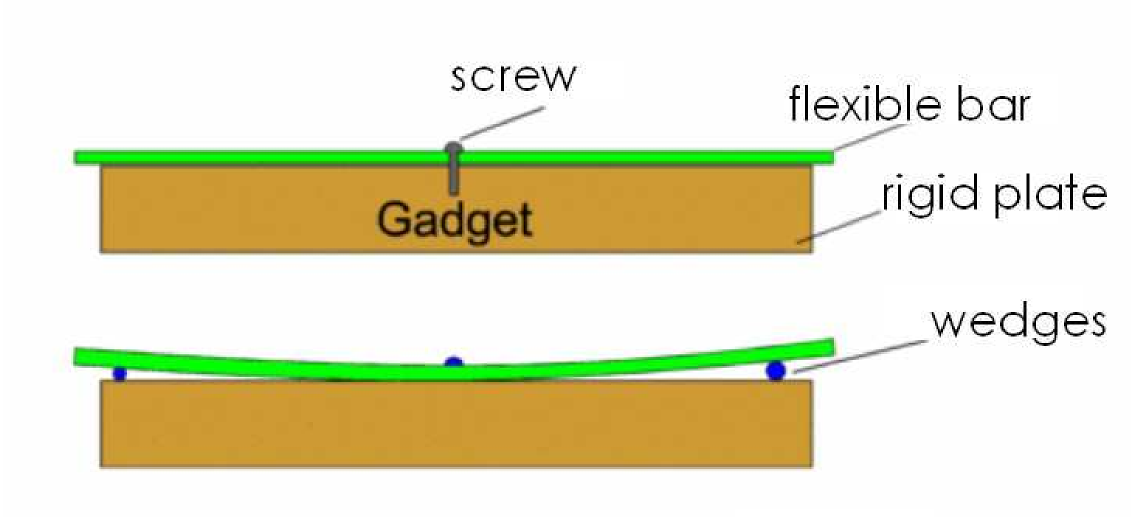
Learn Lesson n° 10

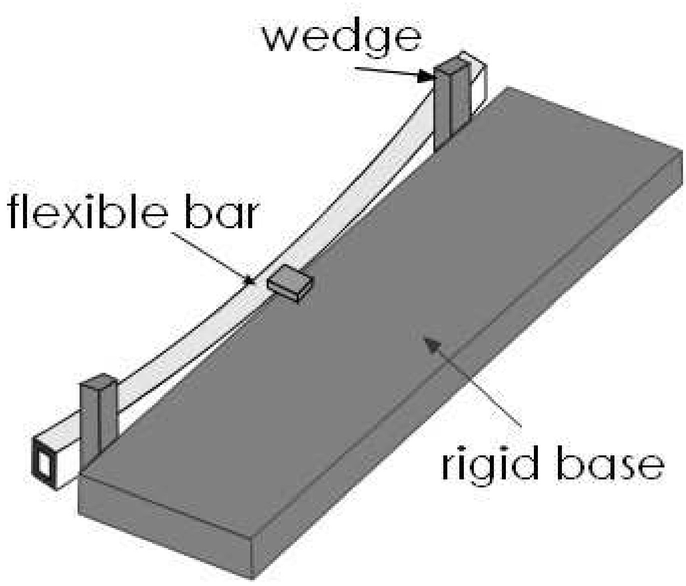
Sails are the Engine of the Sailing Yacht and RC Models.
Making Sails is an Art!

Once I discovered an article about a strange object probably used in the past century to fabricate Sails for the Fishing Boats.

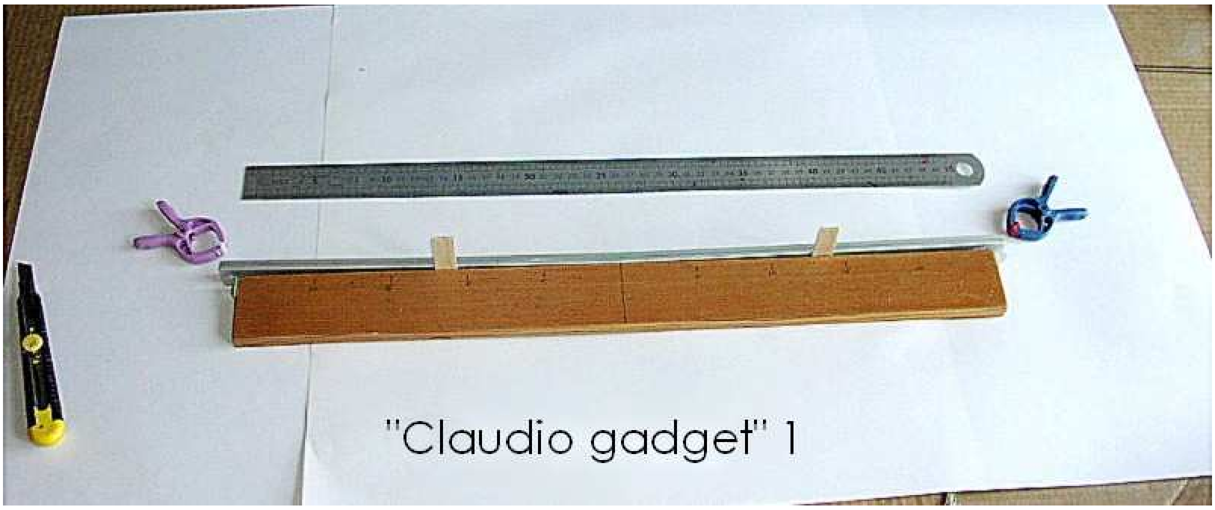
This is the basic "tool" that is briefly discussed here :

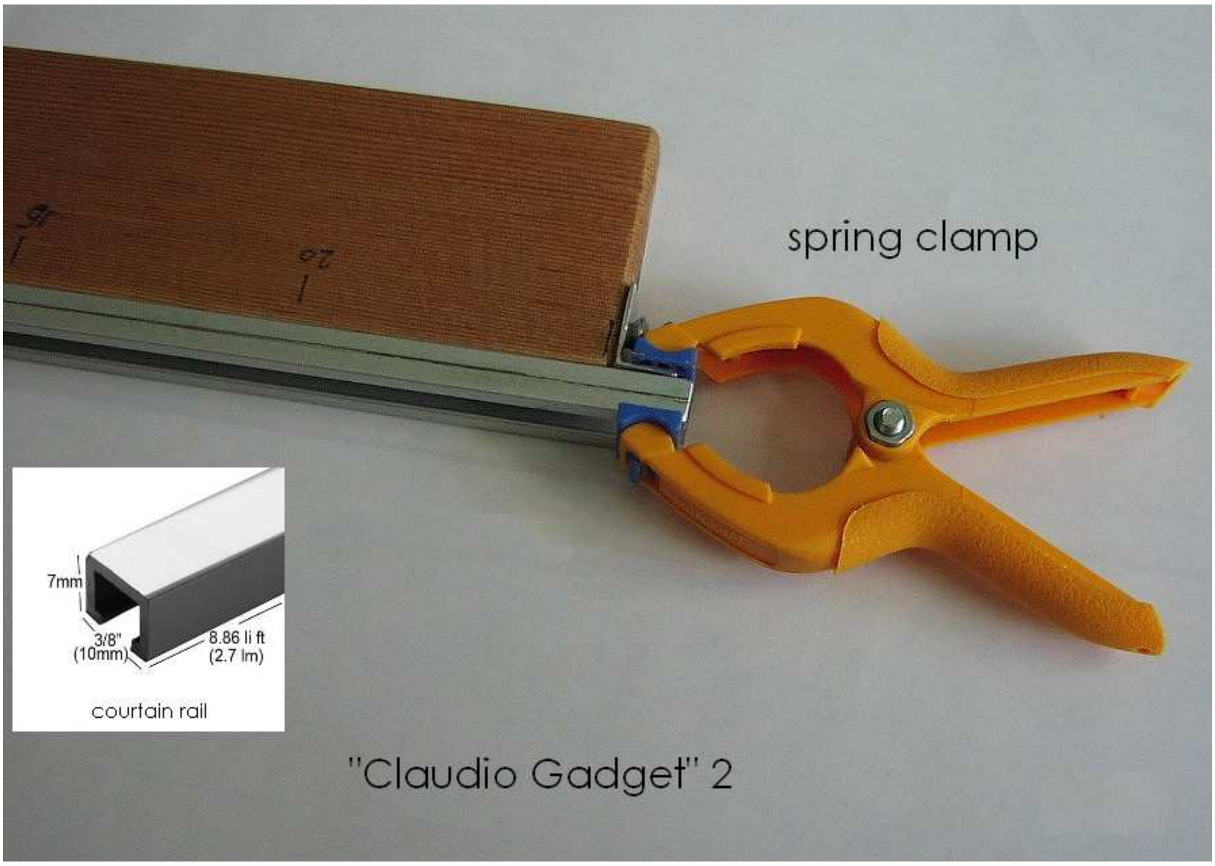
http://www.nonsolovele.com/2013Tecniche.shtml





The Claudio Gadget is actually described later in this book and
on the Web by various persons like Eric Rosenbaum and Ben Morris.
Here some pictures of my original "Gadget":





My Nautical Library

It is through these books I tried to understand sailing techniques applicable to RC Models.

1. Model racing Yacht by Priest & Lewis
2. Principles of Yacht Design by Larsson and Eliasson
3. Design of Sailing Yachts by Gutelle
4. Architecture du Voilier by Gutelle Tome 1
5. Architecture du Voilier by Gutelle Tome 2
6. Les Voiles by Cheret
7. High Performance Sailing by Bethwaite
8. The Sailing Yacht by Baader
9. Yacht Design by Garden
10. Boats with an Open Mind by Bolger
11. 100 Small Boat Rigs by Bolger
12. Sea Sense by Henderson
13. Sailing Yacht Design by Douglas Philips Birt
14. Elements of Yacht Design by Skene
15. Laminated Wood Boat builder by Miller
16. Seaworthiness by Marchaj
17. Model Yacht Radio Control by Reece
18. Capire e Progettare le Barche by Lodigiani
19. America Cup Yacht Design 1851-1986 by Chevalier & Tagland
20. J Class by Chevalier
21. The Gaff Rig Handbook by Leather
22. 6 series books about Sailing Boat Design "Loisirs Nautiques"
23. Model Yachting Magazine by AMYA 4 years issues
24. Chasse Marée Magazine 6 years issues
25. From A Bare Hull by Maté
26. Model Yacht and Model Sailing by Walton
27. Model sailing Yachts by Marshall's
28. Regolazione dell'Albero by Borgströom
29. Sailing Racing Rules – by Code Vagnon Ed. du Plaisancier
30. Restaurer et Entretenir les Bateux en Bois by Ed. Chasse Marée


100 SMALL BOAT RIGS
PHILIP C. BOLGER
100 SMALL BOAT RIGS · BOLGER
DESIGN OF SAILING YACHTS
alain colas
FROM A BARE HULL

My Models

This is the list of my Model Design :

Marblehead Class
Studio 1
Studio 2
Studio 3 (see cover page)
Chine Esterel
1289-M
Azur 8

10 Rater Class
Esterel 10 ND
Esterel Sugar Box

12 Metre Class (Conversion of real boat into Model)
American Eagle
Azzurra
Columbia 1958

J Class (conversion of real boat into Model)
Enterprise
Endeavour
Ranger

Various (Designs outside Rules)
AC33
43-900
Esterel 45”
1.2.3.
FDS-11
Staysail
Tuiga (conversion of real boat into Model)
UFO 22 (conversion of real boat into Model)
UFO 28 (conversion of real boat into Model)
Delta Rig
65-Cat

AC Models (new designs or inspired to America Cup boats)
AC100 (5 conversions to RC Models: A, B, C, D, U)
AC120 (16 conversions to RC Models : Alinghi, China Team, America 3, Areva, Desafio, BlackMagic, Luna Rossa, Mascalzone Latino, NZL20, Oracle, TNZ, Victory, Young America,
AC130

RG 65 Class
CD-65
Esterel 65
Fuxia 65
Trap 65
65-CAT

IOM Class
Wild
IOM-ND
Lazy

Footy Class
Footy Esterel
Futinett

Guinness Record (Smallest 2Chanels RC model)
Mini Freccia & Servos

Servos
Modified HS725BB
Modified micro servo LS-3 for Mini-Freccia (Guinness)
My plans will be listed at the end of this book as PDF prints, but short discussion and some project drawings are presented here for the analysis purpose.
International Radio Sailing Association is ruling some RC Model Classes, while other RC Models comply with National Class Rules.

Class M

Rules Short List

Mast height	2160mm
Hull LOA	min. 1275mm - max. 1290 mm
Hull Beam	min. 100mm
Sail Area	0.5161m²
Dept	max 660mm

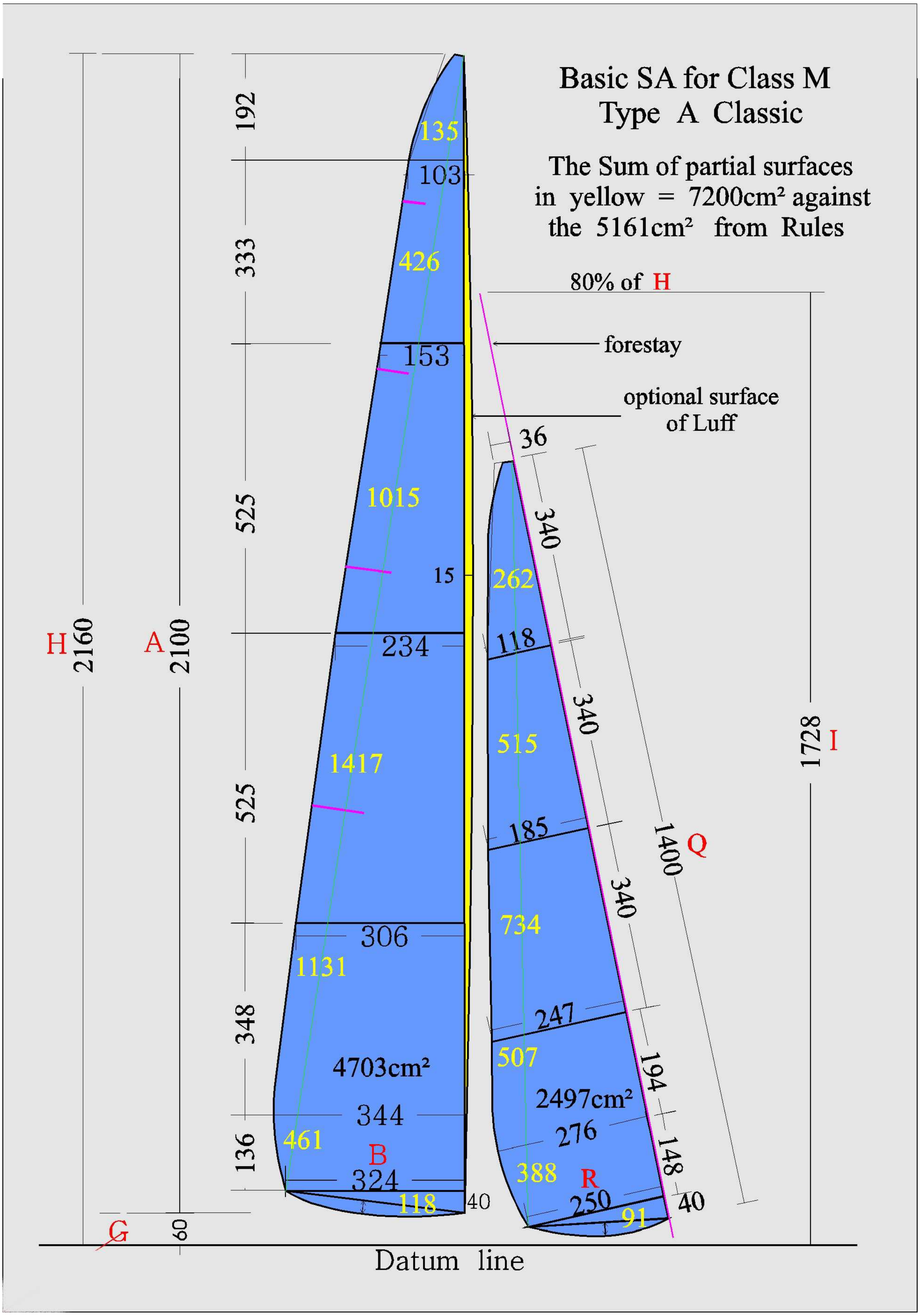
Interesting from design point of view since no limitations are imposed for the Displacement as well for the max Beam and hull Draft.
Further, according to the sail's formulation, the real Sail Area can be 7200cm².

Class M - Data for Rig & Sail Surface distribution							
RIG		A*	B*	C	C1	C2	B1
Total surface		0.5161 m^2	0.5161 m^2	0.4900 m^2	0.4200 m^2	0.3500 m^2	0.2800 m^2
Jib %	Classic	36	38	40	43	46	50
	Swing Rig	22	25	26.5	28	29	30
Main Luff in mm	from	2120 **	1900	1700	1450	1200	1000
	to	1900	1700	1450	1200	1000	800
Jib Luff in mm	from	1150	1050	950	850	750	700
	to	1200	1100	1050	1000	900	800

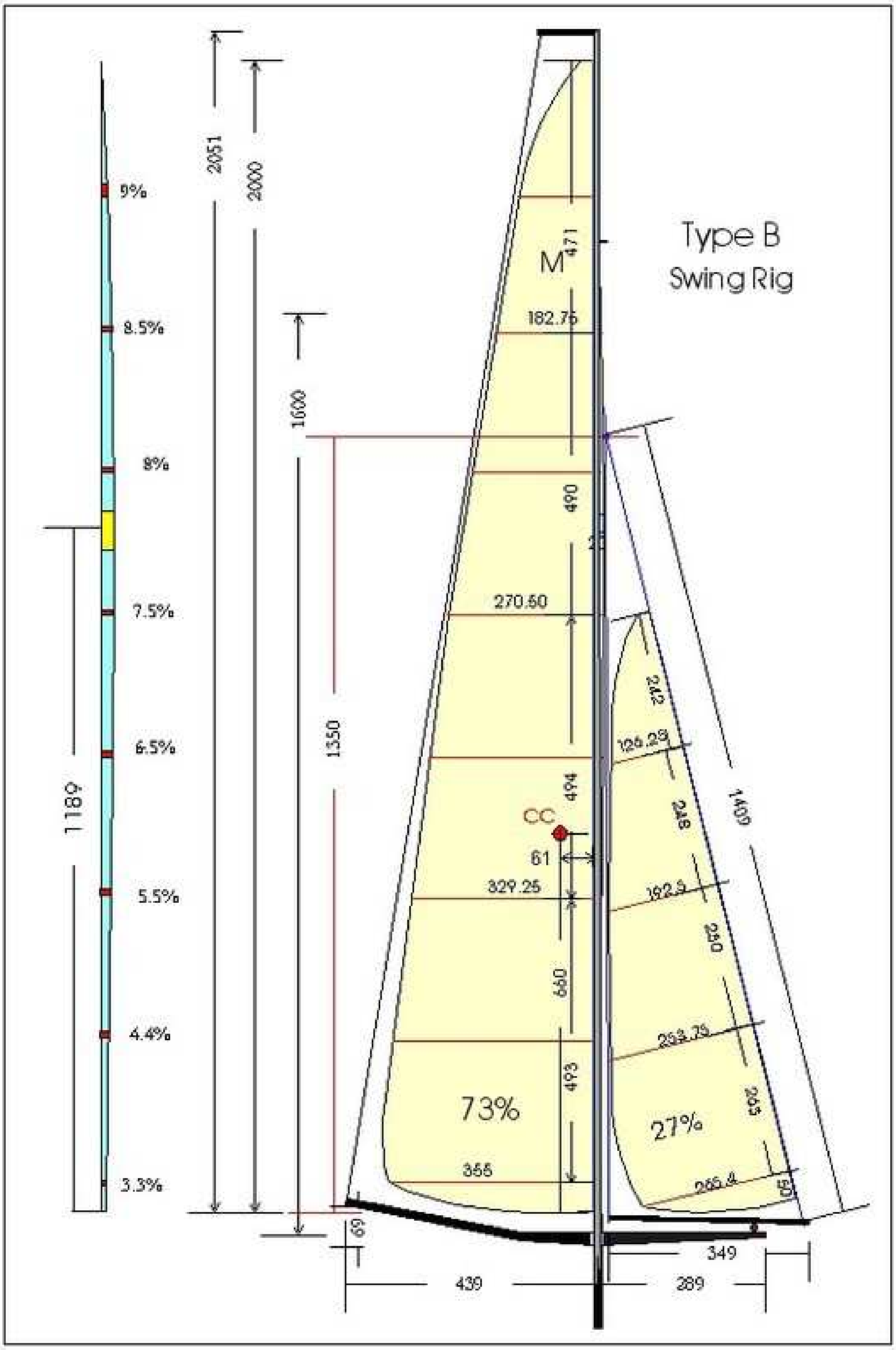
* 0.516128 m^2 = (as per Marblehead) 800 $inches^2$

** Swing Rig Only

Class M Rig dimensioning
Example of Classic Sail Plan type A



Example of Swing Rig Plan type B



My first “modern contact” with RC Models started with the Marblehead Class, a beautiful model with a rather tall Rig.

My first Model was Studio-1, which could not be different since was studying Naval Architecture.
A year before in 2003 I met at the YCC in Cannes a brand new Dragon made in Germany, the Hull was made with laminated wood, I was astonished by the beauty of that hull.

This picture shows part of my Lab

When studying the constructional method I believed in the exceptional solid characteristics offered by that method.
Later I discovered that the glue adhesive was adding too much weight.
Probably I did not found the right method for bonding

This was my first trial with Strip-planking technique using mahogany veneer of 0.6mm.

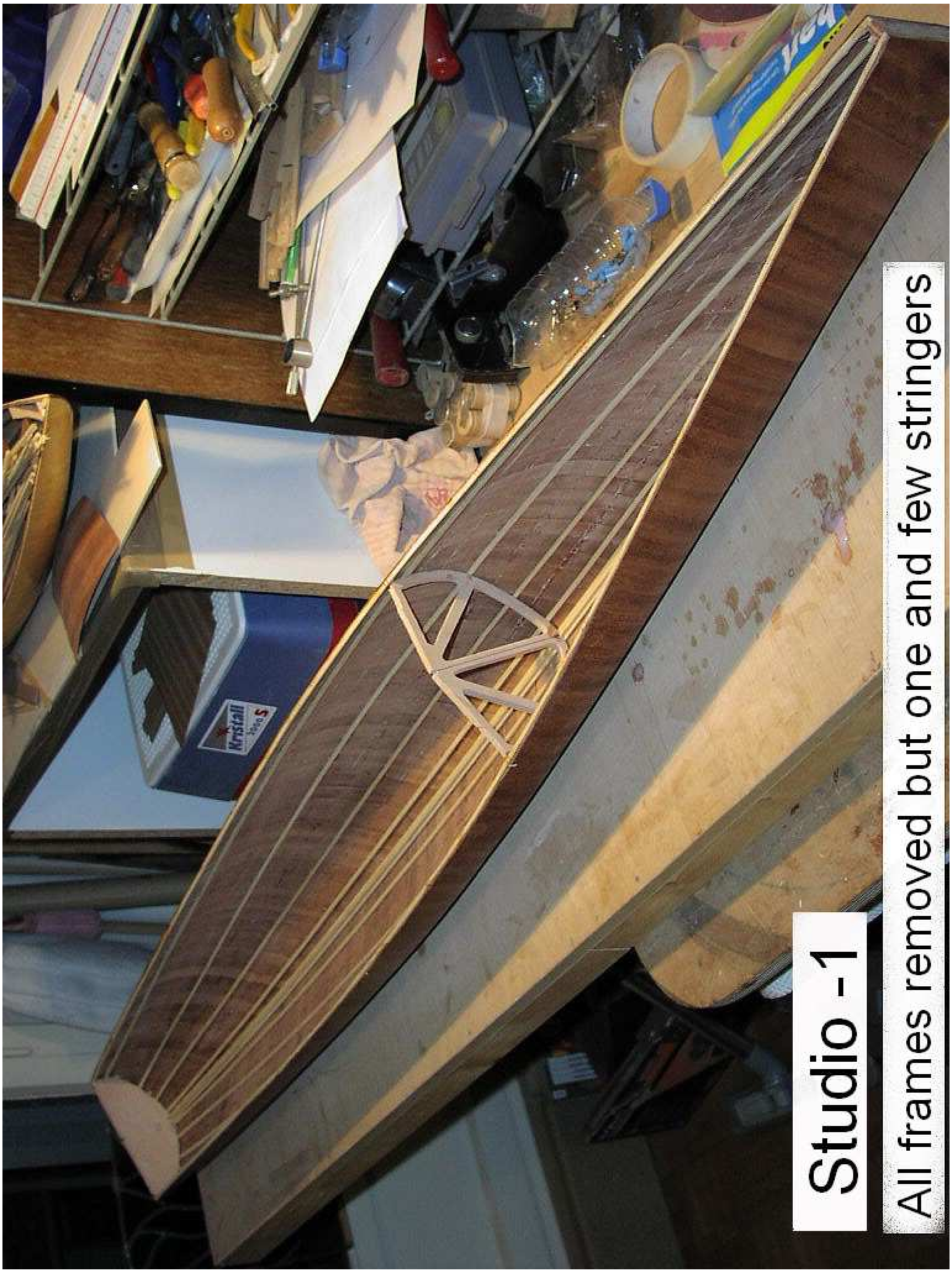
Studio-1

Was almost a disaster in terms of weight since the hull alone weighed 1035g.

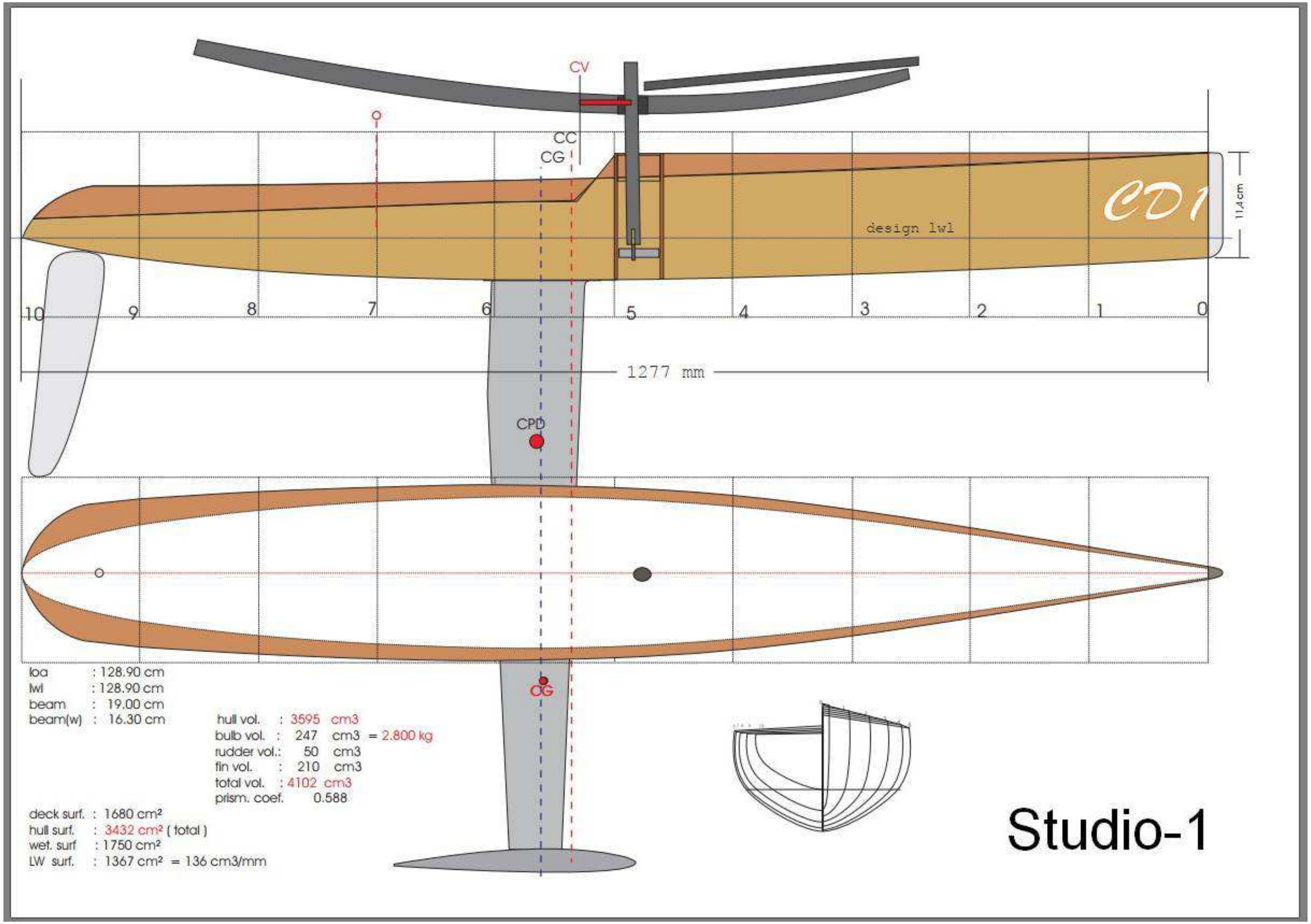
The major contributor was the glue used being the UHU Hart.
The total weight was 4460g and the waterline was moved up by 2.5mm putting the waterline out of specifications.
It became clear that the technique of strip-planking was not providing the expected performances unless the bonding process was revised.

Studio-1 was a nice looking model, but a failure as an RC Model!

It was necessary to go back to the Drawing table alias my PC screen!



Nice looking hull construction but poor performer!


CV
CC
CG
CD1
design lwl
11,4 cm
10
9
8
7
6
5
4
3
2
1
0
1277 mm
CPD
CG
loa : 128.90 cm
lwl : 128.90 cm
beam : 19.00 cm
beam(w) : 16.30 cm
hull vol. : 3595 cm3
bulb vol. : 247 cm3 = 2.800 kg
rudder vol.: 50 cm3
fin vol. : 210 cm3
total vol. : 4102 cm3
prism. coef. 0.588
deck surf. : 1680 cm²
hull surf. : 3432 cm² (total)
wet. surf : 1750 cm²
LW surf. : 1367 cm² = 136 cm3/mm
Studio-1

Having missed the construction method with Strip Planking technique I started manufacturing a series of composite material samples in order to verify their strengths and weight per dm².

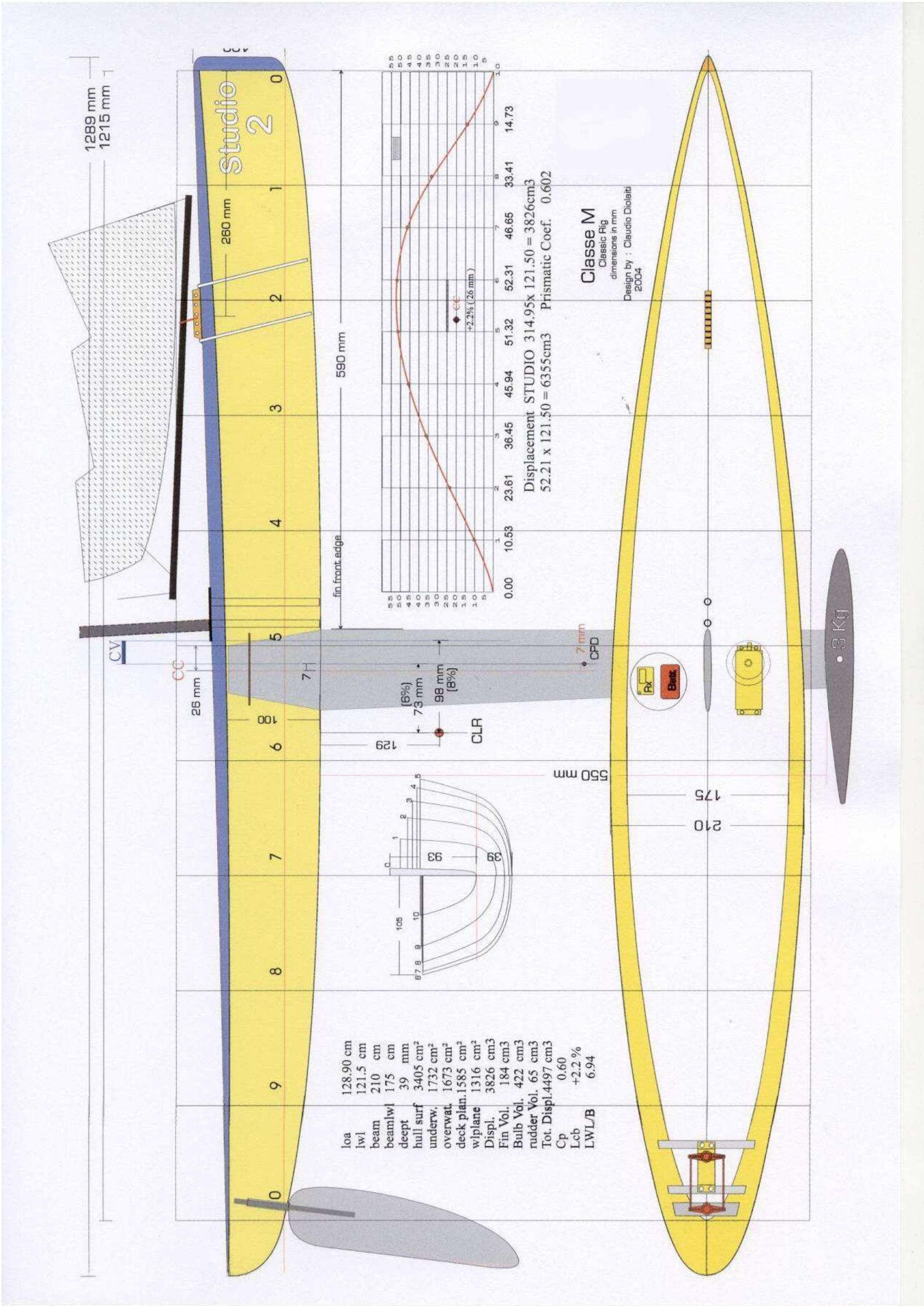
These pictures are showing some of the samples produced, each one is 10x10cm = 1 dm²

Balsa samples with relative weight per dm²

I tried a different combination of tissues to make the new Class M (Marblehead) hull of 1290mm LOA using 3 layers of Fiberglass tissue of 105g/m² or with 2 layers of Carbon tissue of 93gr/m² + 1 layer of Kevlar tissue of 63gr/m².
Decided for Carbon-Kevlar-Carbon sandwich
Kevlar was introduced to compensate the Carbon fragility against shock while Kevlar is very strong
Epoxy resin being the bonding compound.
It may be a "standard" for my future design, although 3 layers of 80g/m² of glass tissue are not abandoned

This plan called "Studio 2", introduced a round stern, an imported idea from northern concept design like Nauticat or Fischer boats.
I was reading that this stern was behaving better with rough waves.
The Water Plan was a symmetric one after reading the Model Racing Yacht book of Priest & Lewis edited in 1954.

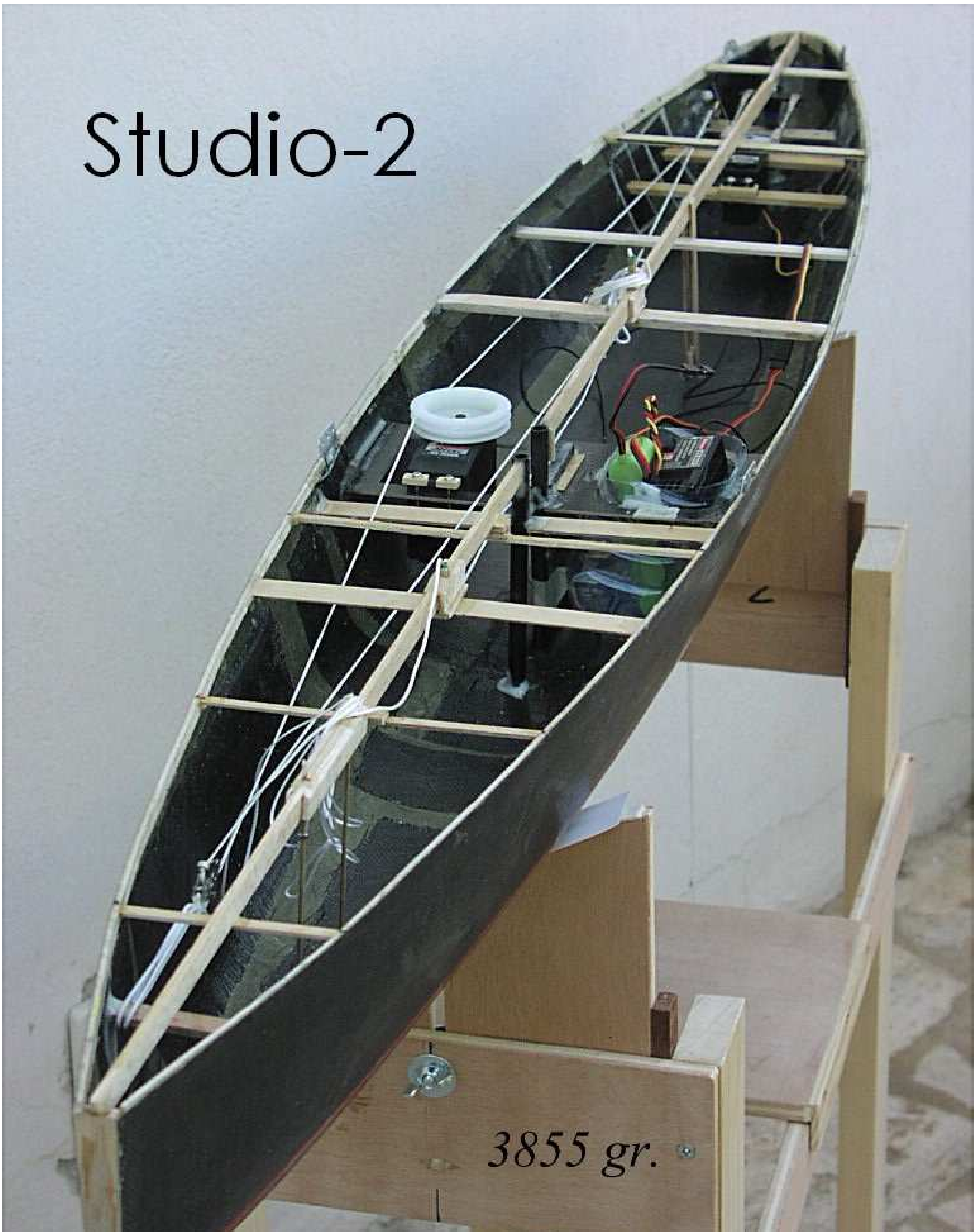
Drawn a new plan called **Studio-2**

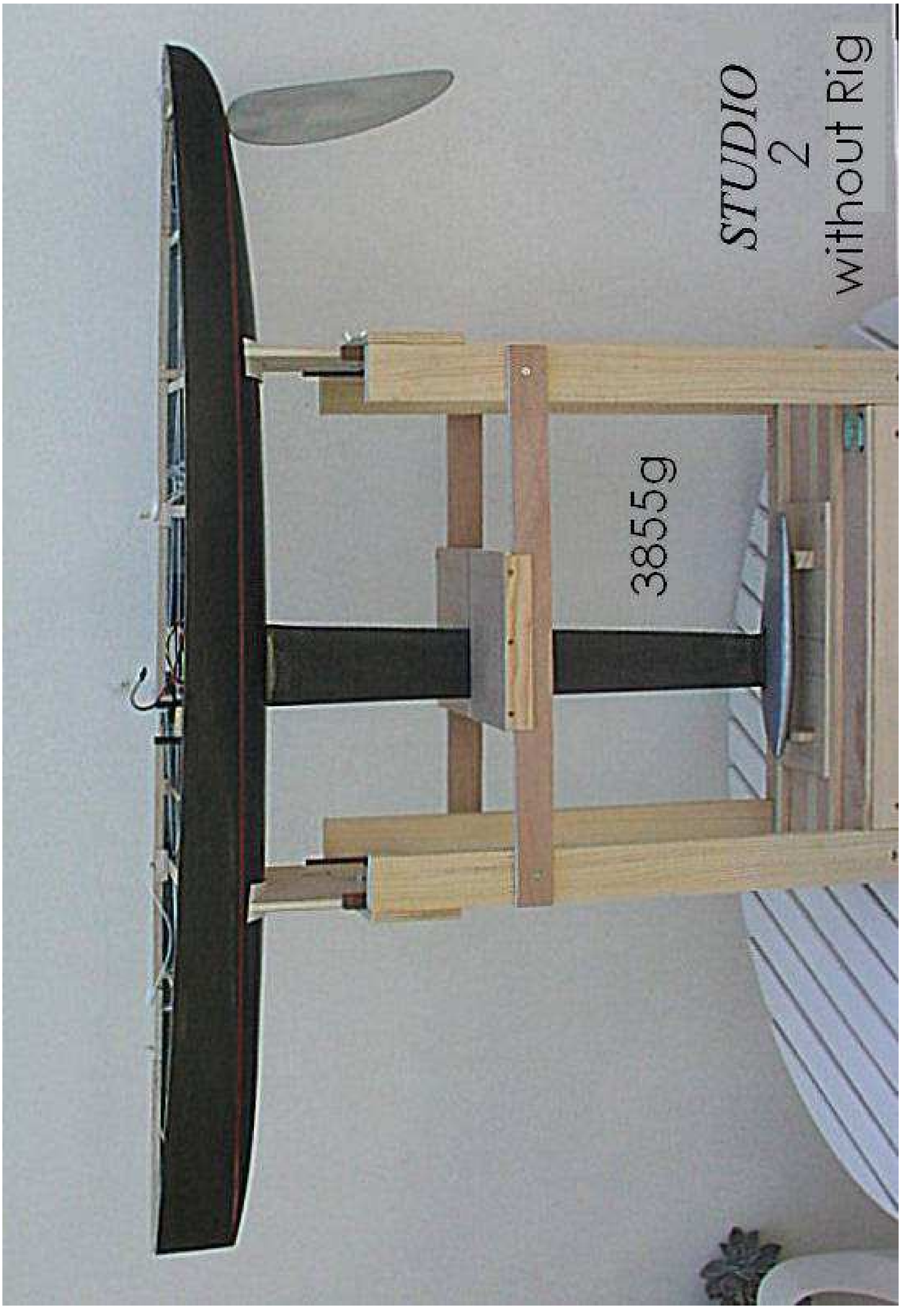


Some of the pictures taken during construction:

This hull appeared too soft and therefore some reinforcements where introduced

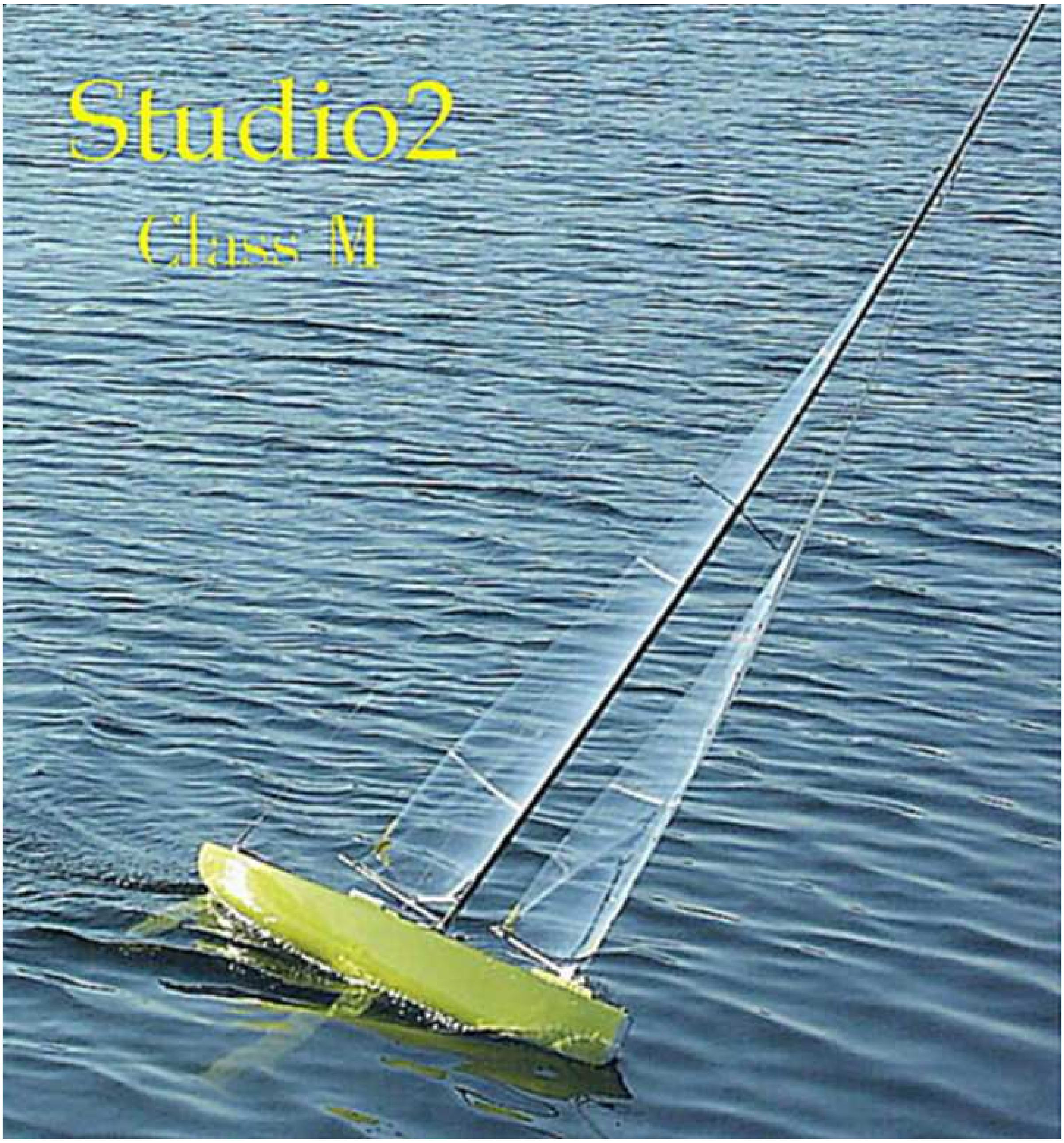
Open view of the Studio 2 servos integration





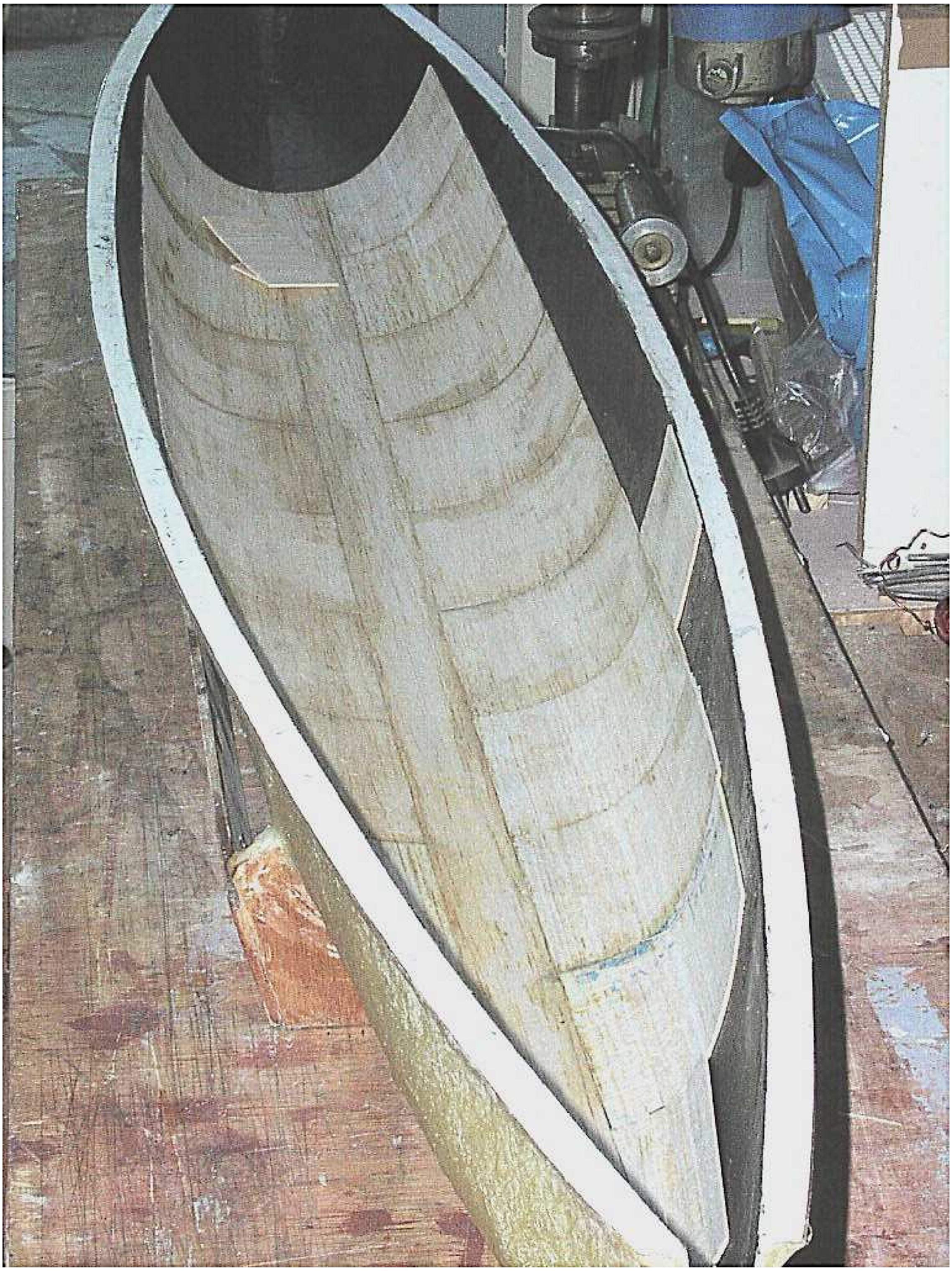
Studio 2 Fin Box centring and bonding before deck integration

Finally Studio 2 reached the water!



The sailing performances were rather good since the expert skipper managed to win two races under medium wind conditions.
Here the experimental sails made with transparent flower packaging film.
This model was weighting about 4266gr, still too heavy for what I was aiming : 4000g !

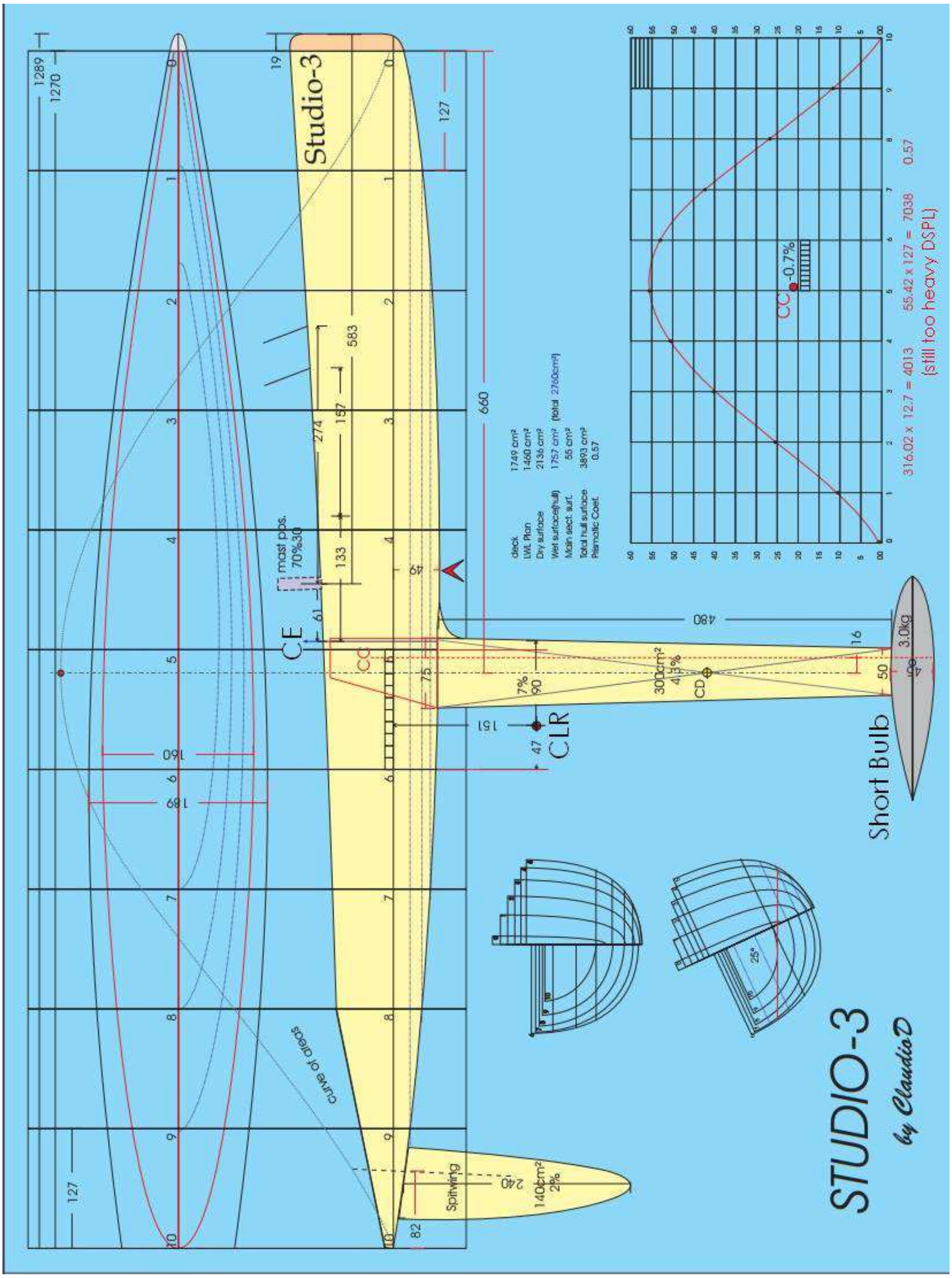
I have experimenting other constructional techniques like the carbon-Balsa-carbon tissue sandwich as well a combination of Kevlar tissue and Aramid Nomex Honeycom 3mm.



The initial idea was to obtain a rigid and light Hull...
I got two consecutive "failures"!
Honeycomb des-bonded probably because the vacuum was not used!

Studio 2 female mold was offered to my Club in Milan, but I do not have any records that this mold was then used to produce Class M hulls.

Studio 3   - an experimental Model



This is my third Class M model and again an experimental design.

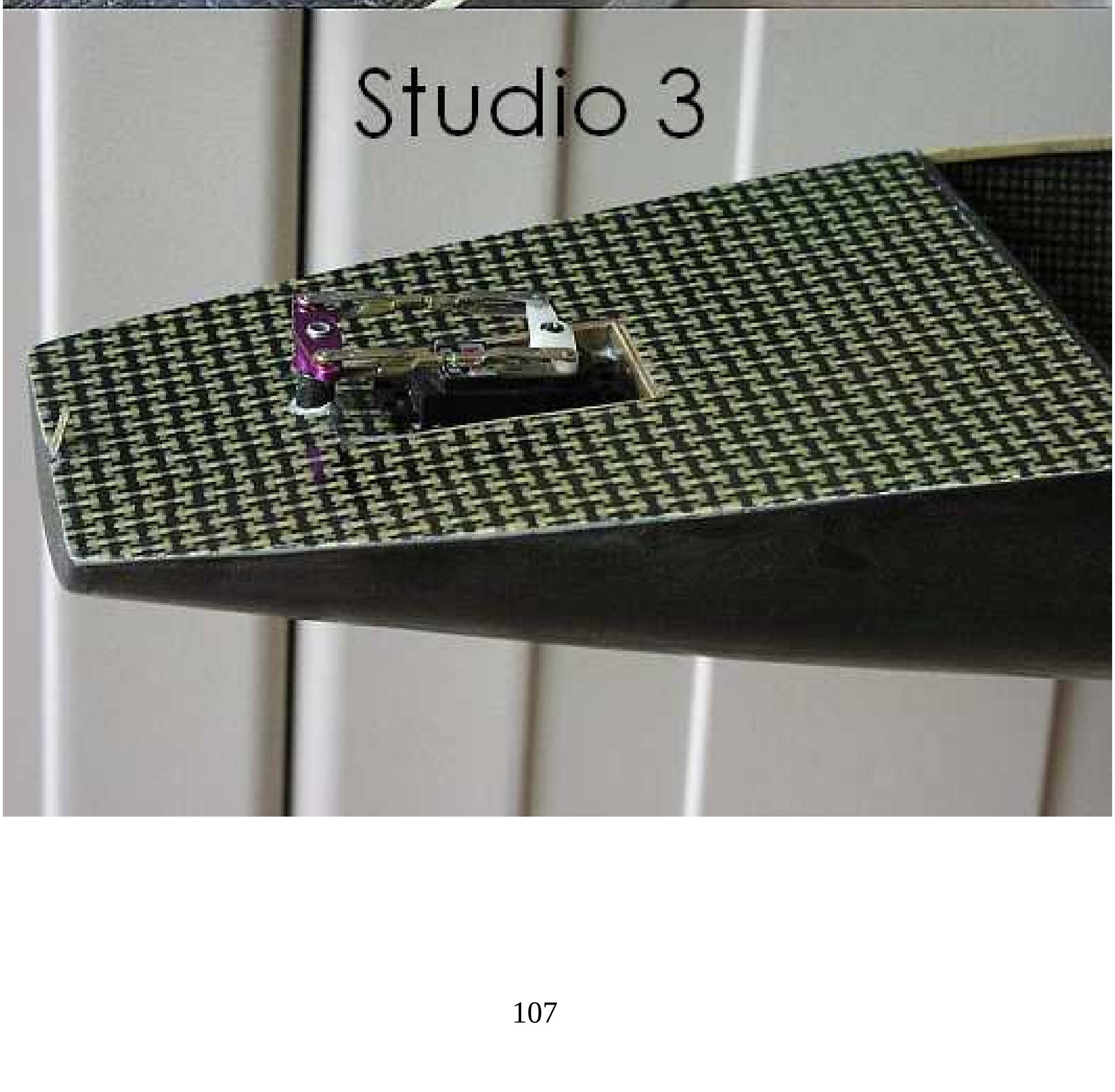

Studio3

Studio3

During Master construction

Studio 3 construction continued

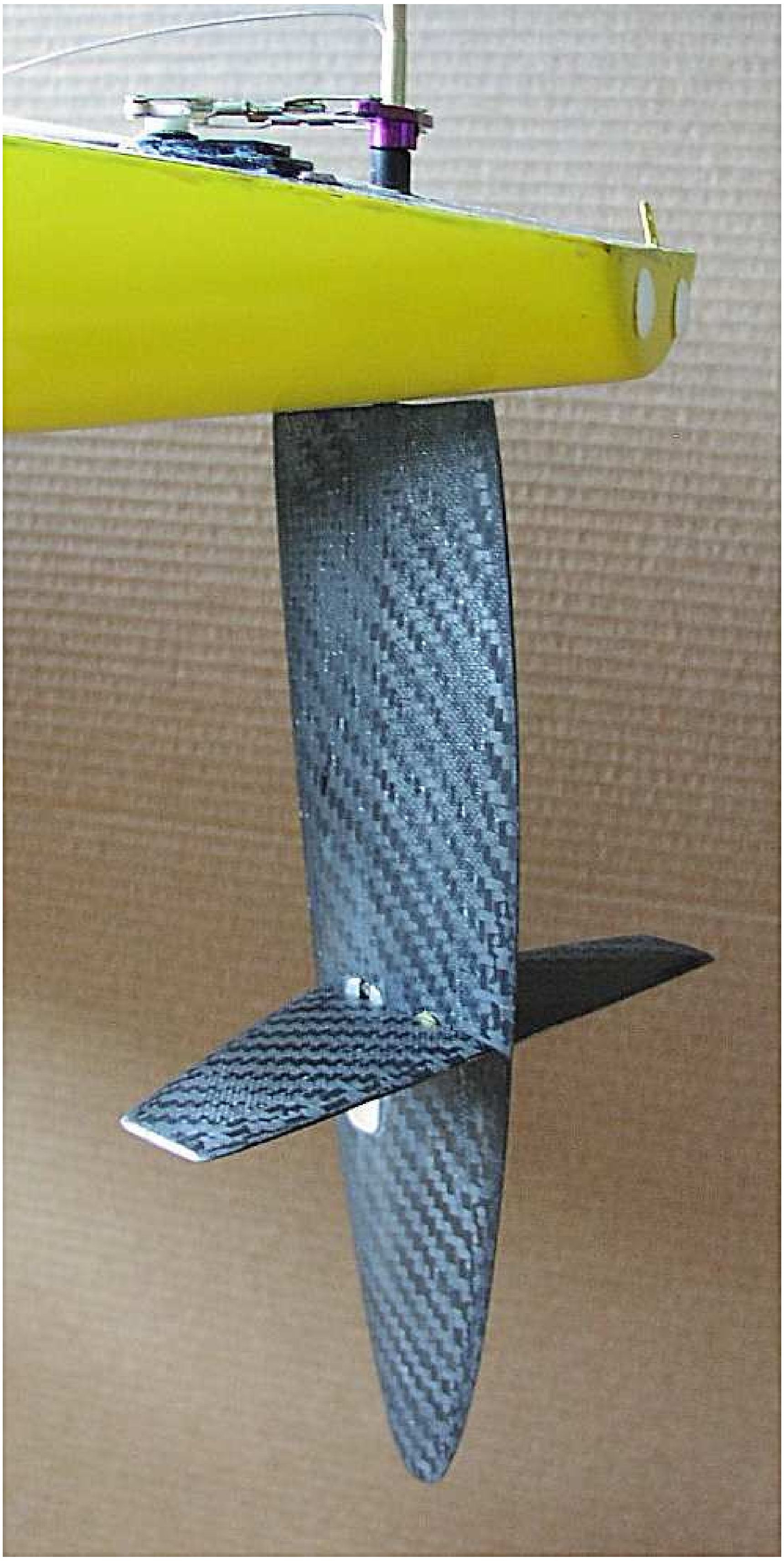

1
2
3


Studio 3

The Rudder axis is a tube.
Inside is supposed to pass the string pulling the Foils

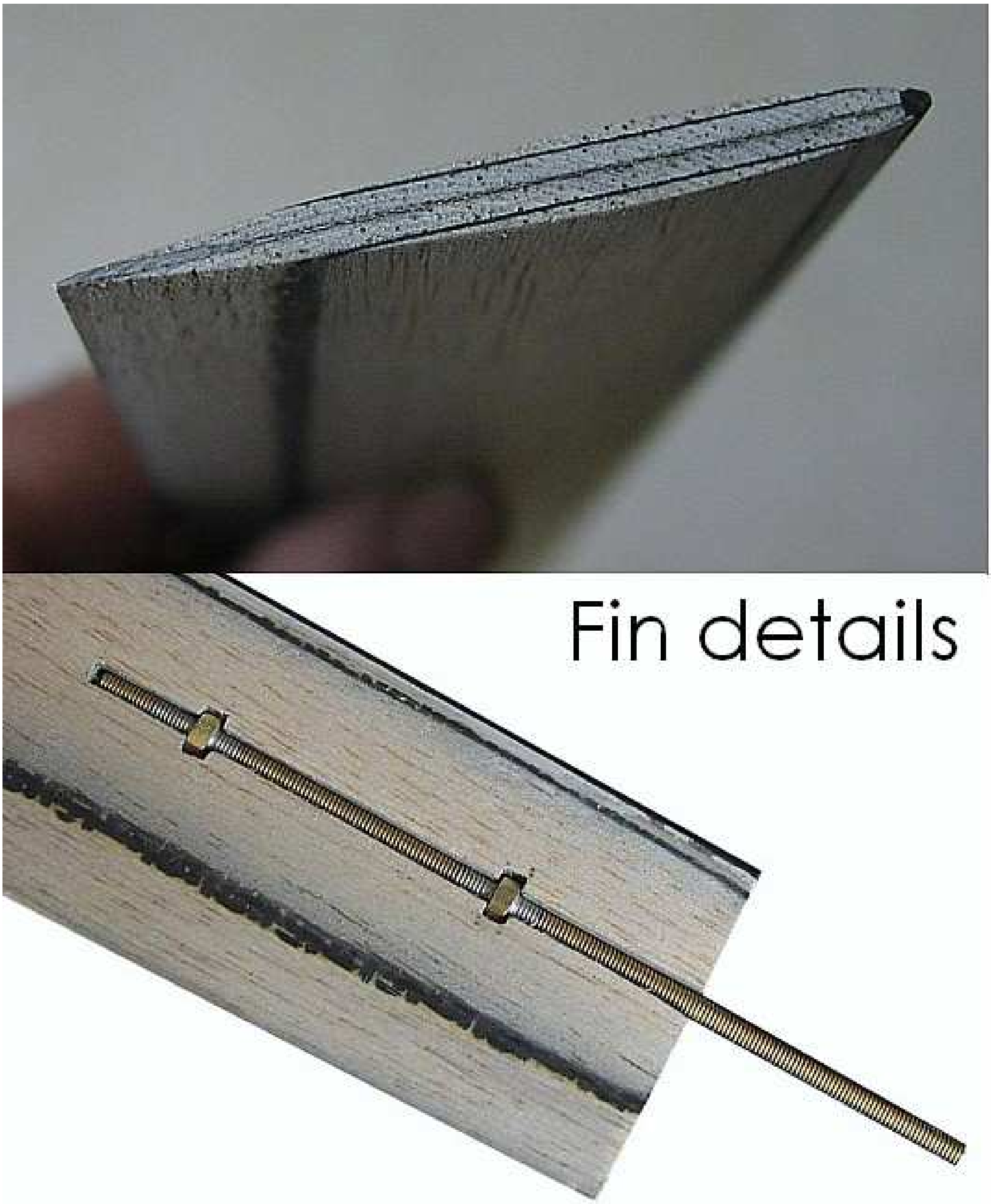
This is how I designed the coaxial pull

Another experiment!   Rudder with adjustable Foil



The foils

Studio 3 Fin construction

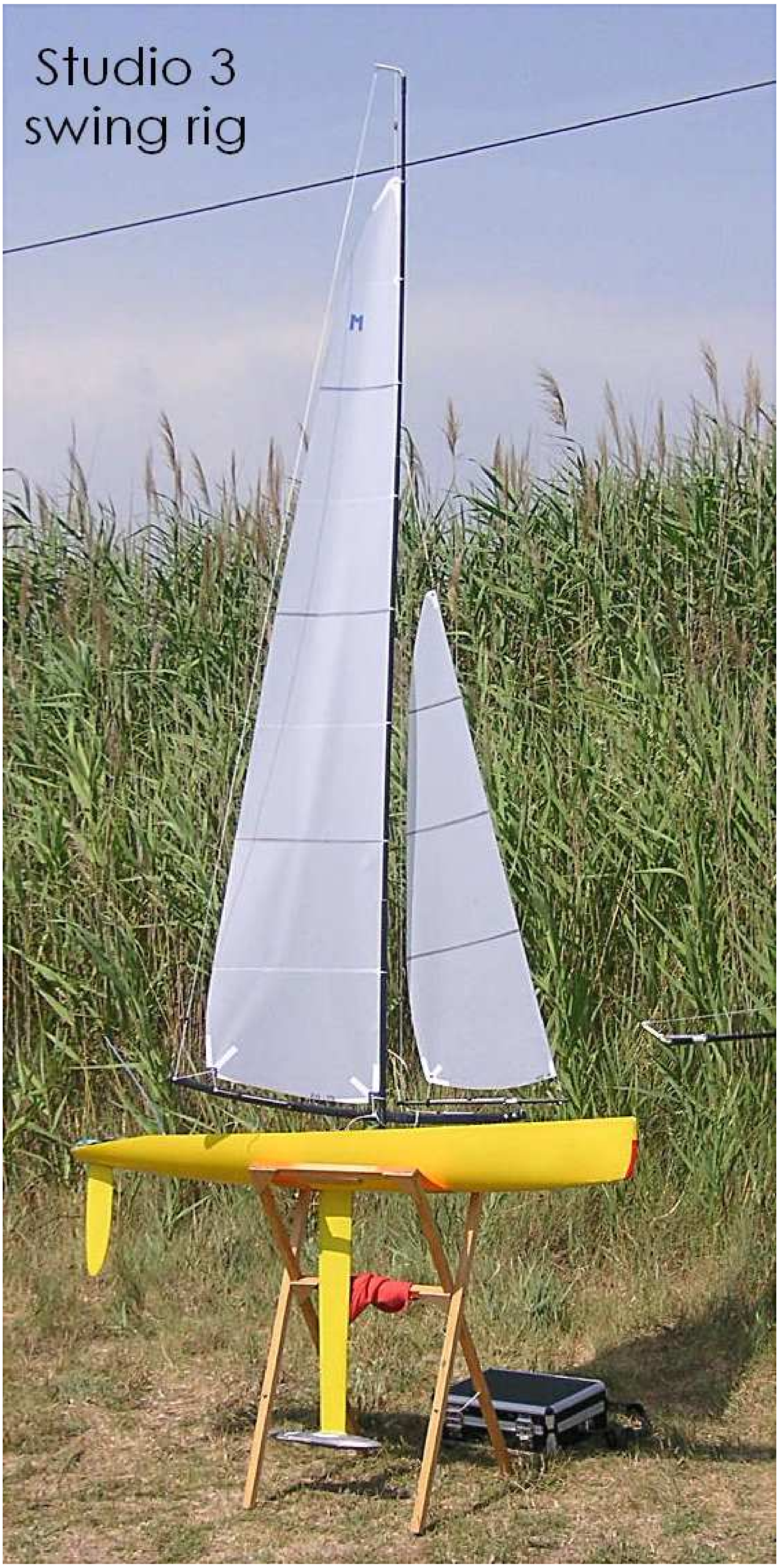



Studio 3

While overtaking a Margo with Rig type B

Studio 3 Running

Almost non wind !


Studio 3
swing rig

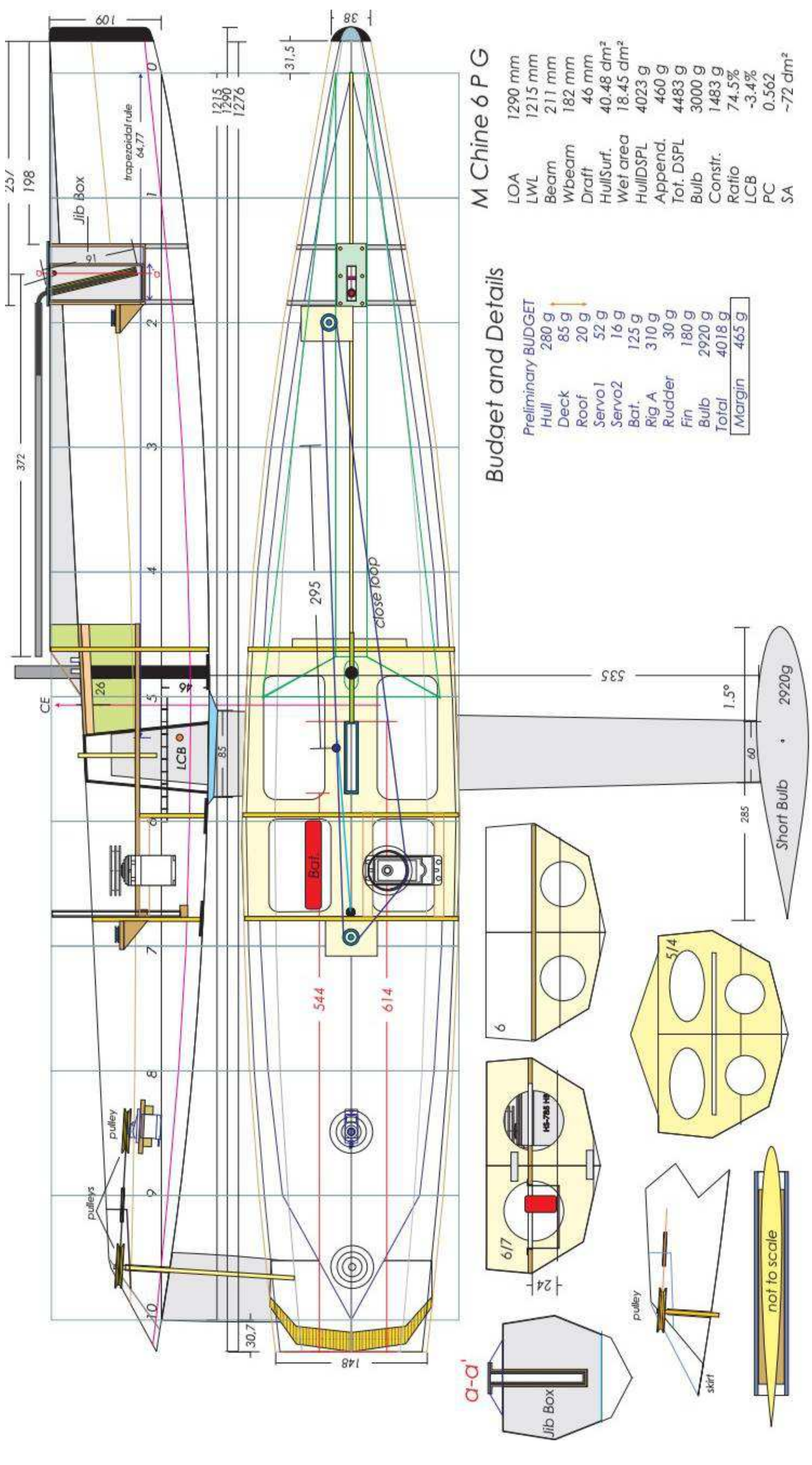
The Studio 3 proved to be a fast model, therefore I considered that this project was another exercise to improve my design and construction technique.

Studio 3 revealed nevertheless a final weight close to 4300g

Actually, it is resting in my garage.

Still considering that the lighter boat will be the faster being all other parameters the same, a new design should take place in the future including narrow deck configuration.
I recall that this option was the answer to an Off-Shore Rule that penalized wide beams.
Modellers found out that, in spite of that restriction, the Model hulls were offering better directional stability with also some gains on the weight (narrow beam).

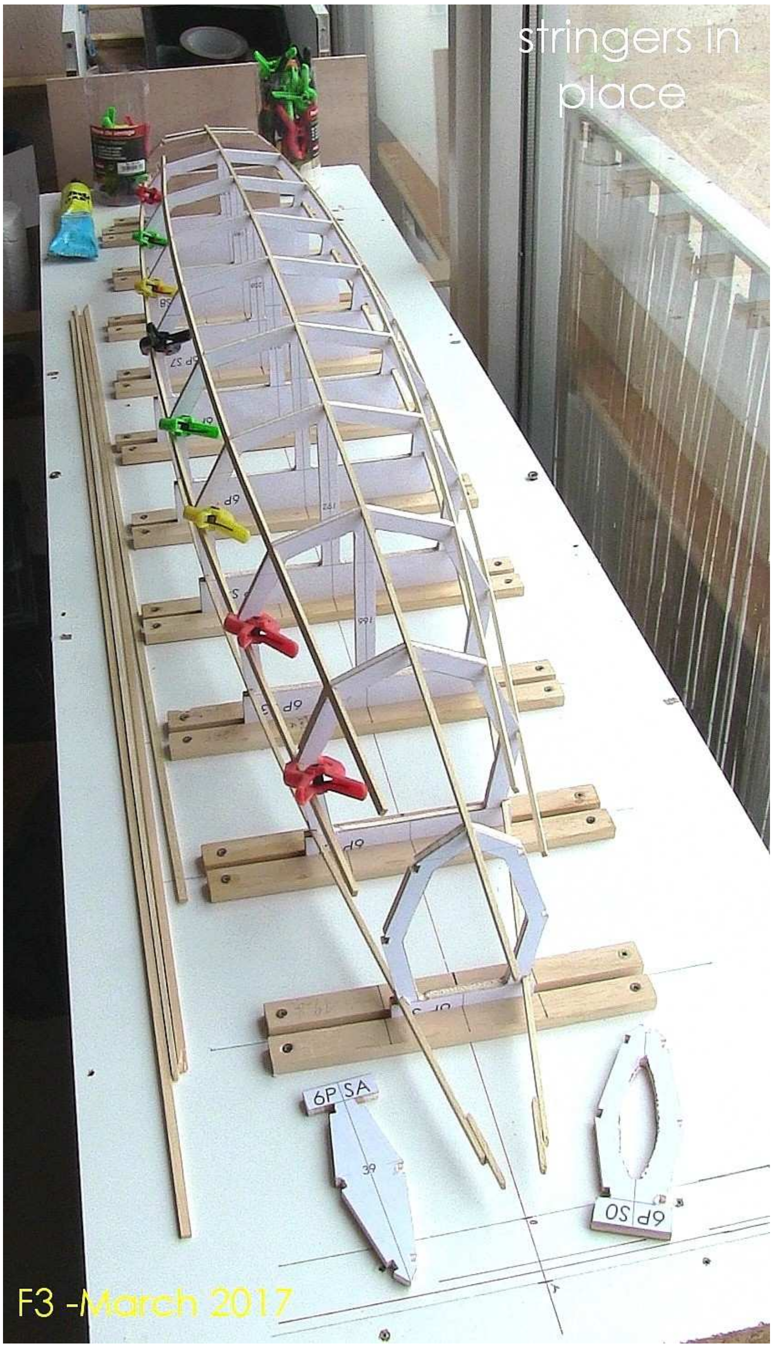
M Chine - 6 panels Hull



I do have designed another Class M that I called M Chine 6

This model was initiated after reading an article about the benefits of a chine hull.

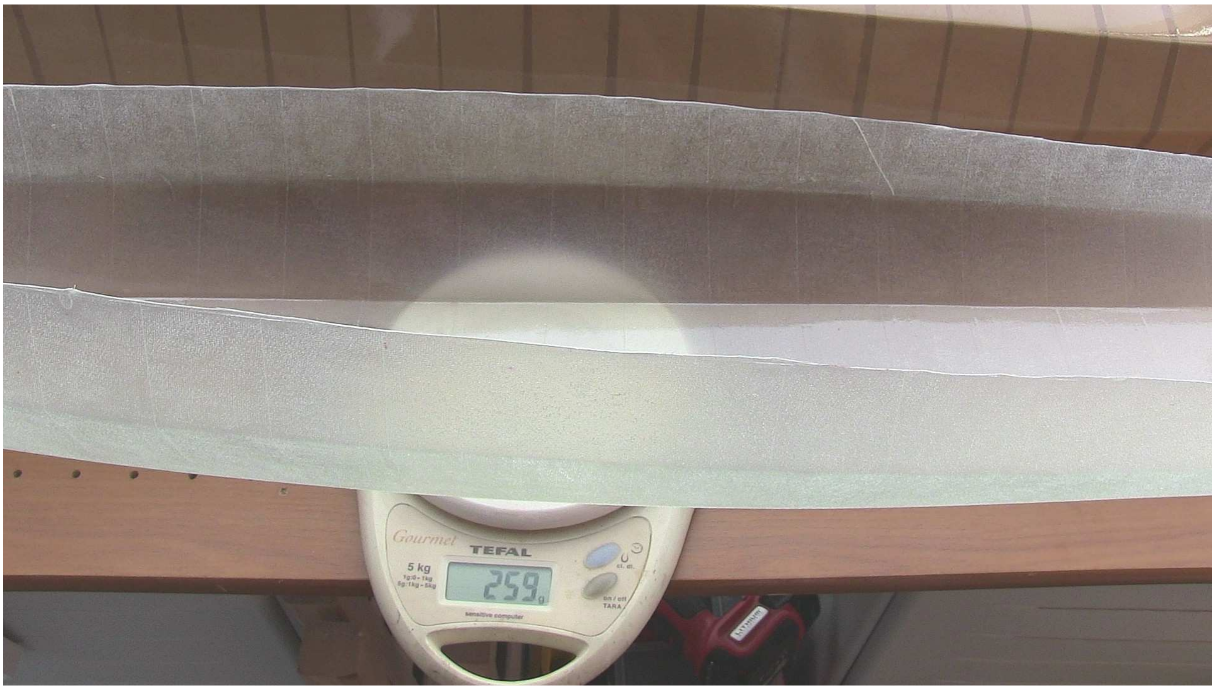
Classical construction with shadows and balsa panels to make the Master



The Master

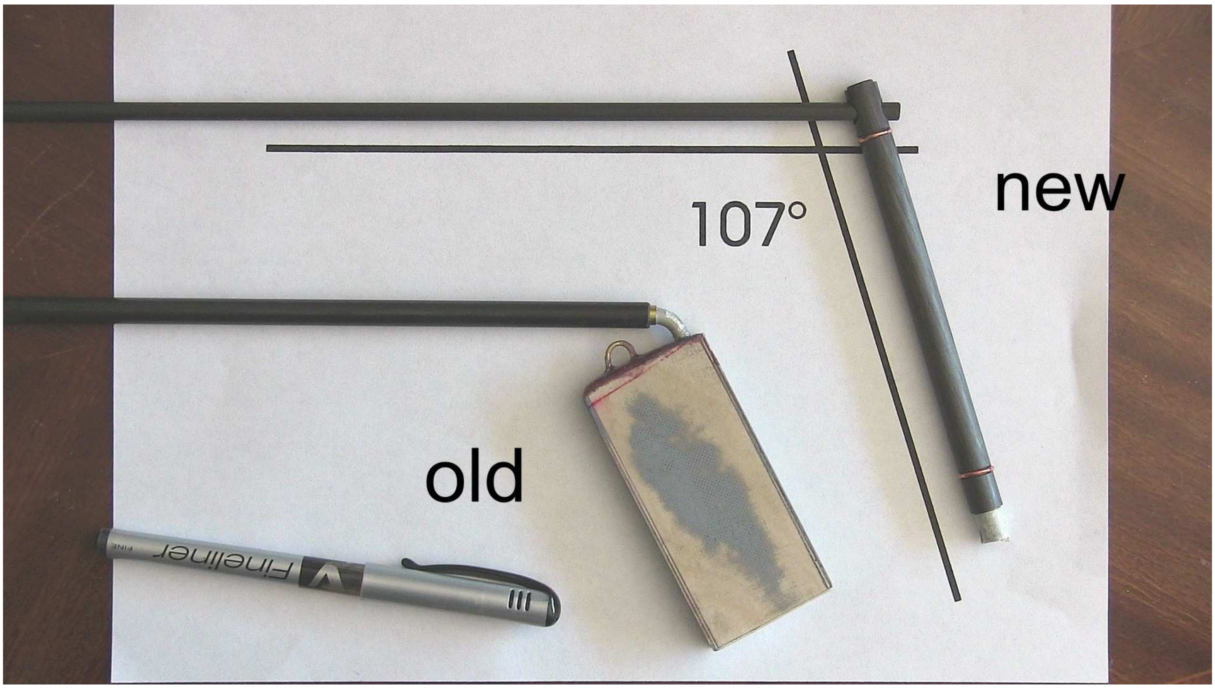
Master covered with Packing Tape

Just de-moulded

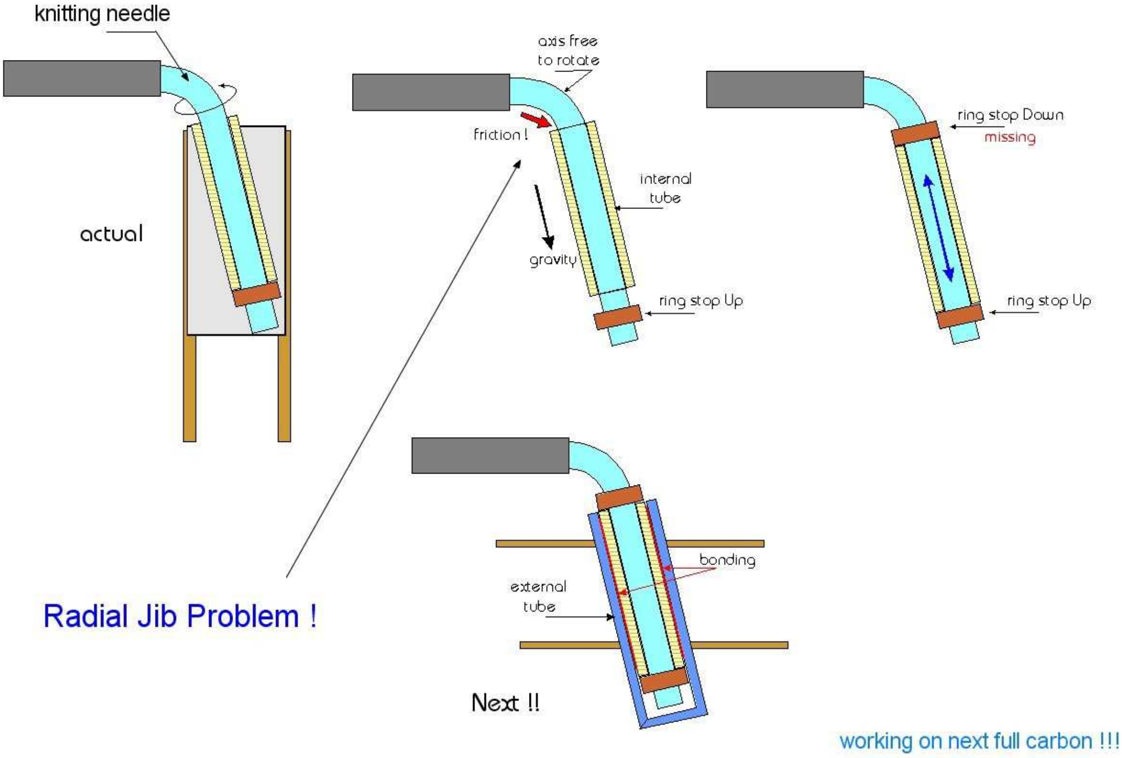


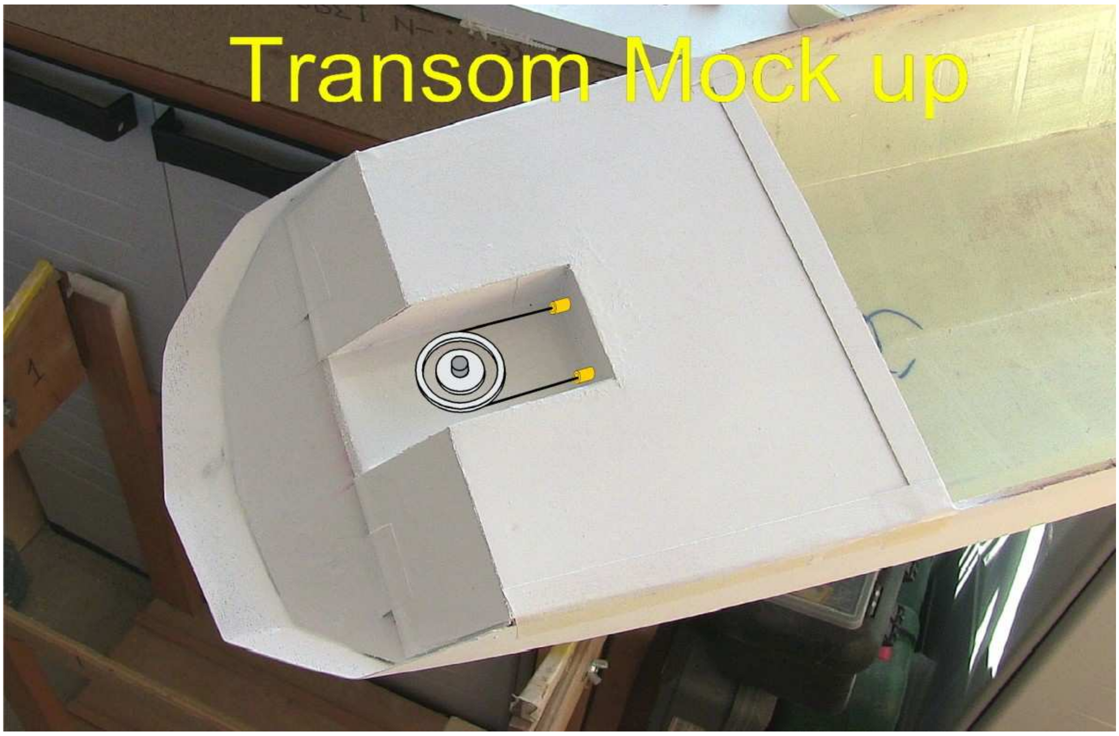
Finished Hull weight 259g

The idea is to make use of a Radial Jib Boom



The old one revealed to be too heavy.
The New one needs more thinking about interchangeability!





M Chine 6 panels still under construction

RG65

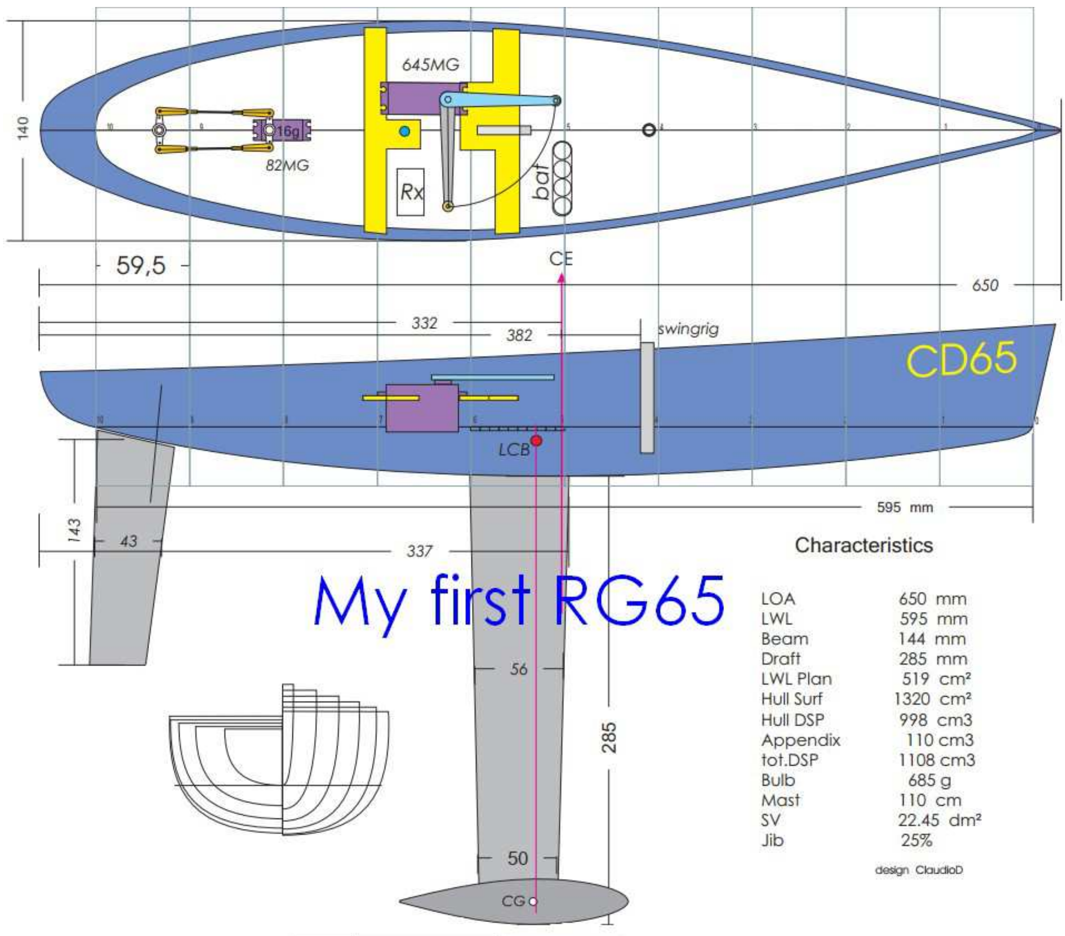
Rules short List:

LOA	650mm +/- 0.5
Rig height	110cm max
Sail Area	2250 cm^2 max

RG65 was a nice discovery when I met Pascal Delapiere in Nice.
We were not living far away from each other.
Pascal was recently returned to France from South America where it became familiar with the RG65 Models.

http://navi.modelisme.com/article286.html

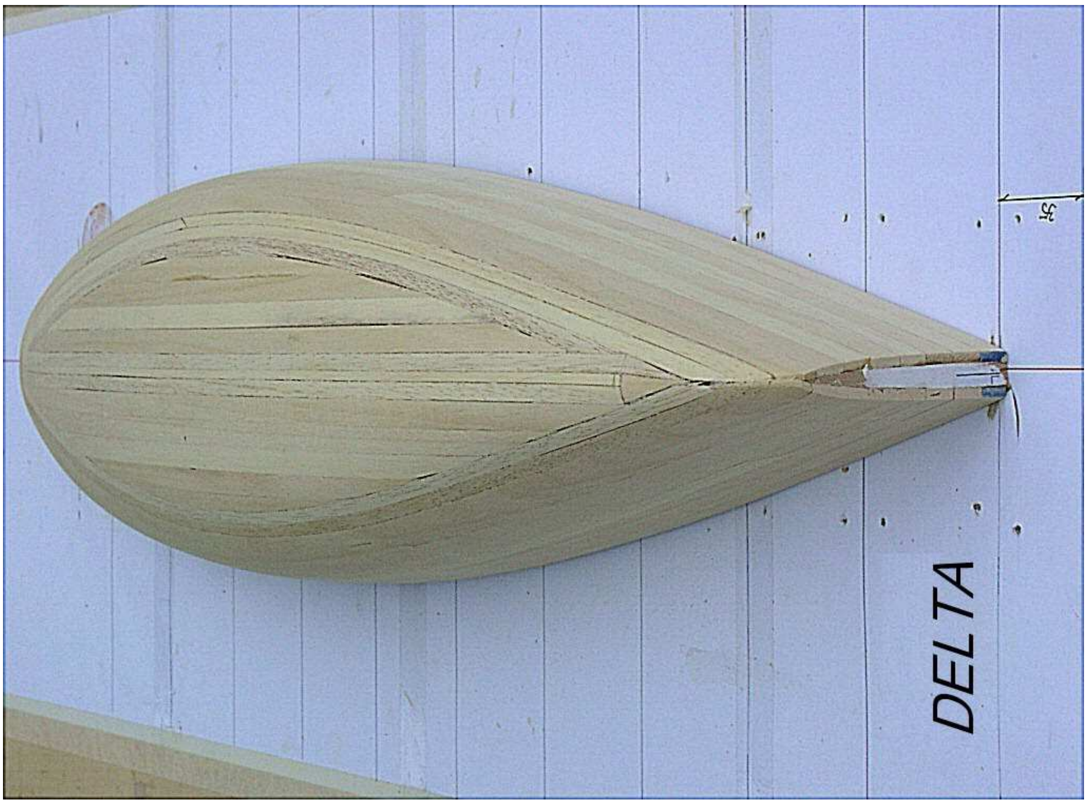
Probably was him that introduced in 2005 that Class for the first time in France.
Easy design and development model at reasonable costs.
An excellent "test bench" from my point of view.
I was really curious about RG65 and started to design some hulls.
The first CD65 with an "L" shaped Fin did not sail as I was expecting.
The problem was the centering, solved with the Bulb reposition in the "T" configuration.
My first model was sailing as most major size models and did not appear to suffer from the wavelets and was responnding well to the sails a rudder adjustments.



As wrote, for me was supposed to be a "Test Laboratory"

I started with the CD65 Model, hereunder, a series of images referring to RG65 modeling.

I use images since more talkative then words and less spelling errors:



Several paint layers used, aiming to get best finish for the mold fabrication

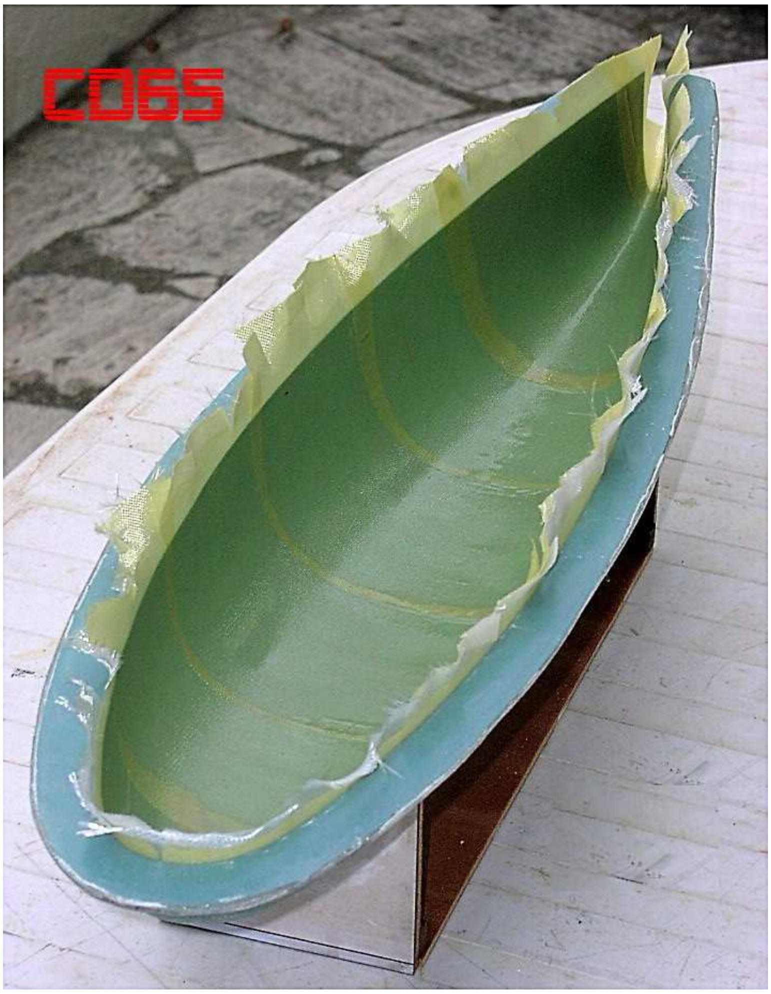
Ready to start the Mold construction

After 9 layers of fiberglass-epoxy of 200g/m²

Detail of bow cutout


CD65
Mold


kevlar & glass
73 & 80
g/m²
66.70


CD65


CD65

Main boom with Park Avenue simulation !

This series of pictures are describing my first RG65 design.
The model proved also to be very fast as such to reach the critical speed where the generated wave was initiated at the Bow and terminated at the Stern


CD65

Collision route or priority matter?

CD5 proved to be a very satisfactory Design.

The Delta Rig

Rules Short List

New experimental RC Model
Mono-hull RG65
Mono-sail
Mast After height 1100 cm
Sail Area 2250cm²

The idea to develop, at model level, this type of Rig initiated when reading the Philips Bolger book:

"Boats with an Open Mind"

Philips encouraged me to go ahead with the modeling of the "Staysail" design.
The real-scale boat apparently, as reported, was planning rather well.

This design was developed in 1922.
It was so good that the builder decided to hide it to avoid that already placed order would be canceled in favor of the Staysail boat.,

Series production was, nevertheless, finding technological difficulties as the Mast rig supports and Hull strength.

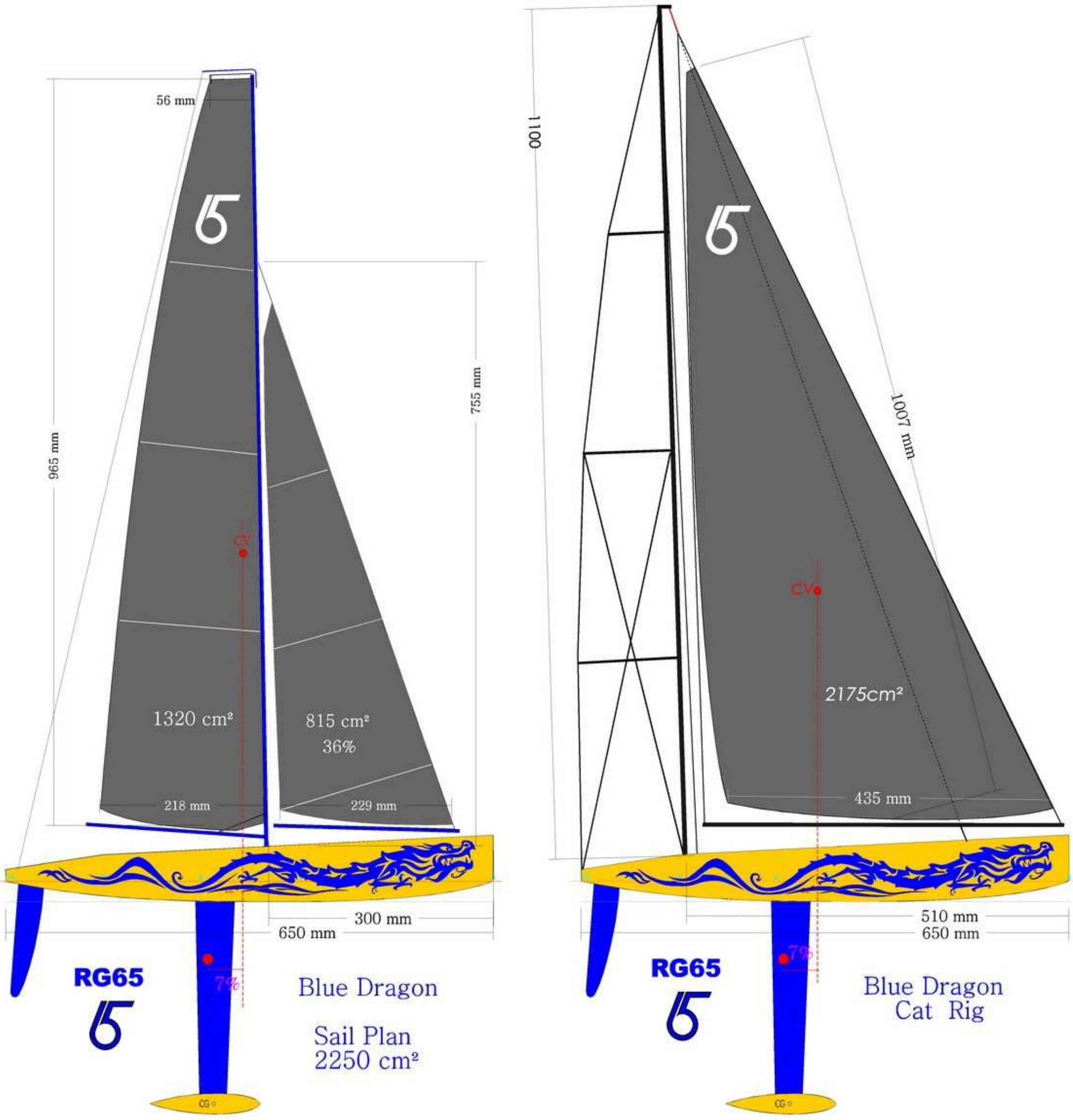
No Composite material existed at that time!

The first Staysail real-scale boat was the CorSair 24.

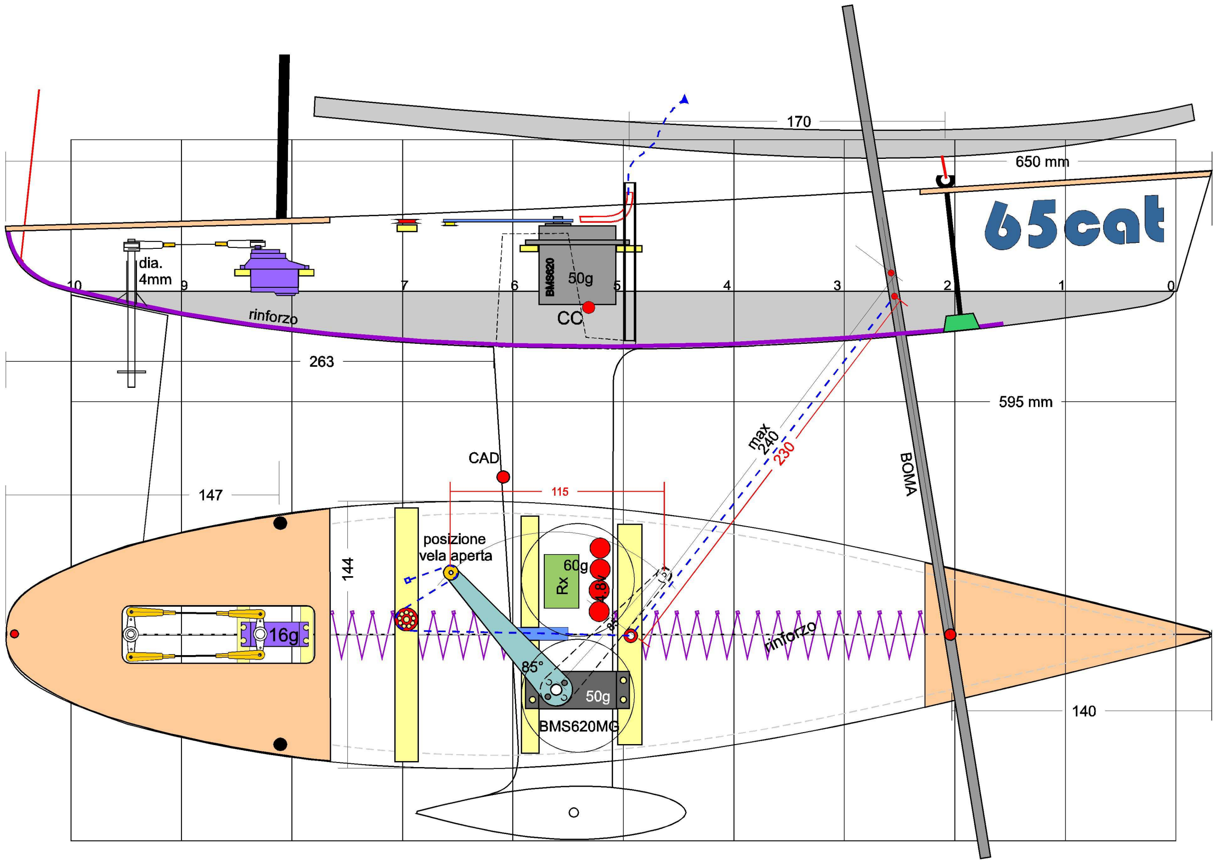
I have made a new CD5 hull aiming to build a Delta Rig Model.
One of the major questions was related to the longitudinal strength of the Hull as it was found in the 1922.

This is the basic idea.
While America Cup was passing by, I said that the Dragon used by China Team was a nice drawing!

Here after the difference between a Classic Rig model and the New Delta Rig Design

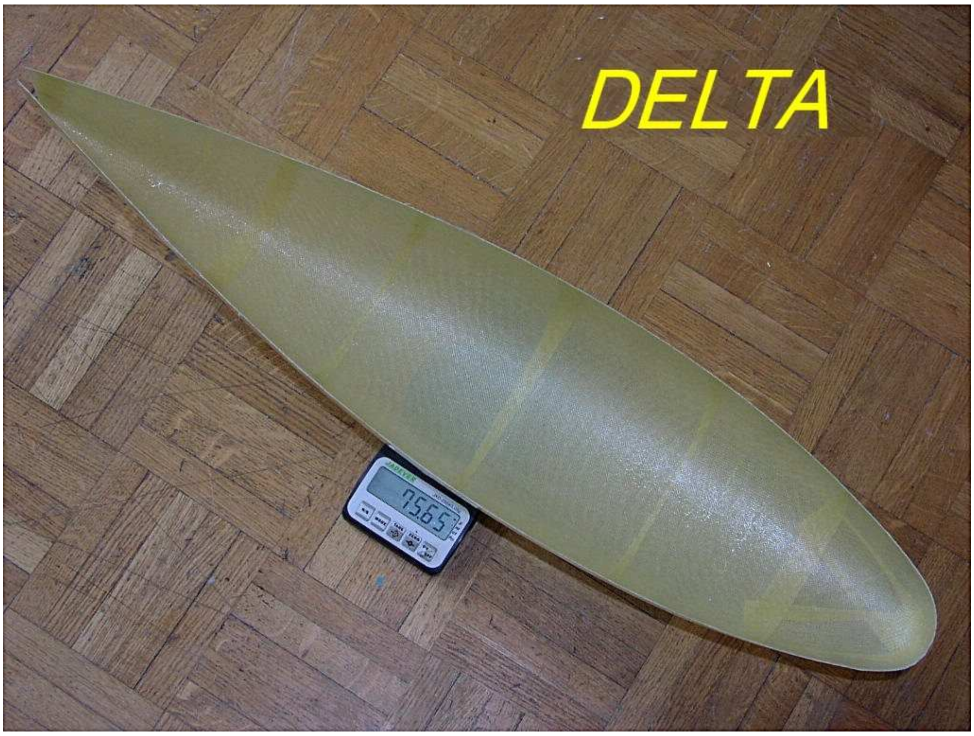


The Delta Jib has the same sail area surface



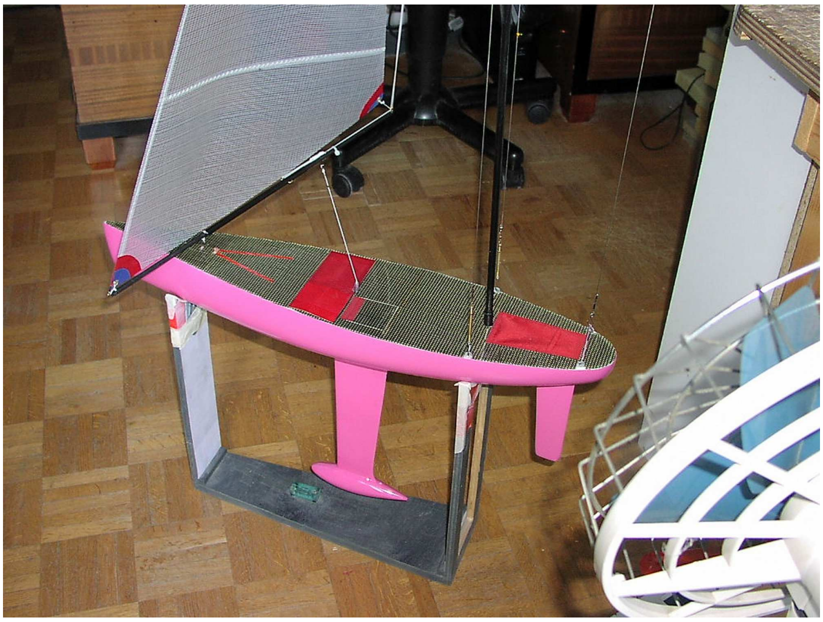
Delta Rig Boat basic Layout

Hull de-molding and excess cut out



Bare Hull weight 76g

under assembly



Changed color and Air blower testing

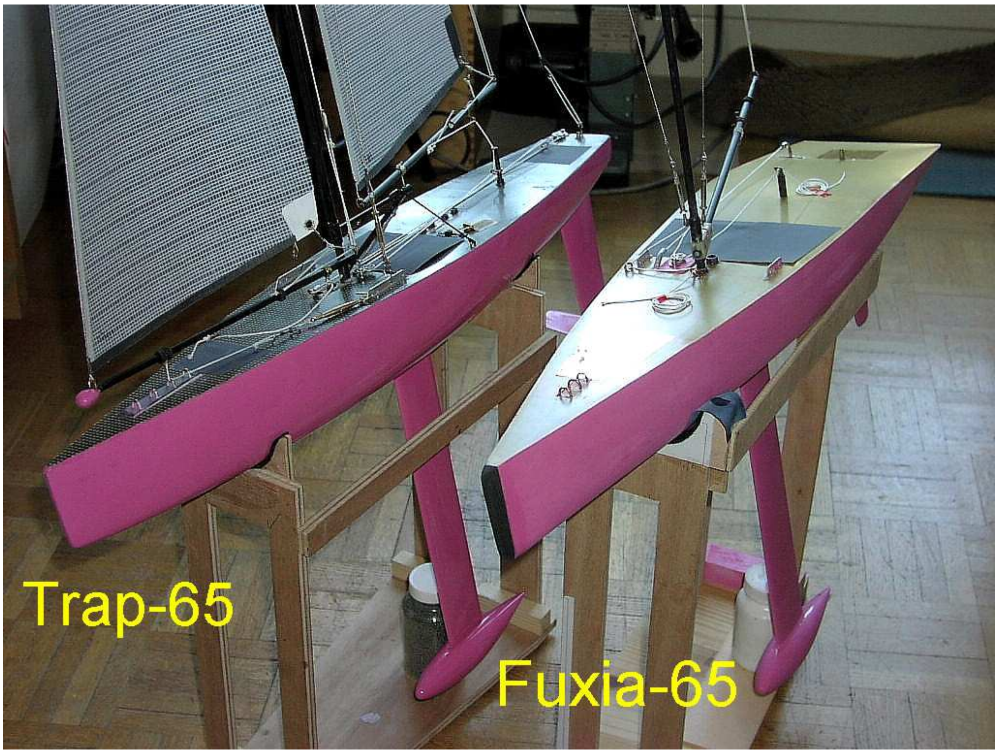
Julien when was playing with the Christmas Present
Only 8 years old !

YOU TUBE VIDEO

https://youtu.be/9lyWYXwoGUM

https://youtu.be/JHYk4iL0pVE

The RG65 Saga continued with the Trap 65, and Fuxia 65, but never reached water ponds.



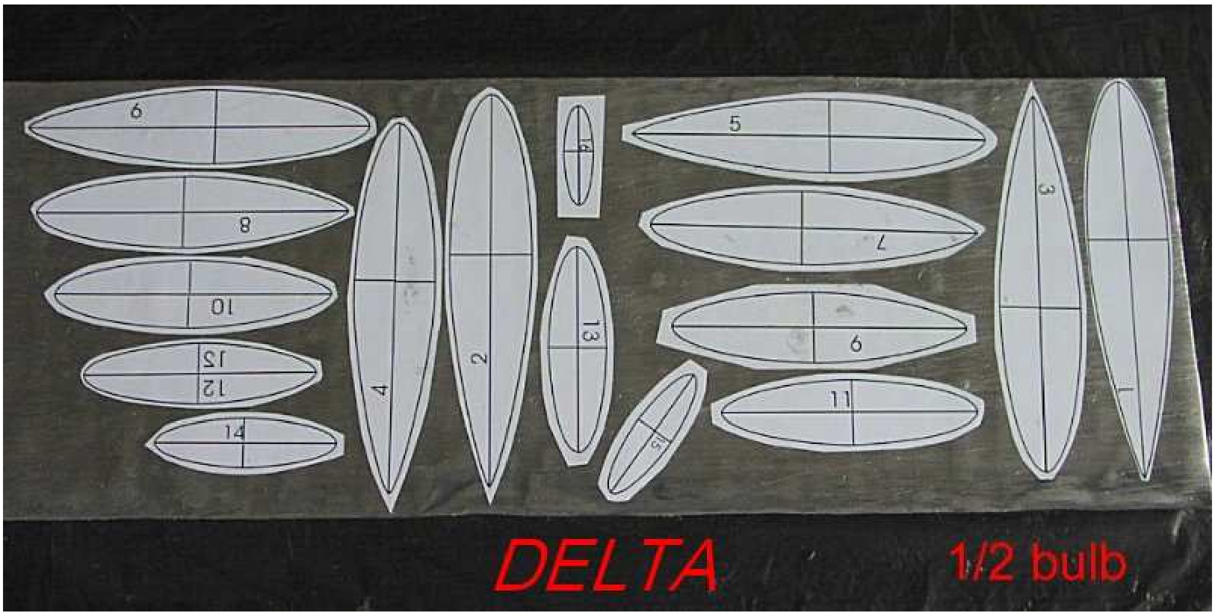
With Trap 65 I have designed a new type of Rig where the Main was supposed to acts as a second Jib, not tested yet….

RG65 Bulb

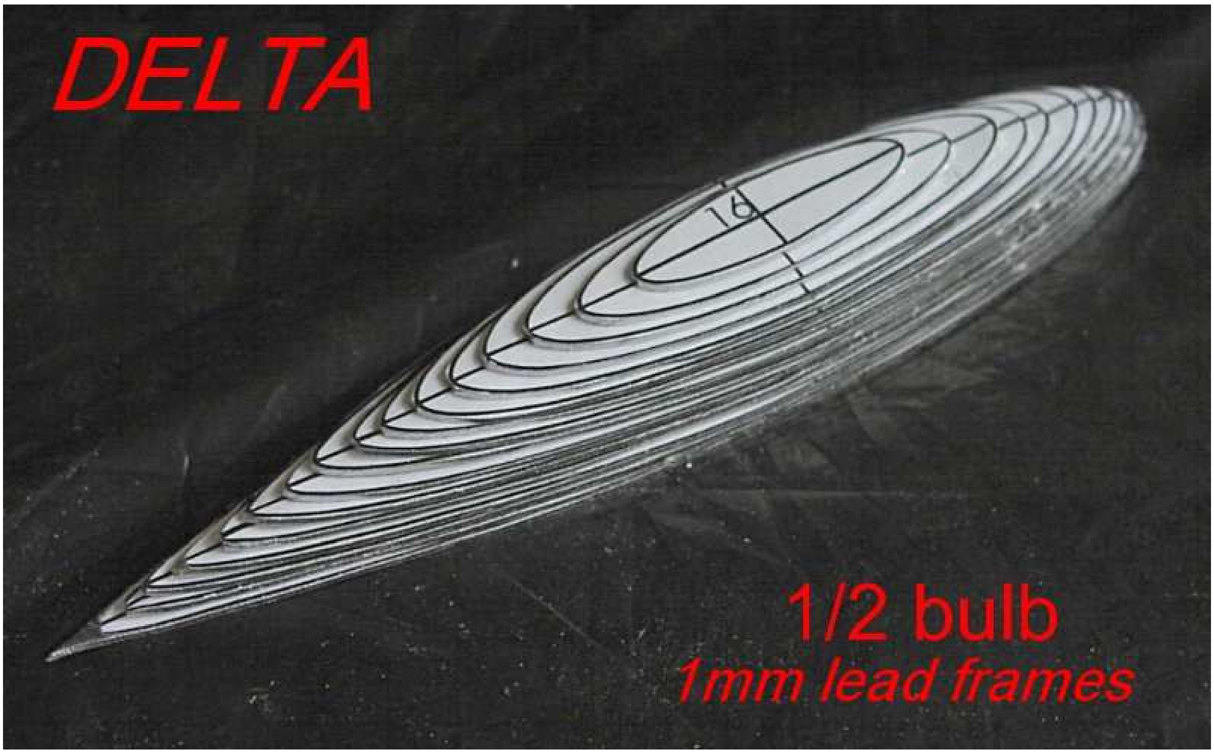
Rules Short List

Length	**650 mm**
Mast height	**1100 mm**
Sail Area	**2250 cm^2**

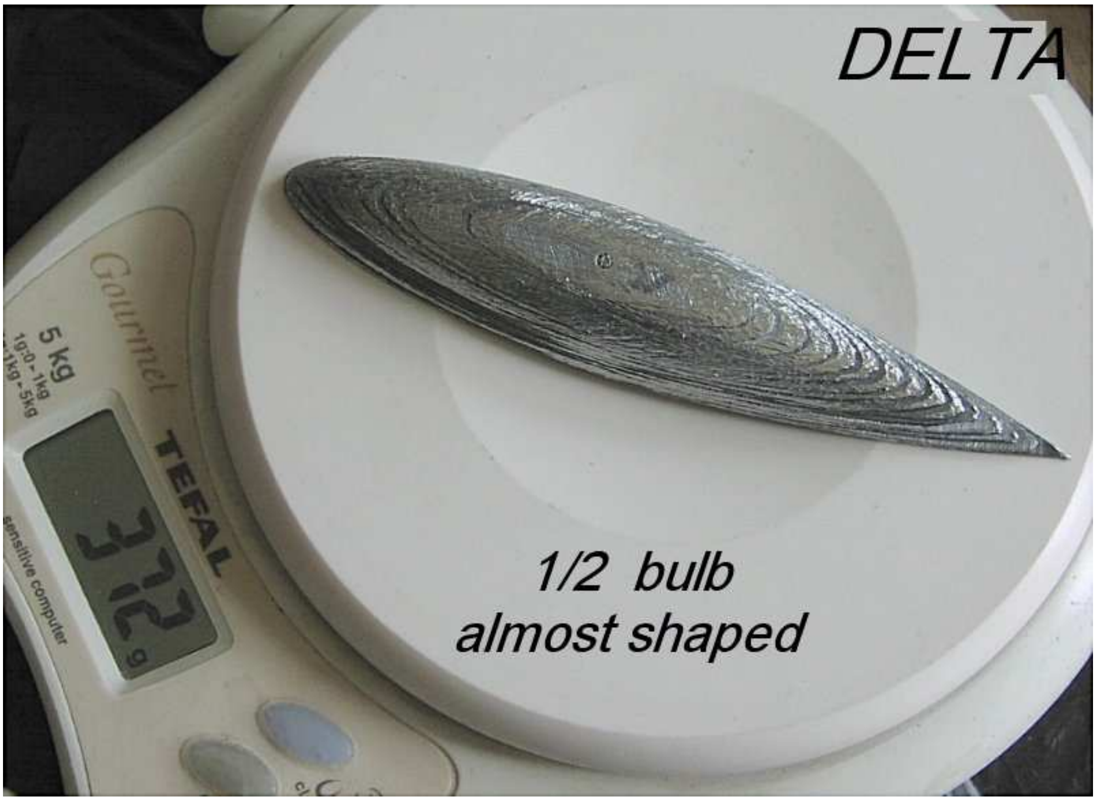
The rudder construction technique I use is always the same for all my Models.
Lead foil of about 1.5mm thick.

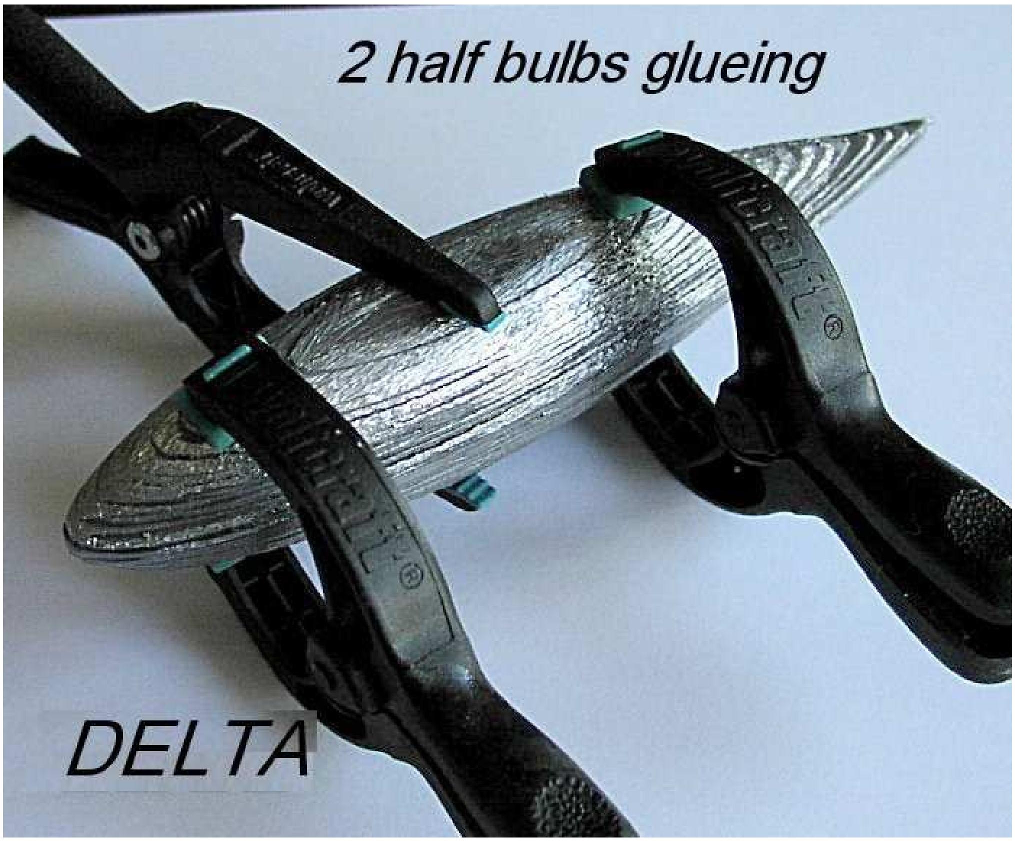


Lead sheet cut with scissors



Bonding with Cyanolite





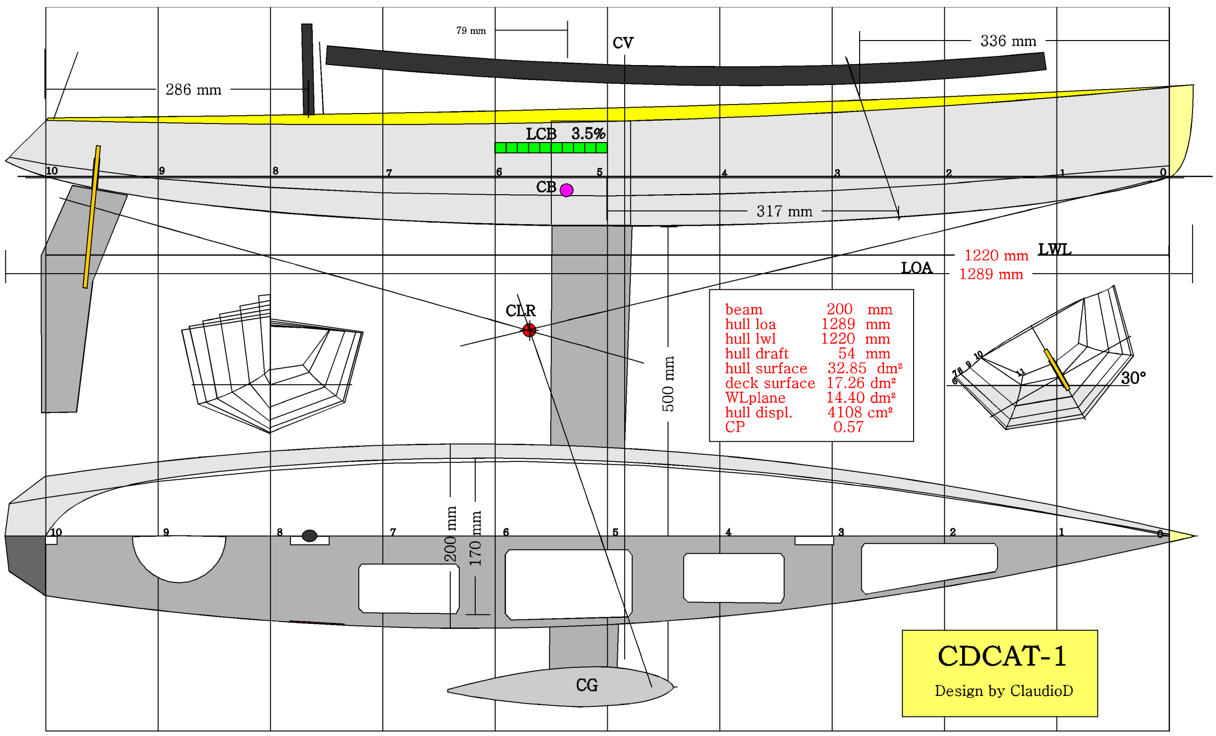
Bulb finished left only fixation holes

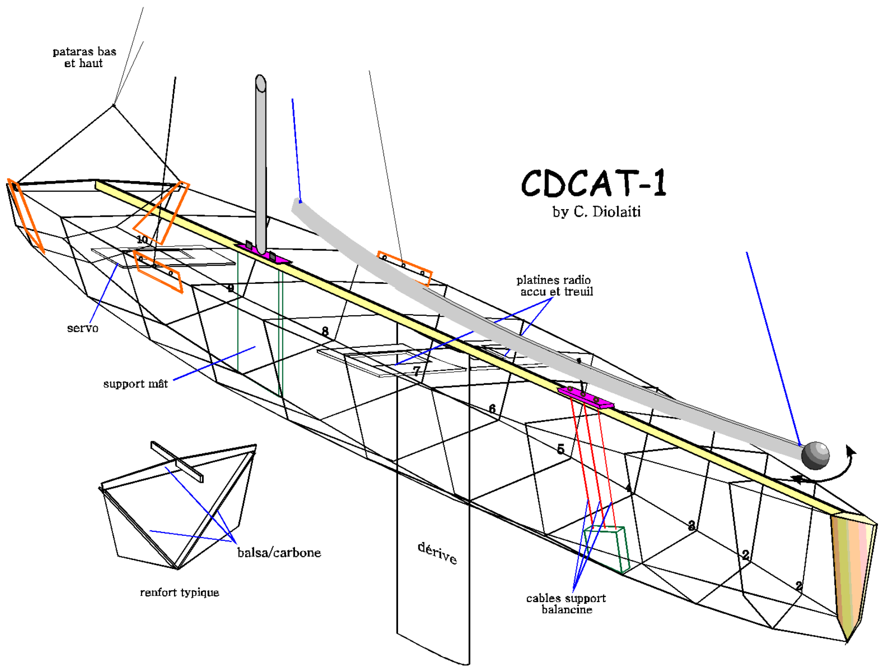
The CD-CAT

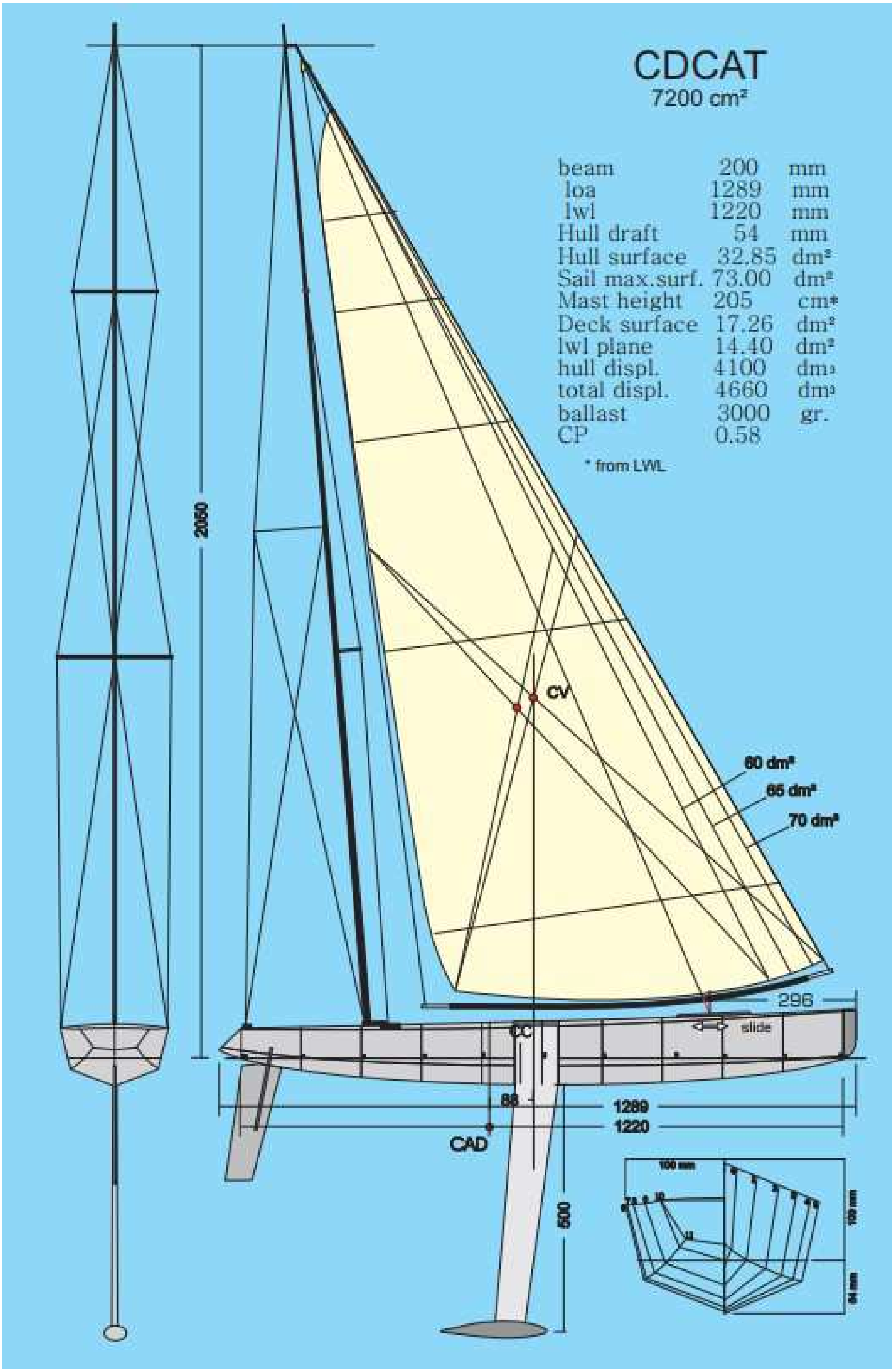
Rules Short List

Experimental Model based upon Class M Hull
Mono-hull and Mono-sail with Mast after
Sail Area 7300cm² max
Mast height 2050 mm

The results of the Delta Rig, suggested to enlarge the scale and use a Class M Hull.
To accelerate the construction I used frames and Balsa plates covered with Carbon-Epoxy .

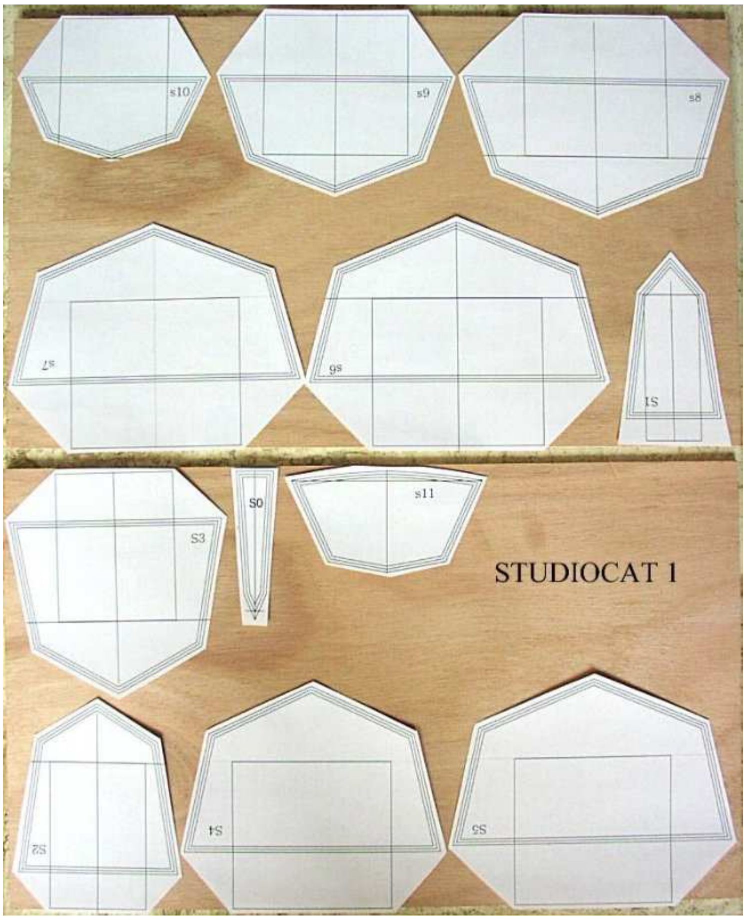





CDCAT
7200 cm^2
beam 200 mm
loa 1289 mm
lwl 1220 mm
Hull draft 54 mm
Hull surface 32.85 dm^2
Sail max.surf. 73.00 dm^2
Mast height 205 cm*
Deck surface 17.26 dm^2
lwl plane 14.40 dm^2
hull displ. 4100 dm^3
total displ. 4660 dm^3
ballast 3000 gr.
CP 0.58
* from LWL
2050
CV
60 dm^2
65 dm^2
70 dm^2
296
slide
CC
88
1289
1220
CAD
500

It was not excluded to configure the rig with two Jibs.
Unfortunately the Boom broken, (poor design of mine) and the experiment was stopped there.
The data collected proved that the design idea was a valid one and hoping that one day one will come up with a dedicated Group.

The following pages will show how the Stay-sail alias CD-CAT grow-up.




CD-CAT

The Shadows are separated from the balsa plate using a small wedges. This option will facilitate the shadows removal.

Balsa sheet coverage

Sufficiently balanced to stand up alone !!!! LOL

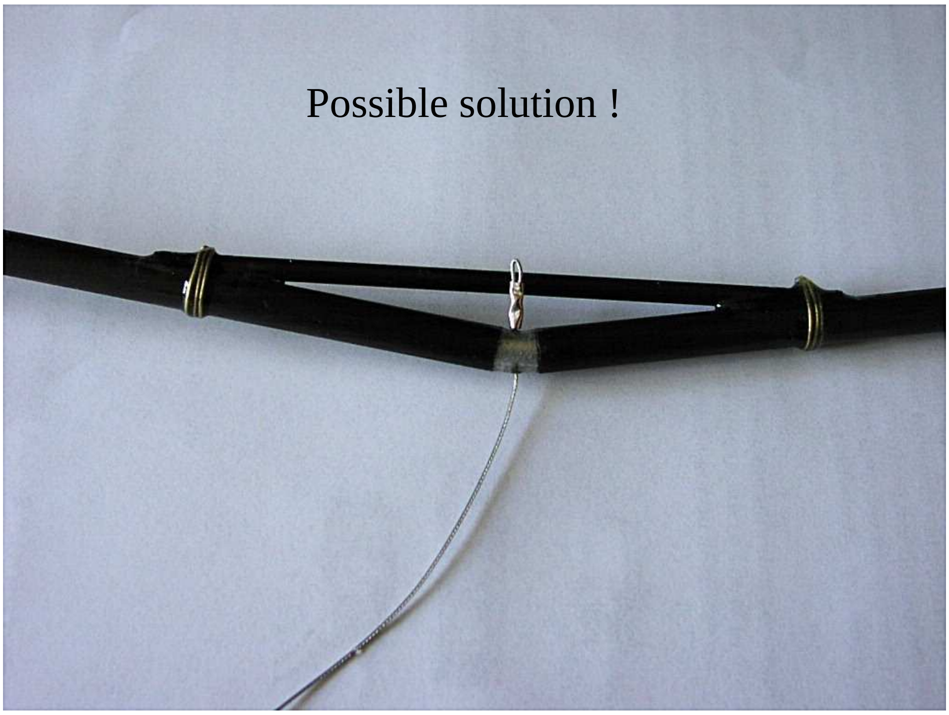
Almost ready to go Sailing!

Battery and radio installed and ready to Go !
Same Sail Area as Class M

No doubts is a fast boat
and rather original between the others

The boom is close to failure !
Time to take it back !

Boom broken = poor design !



Possible solution !

The CD-CAT Story ended with the broken Boom although very satisfied for that RC Model Sailing option!

AC 120

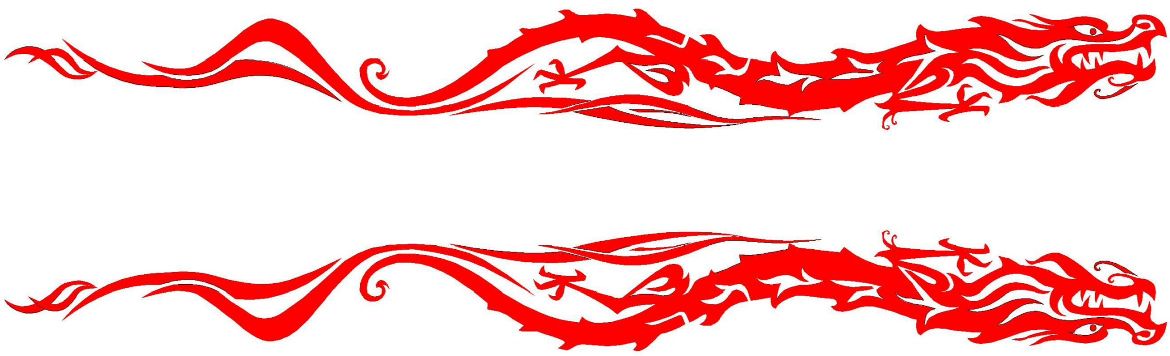
Rules Short List

Loa	1200 mm
LWL	1000 mm
Keel/Bulb	3000g max
Draught	420 mm max
Dspl	4500 g min.
Sail Plan	8000cm² max

Was April 2007 when the first images of the new America Cup boats were presented for the "Unveiling Day" in Valencia (Spain)

One boat decoration attracted my attention; it was the Dragon of the China Team.

I started drawing it on my PC screen with the CorelDraw 5.



I was rather satisfied to the point that I came to the decision to draw the hull around.

The true plans were still under secret, but with a meticulous research work with pictures, allowed me to draw the ALINGHI SUI-100.

Obviously, this Class responded to a Rules called "Safalero Cup".

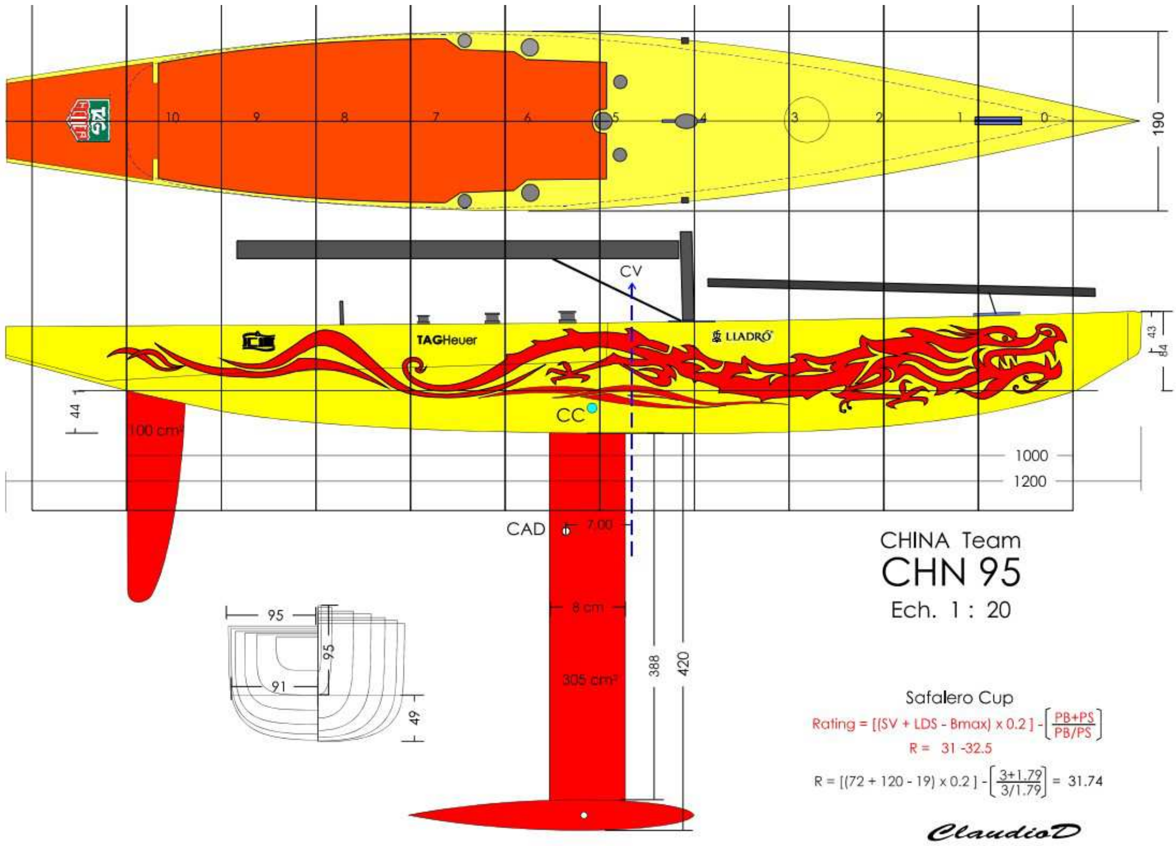
The idea apparently was retained by some skippers in Italy to the point I was encouraged to draw other America Cup model based upon the available pictures on the Web and on the specialized press.

The America Cup "fever" started with a numerous drawings trying to reproduces the boats of various Syndicates.

Few months later the Alinghi was the Winner of the America Cup 2007 and of course the decision was taken to draw or try to draw that model.

Being living in France I gave a priority to the Areva   FRA-93

The China Team at the Unveiling Day April 2007



In the past, before 2007, in Italy a Model Club was developing scale RC Models of the America Cup.
Since not all America Cup boats were using the same dimensions and Sail Areas, the Club designed a Formula called:

Safalero Cup Rating

Rating = [(SA + LOA- Beam) x 0.2] - (Bulb +Hull) / (Bulb /Hull)

Rating accepted by the AC120
From 31 to 34

Where:

- Bulb Weight in Kg
- Hull weight without Bulb in Kg
- LOA in cm
- Beam in cm
- SA in dm²

<u>In this formula the Hull Draft is not taken into account.</u>

With the new America Cup Rules of 2007 all the boats where responding to close restrictions and dimensions for each Syndicate.

The "Safalero Cup" Rules were abandoned with my regrets.

It was decided thus to establish New Rules, I did participate to the writing, although not very happy about the displacement scale factor used.

Using a scale factor of 1:20, while the real-scale America Cup Boats where exhibiting 24tons by the Rules, the scaled model should have specified a displacement equal to the "cube" of the scale:

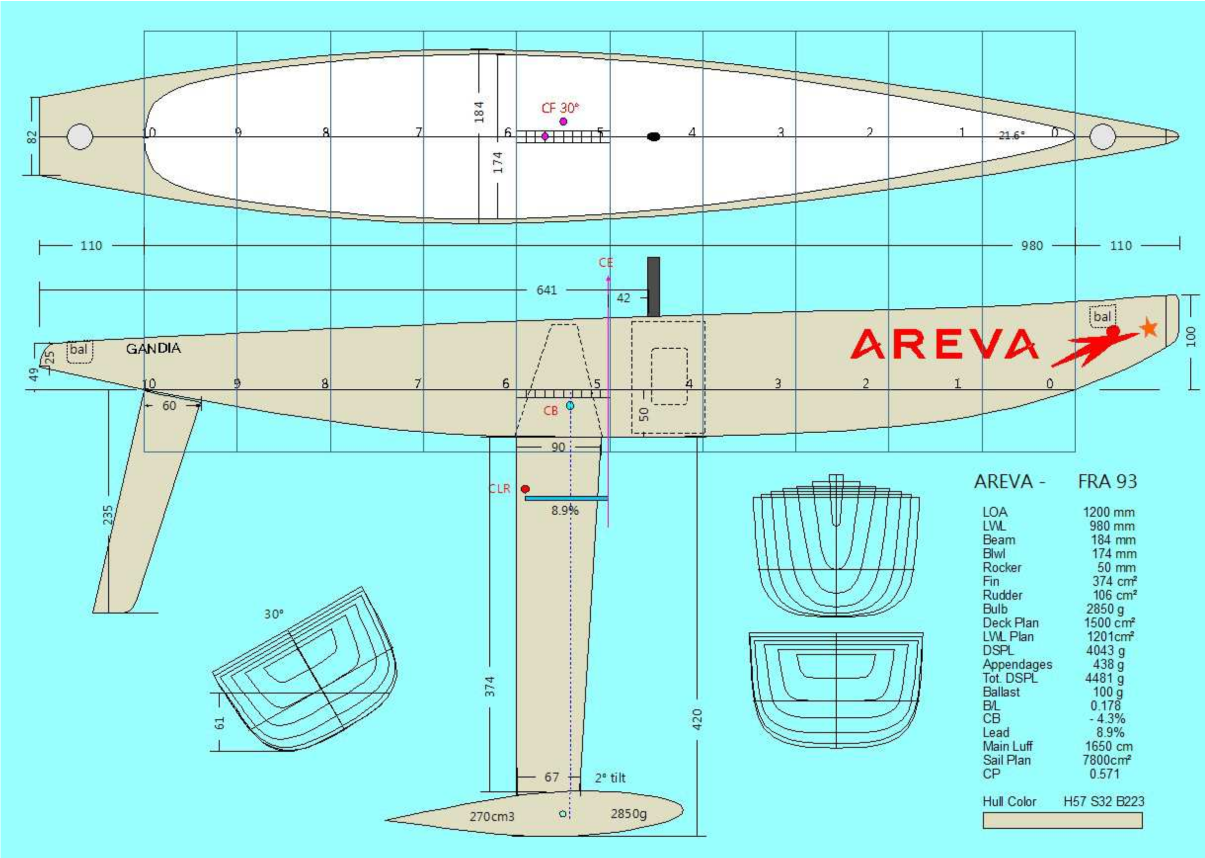
$$24000 \text{ kg} / (20 \times 20 \times 20) = 3.0 \text{ kg}$$

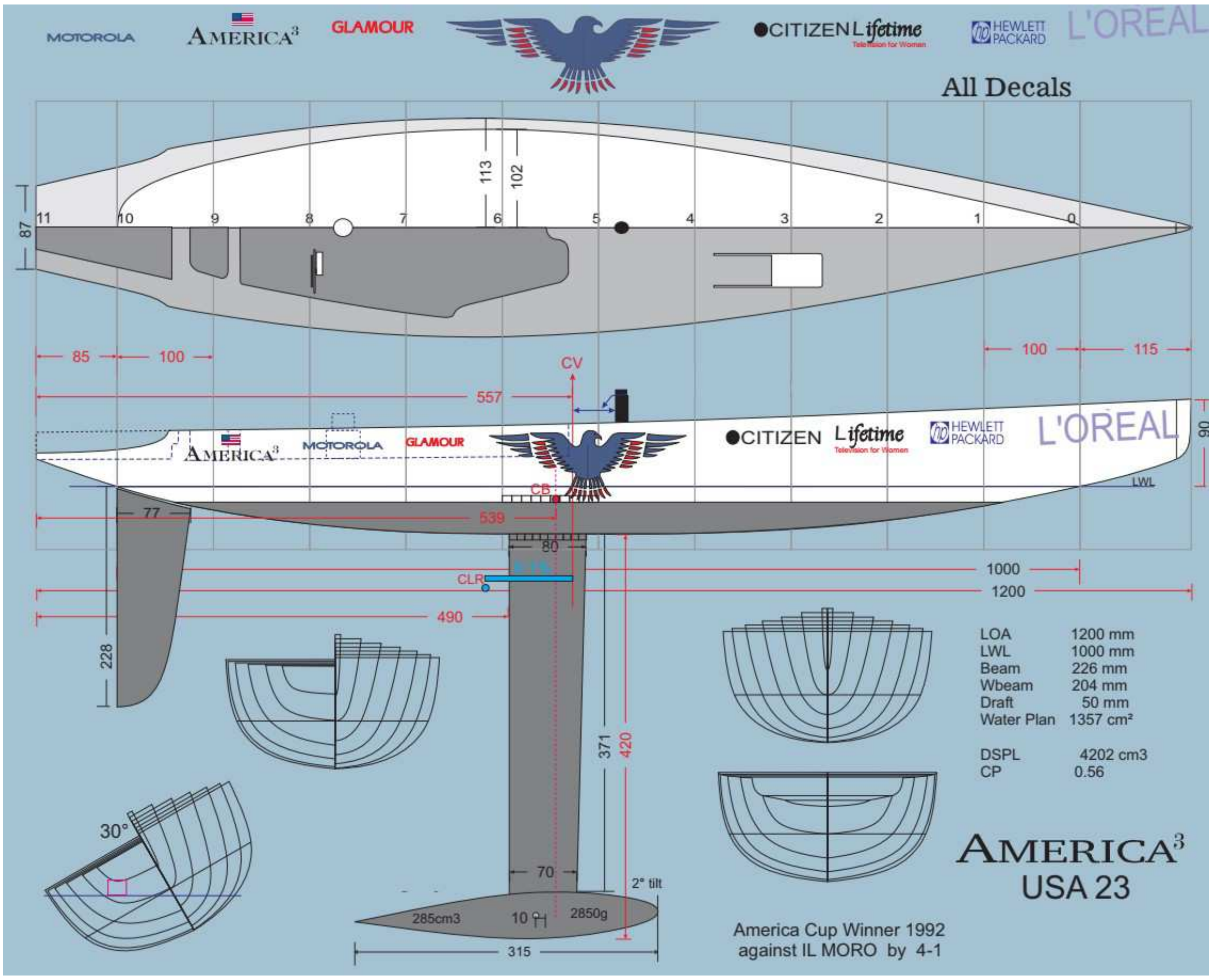
Of course with 3.0kg was almost impossible to build an RC Model of that size.
The AC120 committee decided to fix the AC120 displacement to 4.5kg assuming that builders should have sufficient margin for the construction.
Considering the Rules where the LWL was limited to 90cm, by the similitude with IOM class, the displacement of 4.0 kg was my proposal finally rejected.

My AREVA FRA-93 was often the winner of the AC-120 Italian Cup thanks to the skill of skipper Mauro.
I forgot how many AC120 I drawn, my choice was more dictated by the hull decorations than by the hull shapes that at the end were rather similar.
So far I remember, this is the List of some of my scaled drawings based upon pictures only :

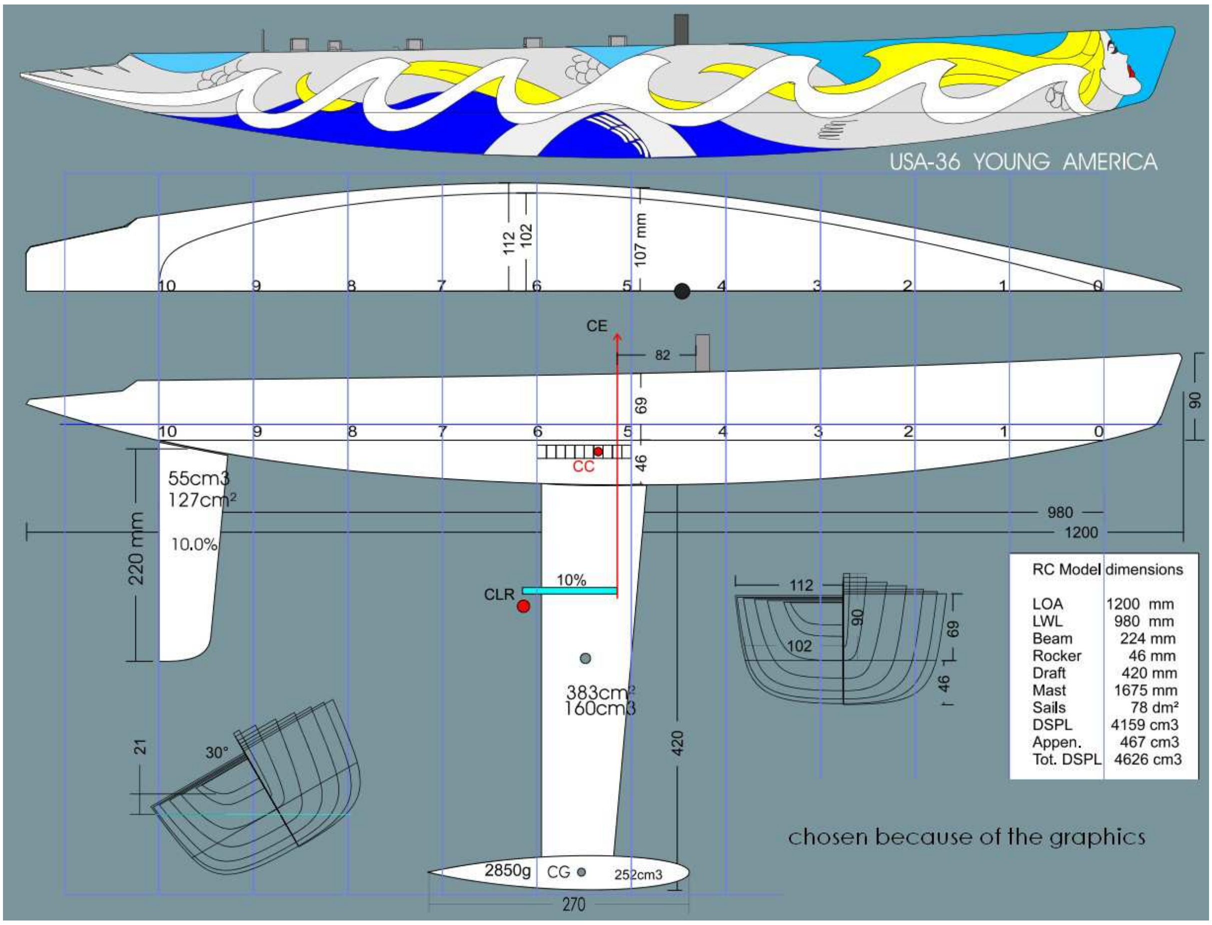
1.	China Team	CHN 95
2.	Areva	FRA 93
3.	America 3	
4.	Young America	USA 36
5.	New Zealand	NZL 92
6.	Alinghi	SUI 100

AREVA FRA-93 the "winning boat" built by Mauro F.

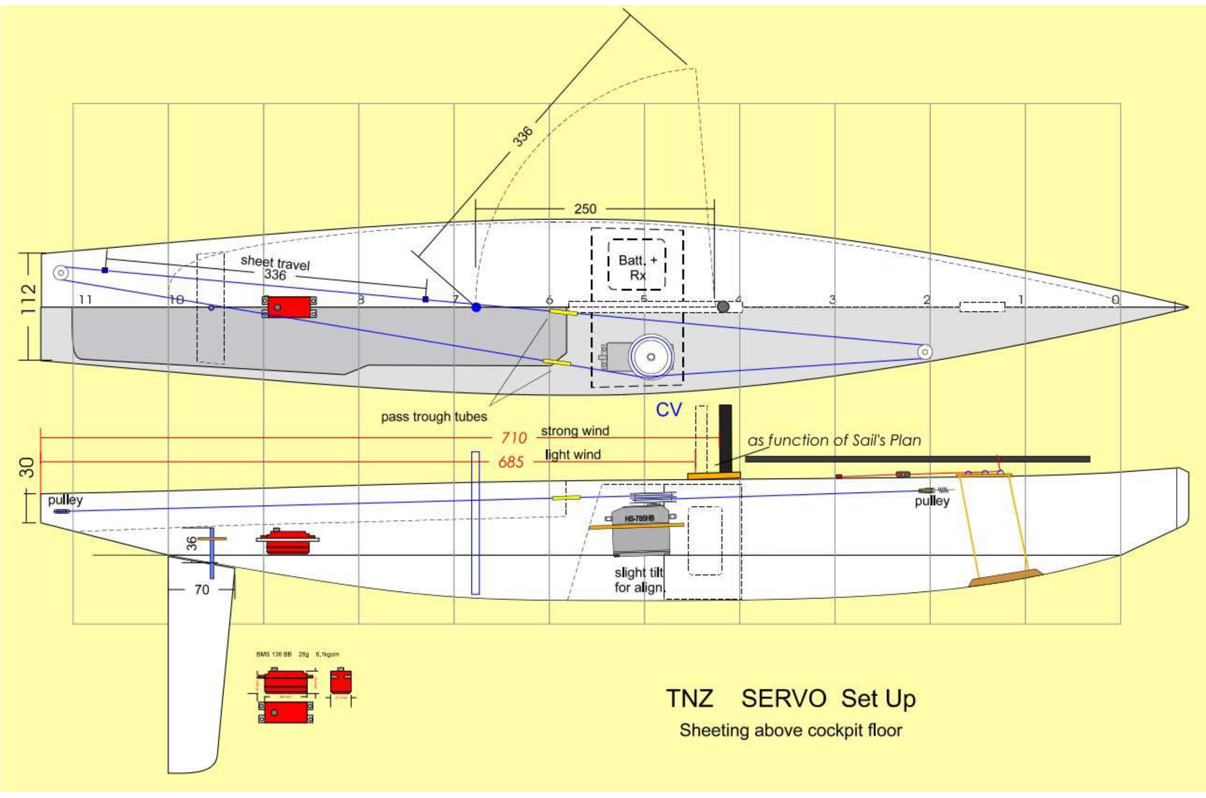

CF 30°
184
174
82
21.6°
110
980
110
CE
641
42
bal
GANDIA
AREVA
100
49
25
60
CB
50
90
CLR
8.9%
235
30°
61
374
420
67
2° tilt
270cm3
2850g
AREVA - FRA 93
LOA 1200 mm
LWL 980 mm
Beam 184 mm
Blwl 174 mm
Rocker 50 mm
Fin 374 cm²
Rudder 106 cm²
Bulb 2850 g
Deck Plan 1500 cm²
LWL Plan 1201cm²
DSPL 4043 g
Appendages 438 g
Tot. DSPL 4481 g
Ballast 100 g
B/L 0.178
CB - 4.3%
Lead 8.9%
Main Luff 1650 cm
Sail Plan 7800cm²
CP 0.571
Hull Color H57 S32 B223


MOTOROLA
AMERICA³
GLAMOUR
CITIZEN Lifetime
Television for Women
HEWLETT PACKARD
L'OREAL
All Decals
113
102
87
85
100
100
115
CV
557
90
LWL
CB
77
539
80
1000
1200
CLR
490
228
371
420
30°
70
2° tilt
285cm3
10
2850g
315
LOA 1200 mm
LWL 1000 mm
Beam 226 mm
Wbeam 204 mm
Draft 50 mm
Water Plan 1357 cm²
DSPL 4202 cm3
CP 0.56
AMERICA³
USA 23
America Cup Winner 1992
against IL MORO by 4-1

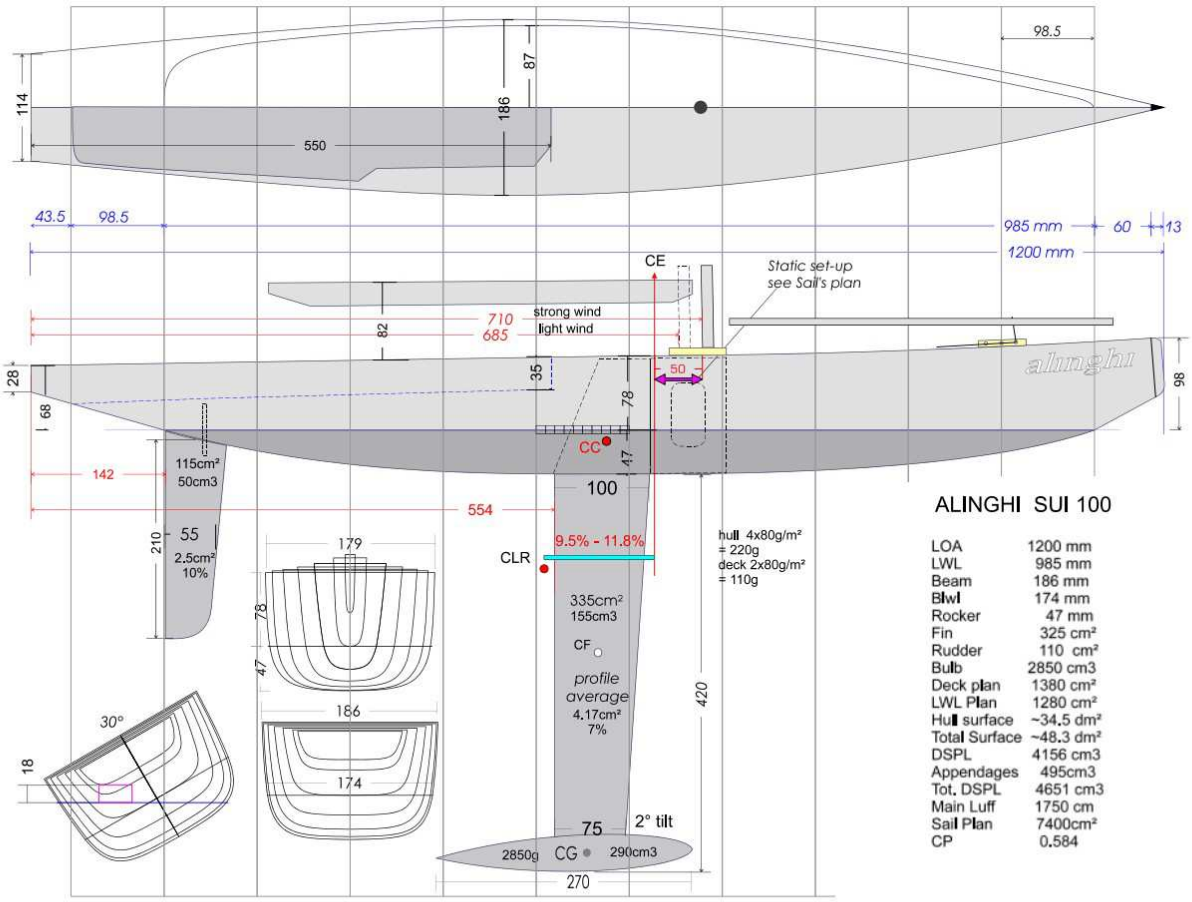
Mighty Mary alias America3 is standing in a field



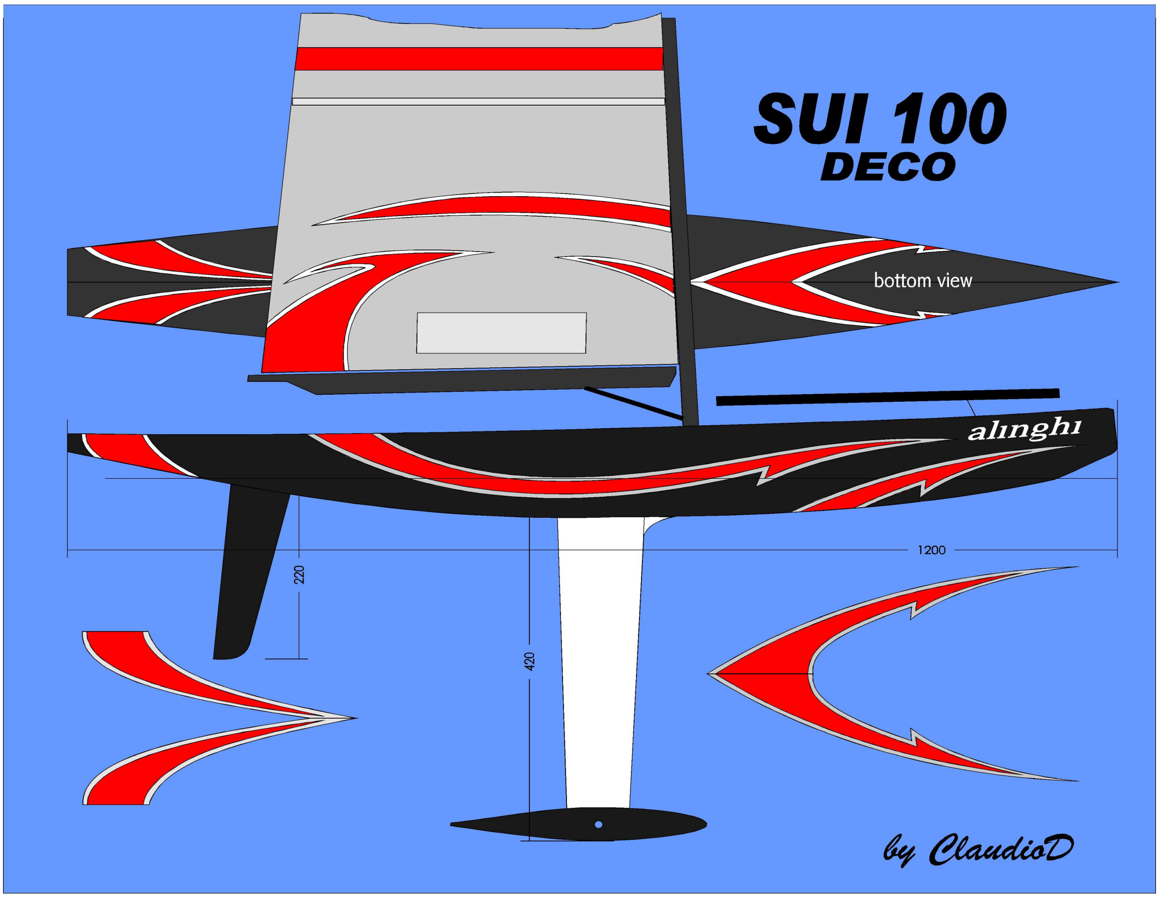
Here below a common view of the Servos installation valid for all models



The NZL decoration

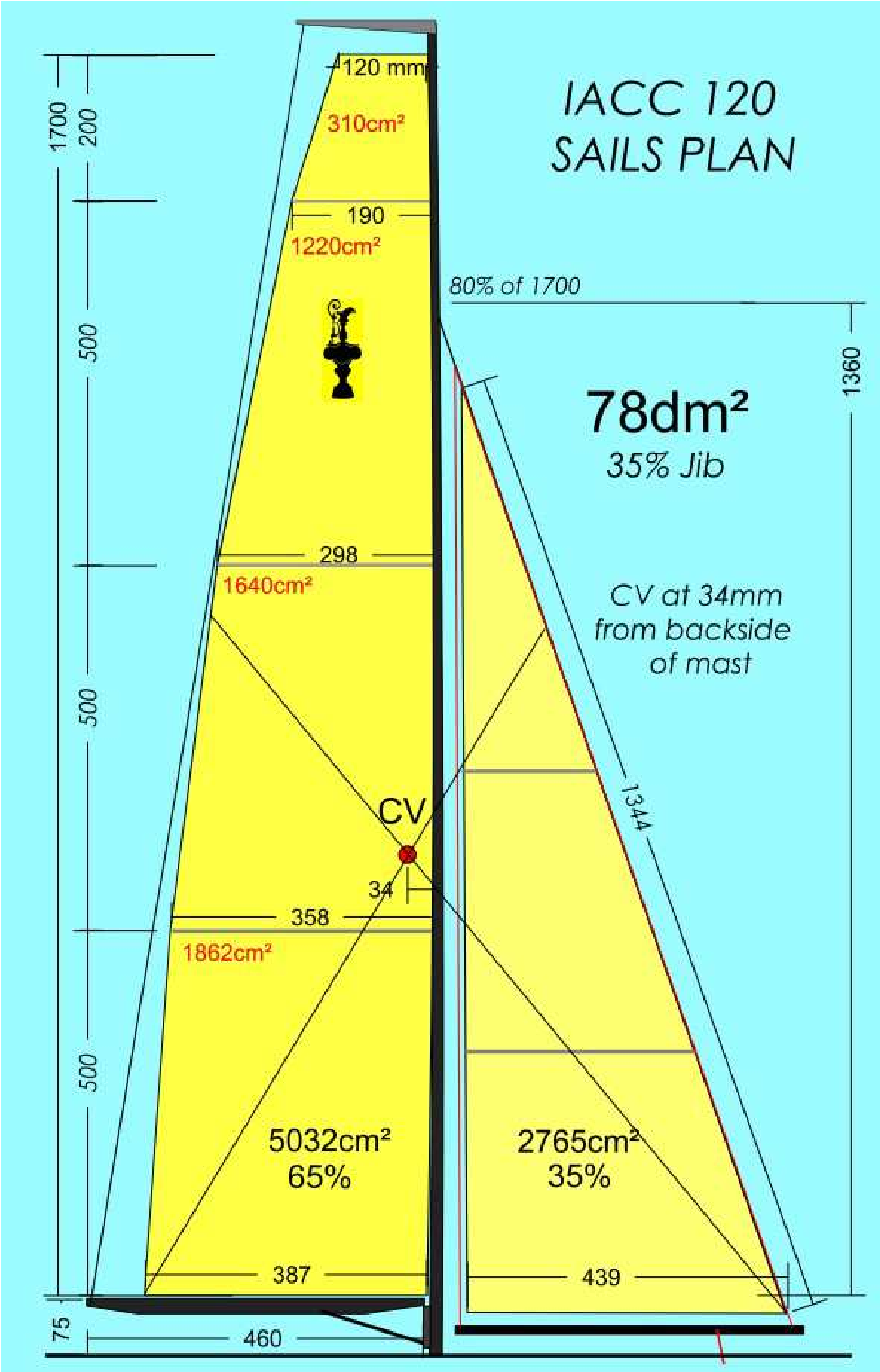


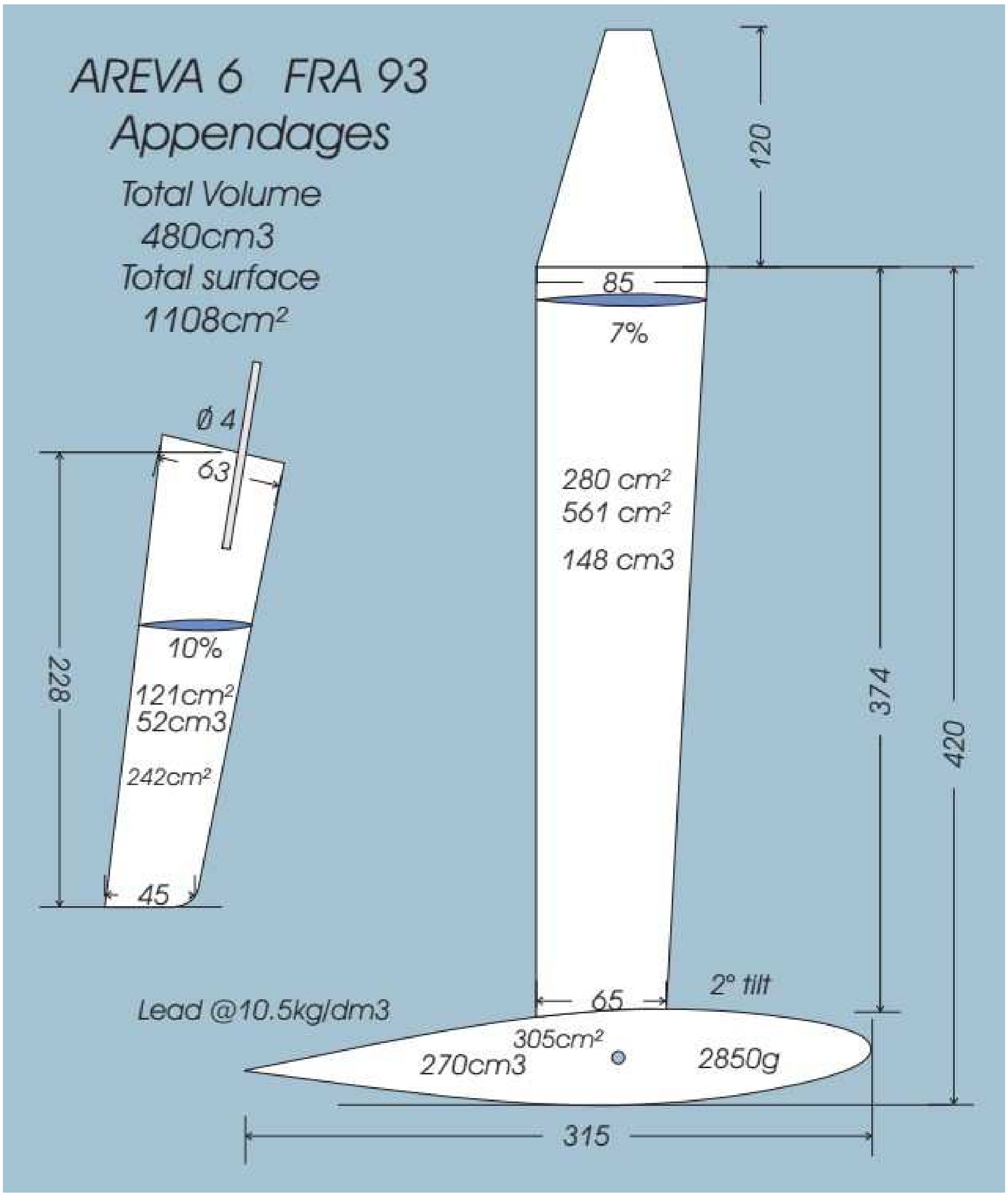
Next page Alinghi Decoration



A beautiful model realized by Marcel in Switzerland

Typical AC120 Sail Plan





These are the typical appendages used for the AC120 models

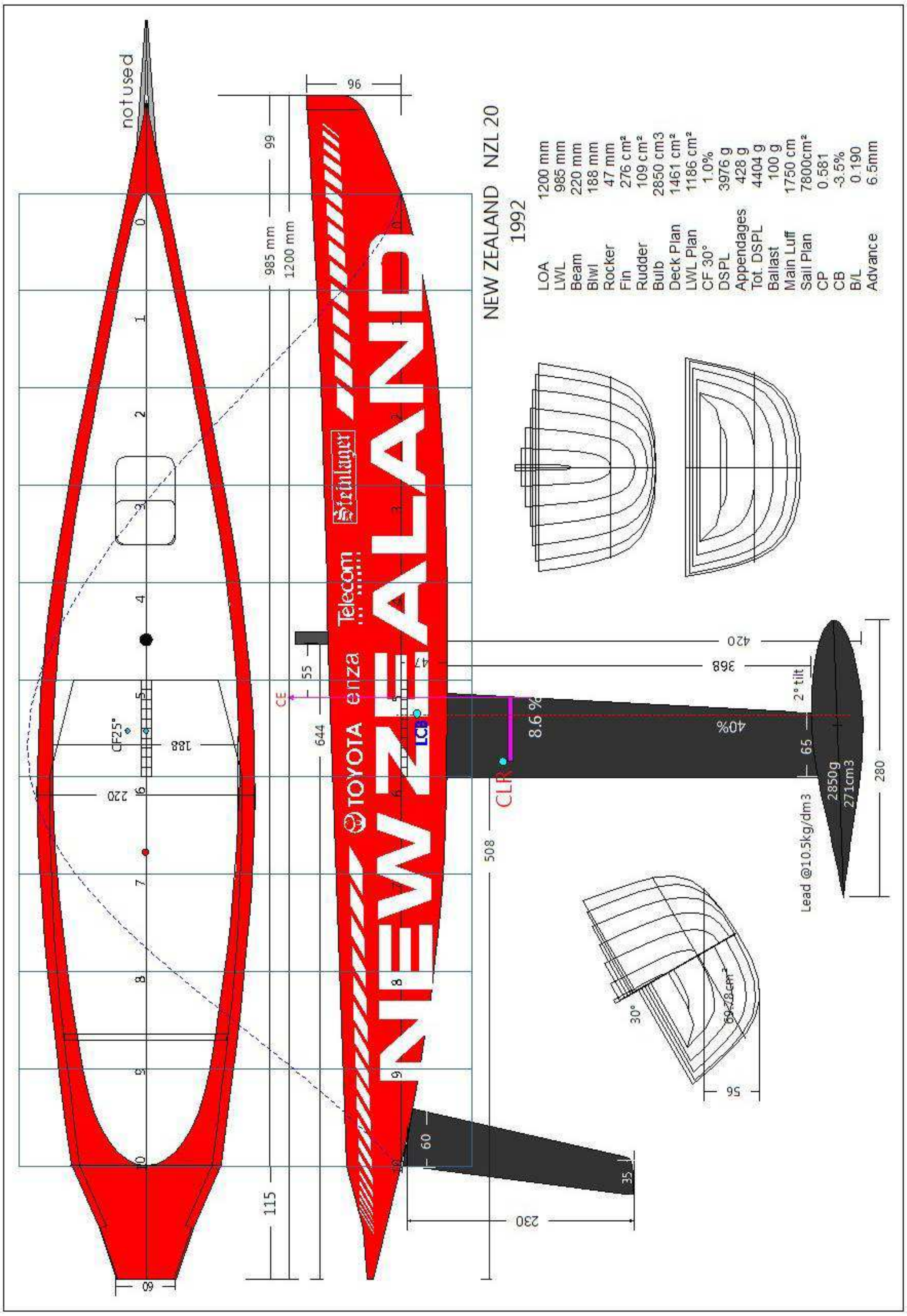
Since 2010 several things has changed including the revision of the Rules.
The major contributor to keep alive this 'Class AC120" was Renato Chiesa.
Wish this "Vintage" Class to continue in spite of the actual America Cup changes.

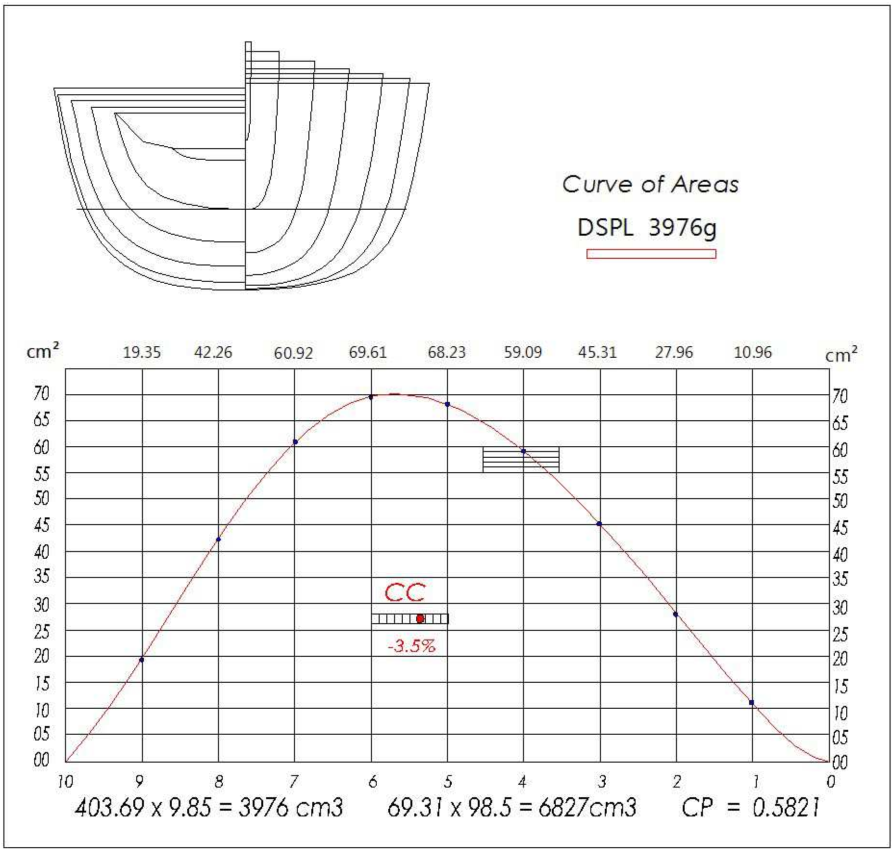
http://www.iacc120.it/intro.html

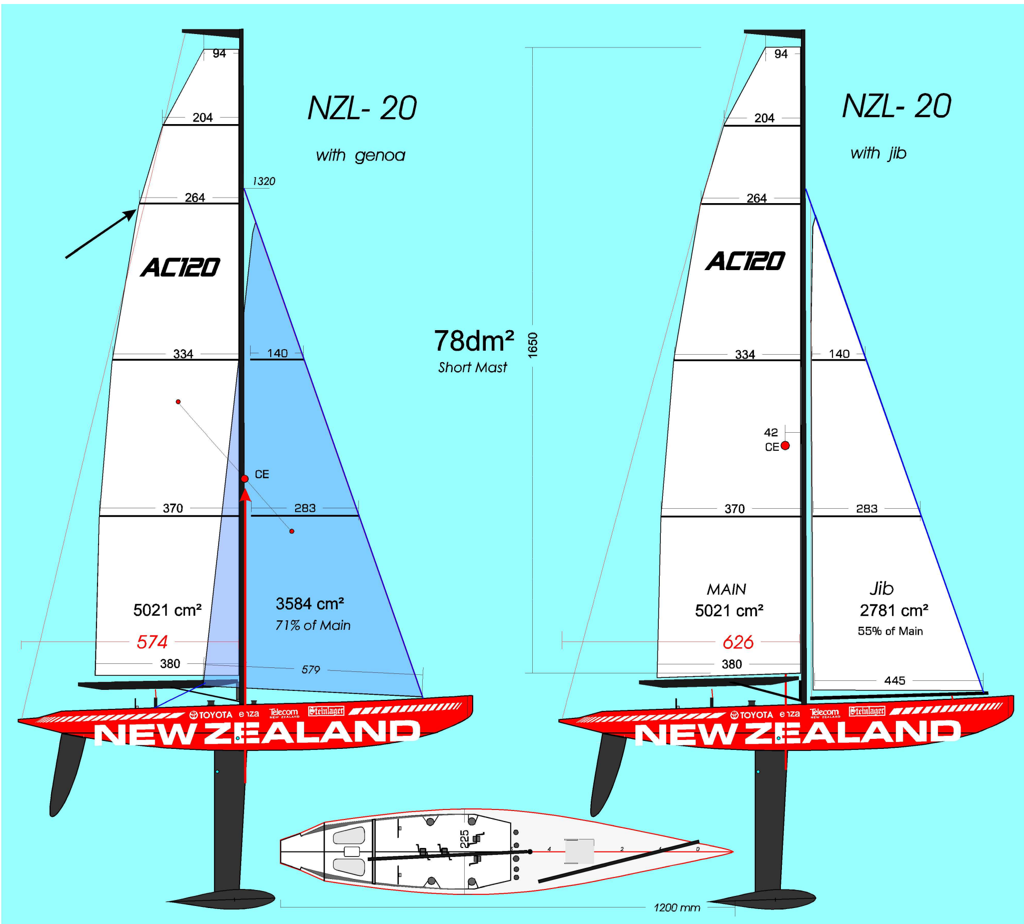
NZL 20 adapted to AC120 Class

This is one of the models I liked most, was used also for experimental purpose concerning the Hull external finish with Red Gel Coat.
At the end was not a good idea since too heavy.

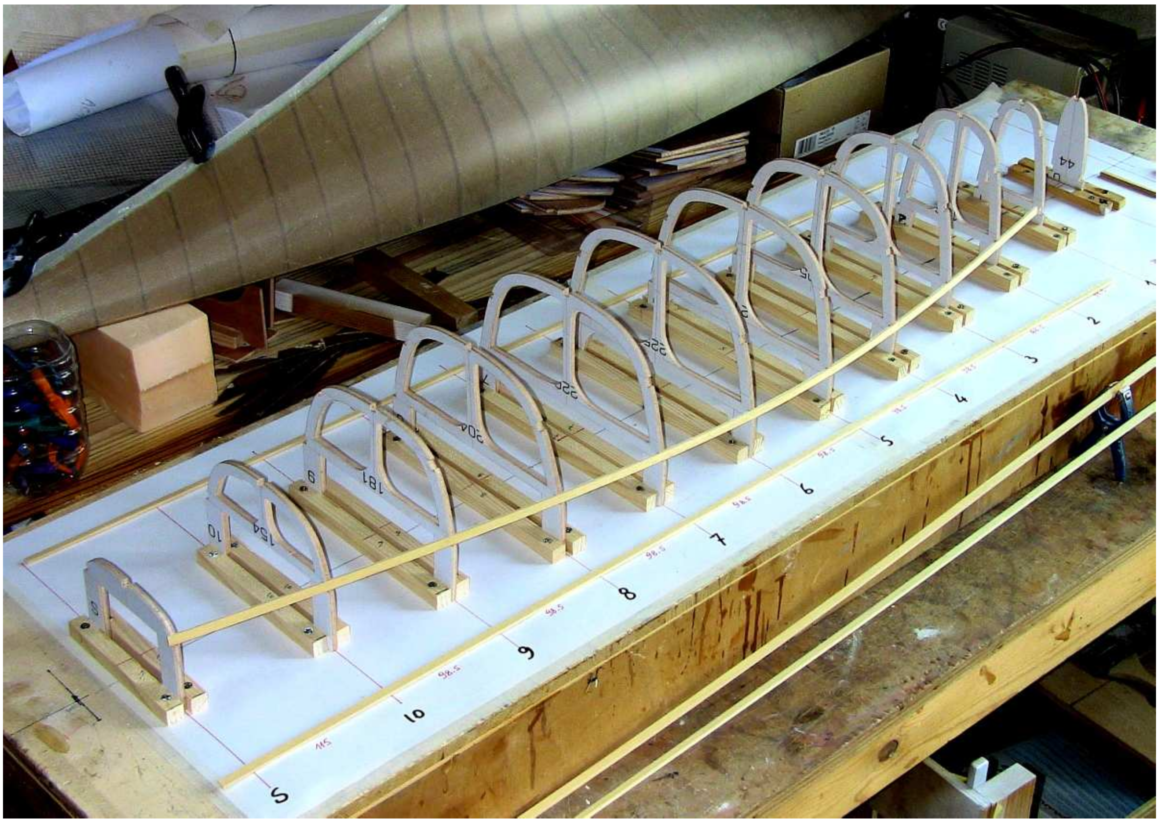
The plan :

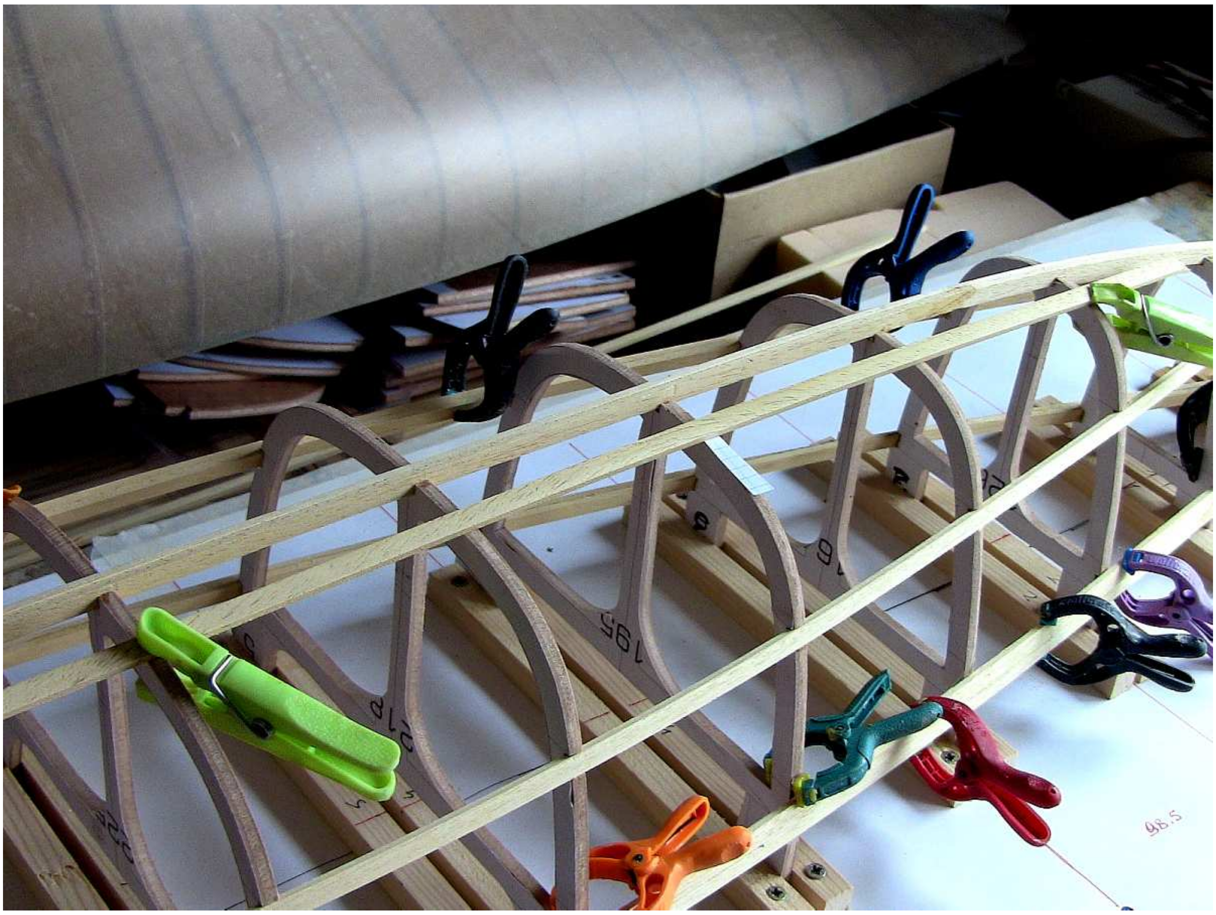


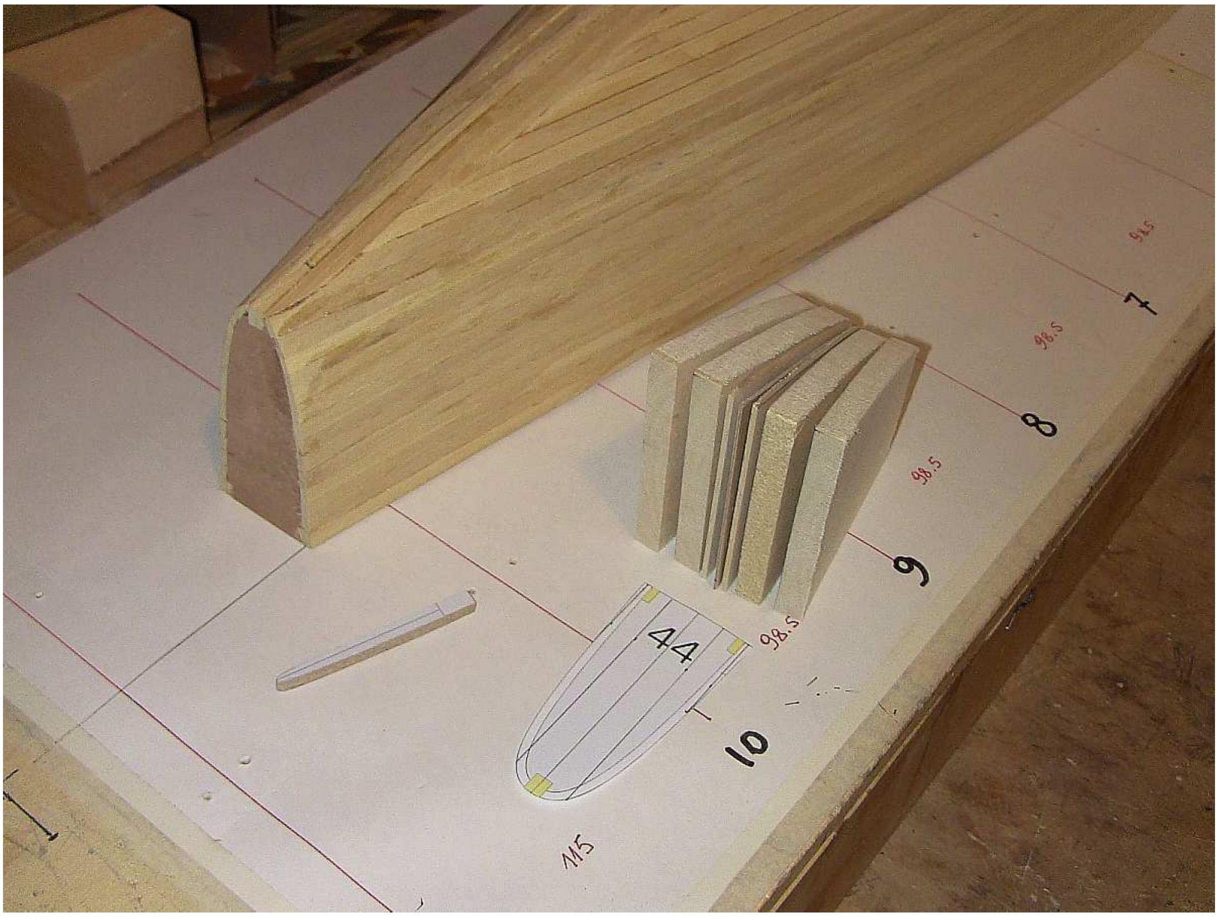

Curve of Areas
DSPL 3976g
cm²
19.35
42.26
60.92
69.61
68.23
59.09
45.31
27.96
10.96
CC
-3.5%
403.69 x 9.85 = 3976 cm3
69.31 x 98.5 = 6827cm3
CP = 0.5821

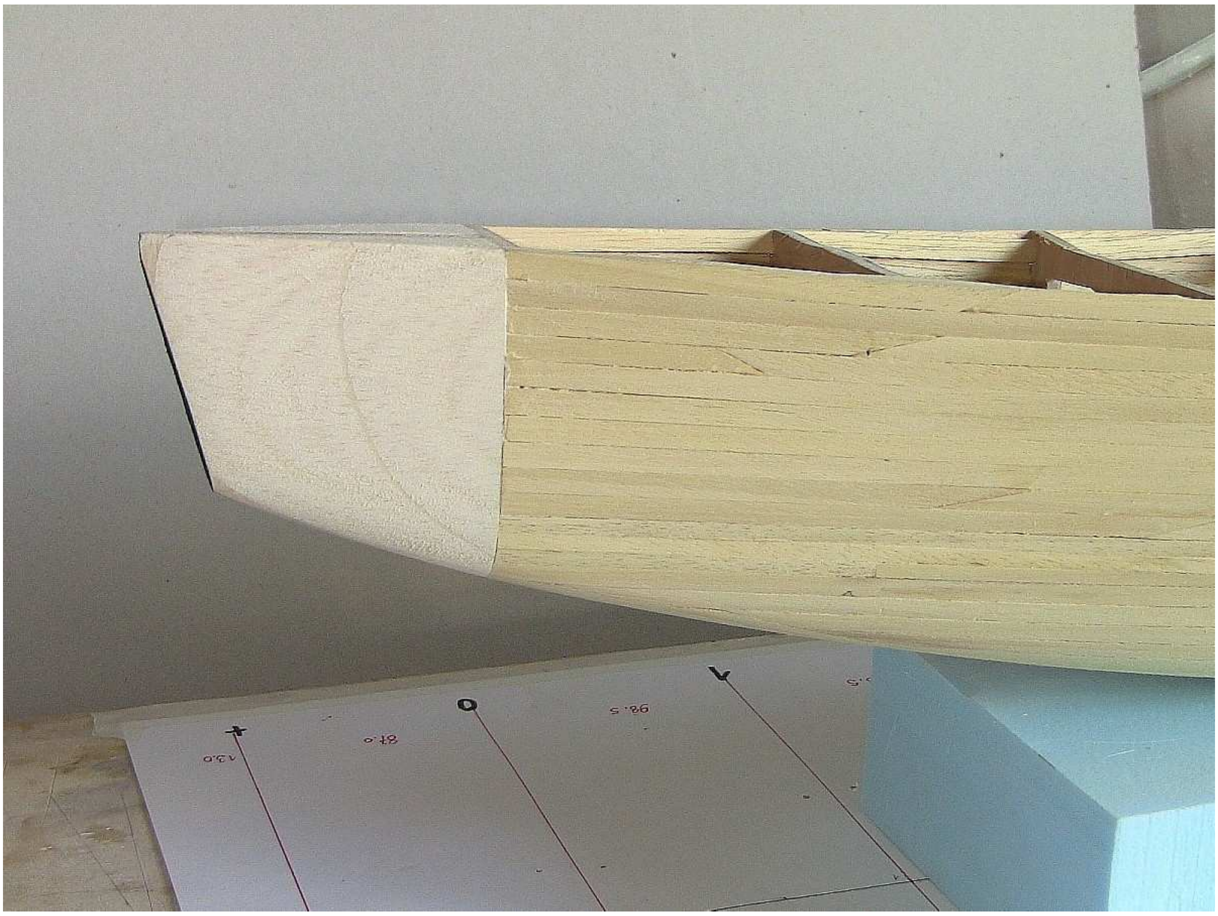

NZL- 20
with genoa
AC120
78dm²
Short Mast
1650
5021 cm²
574
3584 cm²
71% of Main
CE
NZL- 20
with jib
MAIN
5021 cm²
626
Jib
2781 cm²
55% of Main
NEW ZEALAND
1200 mm

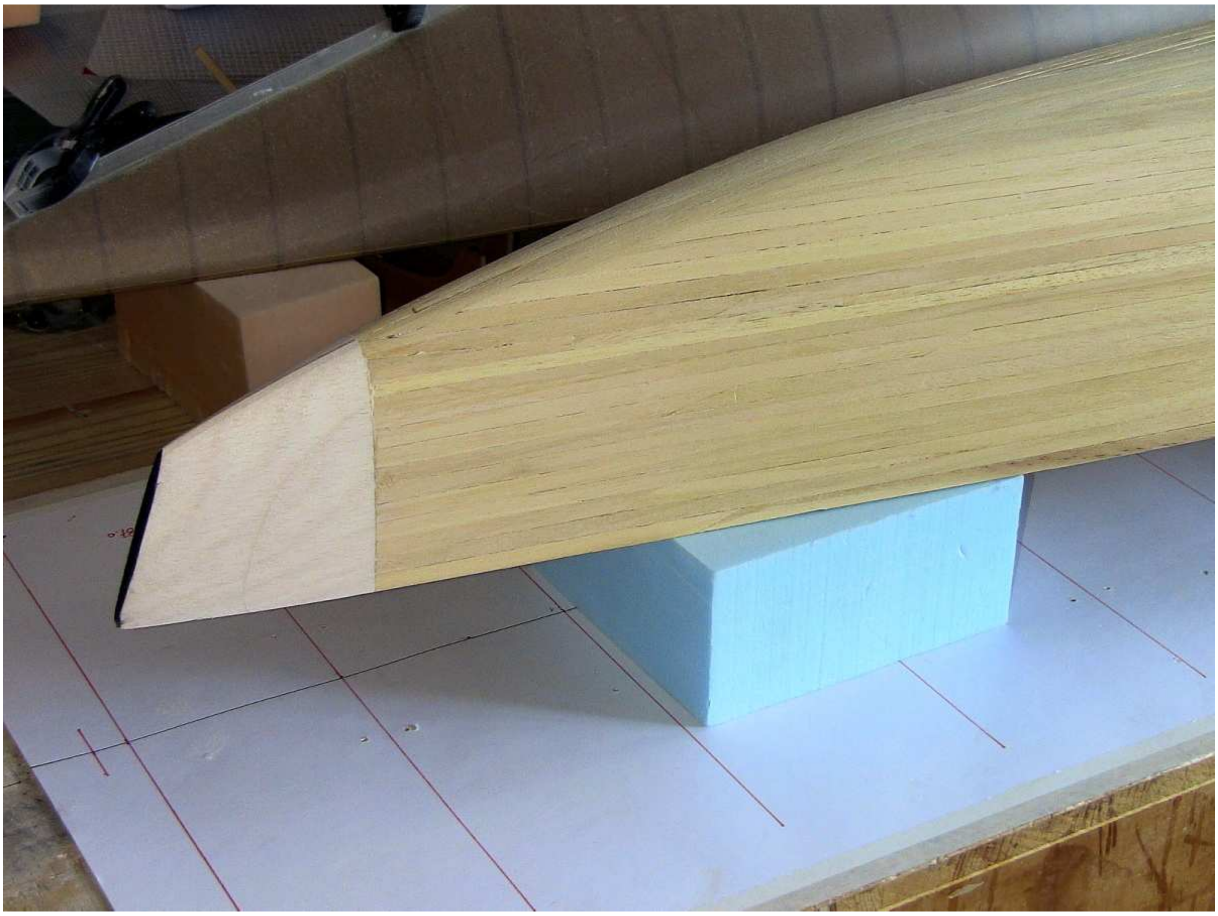
Mounting table as usual

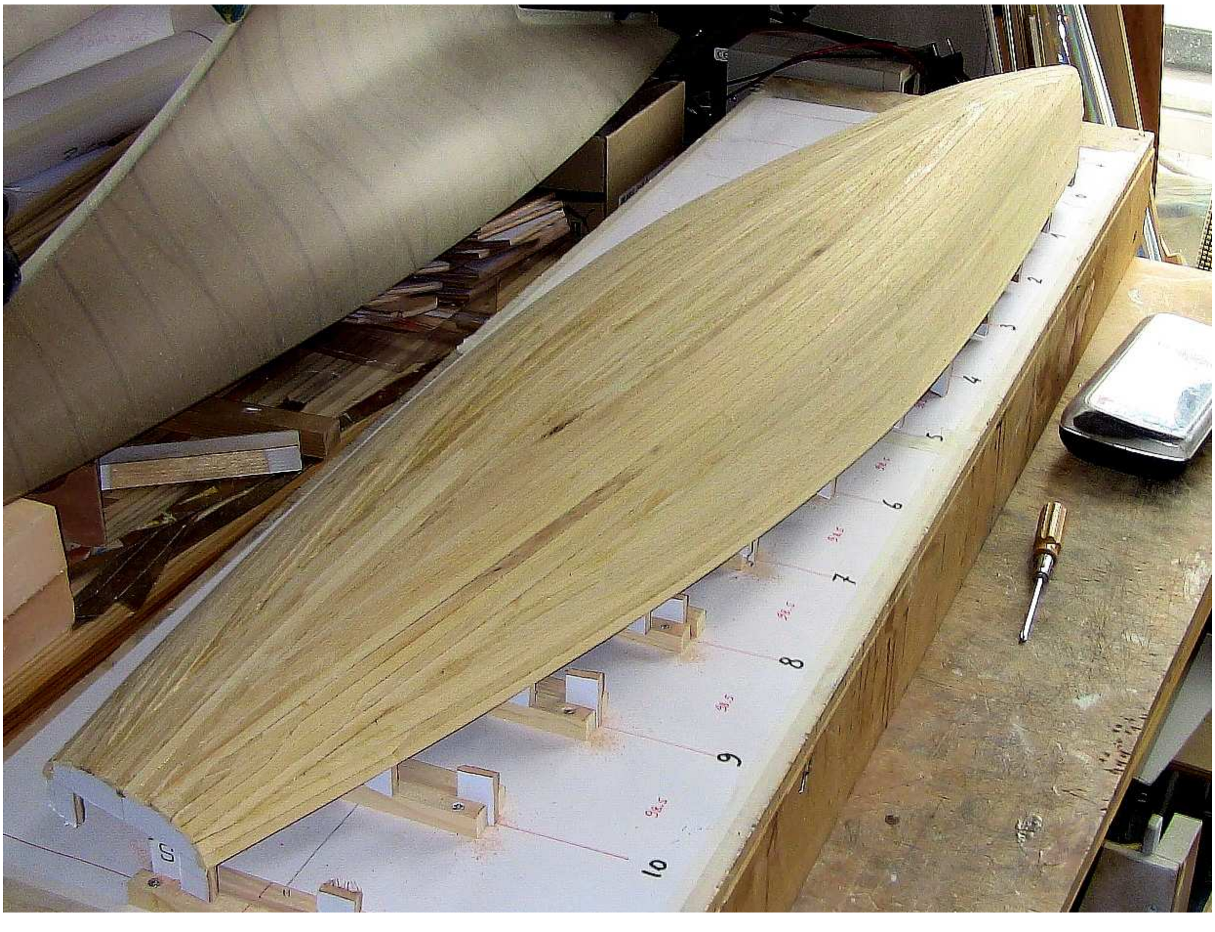


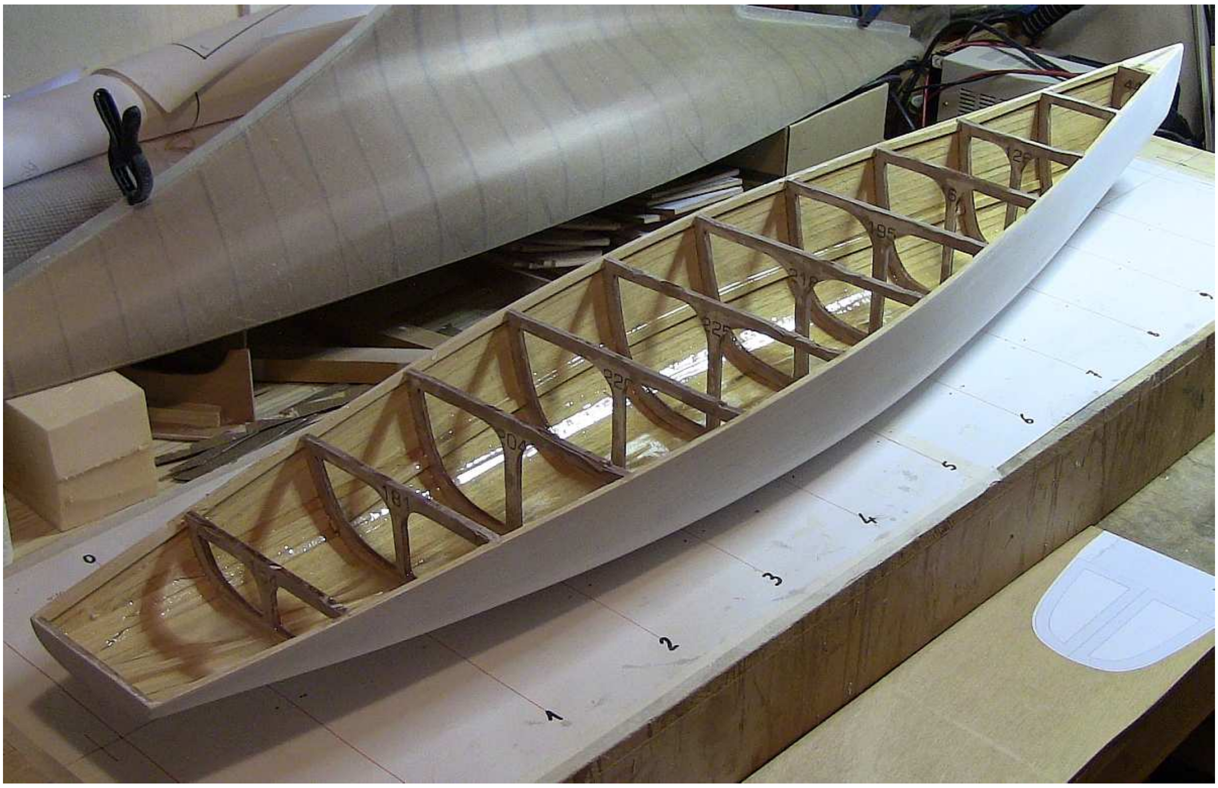



7
98.5
8
98.5
9
44
98.5
10
115

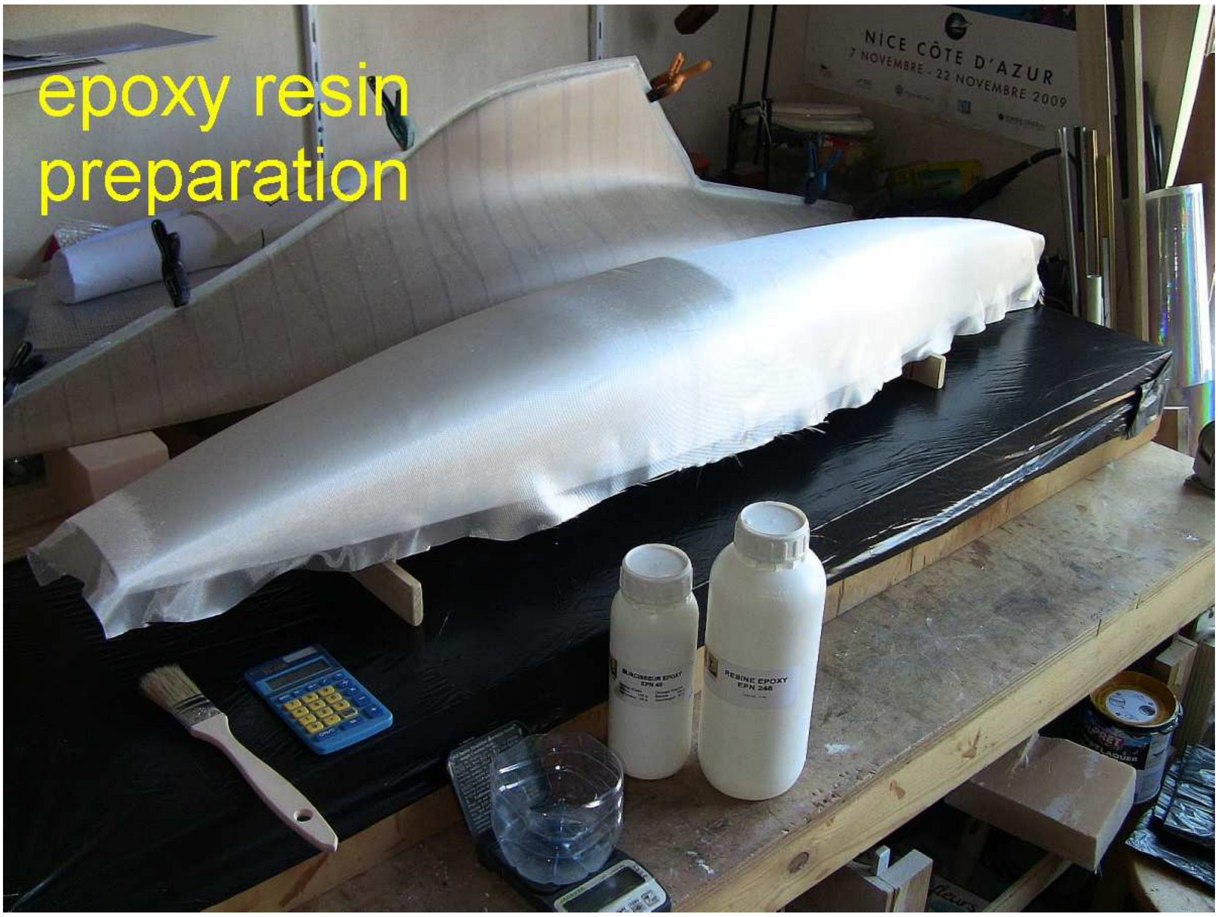








Hull completed

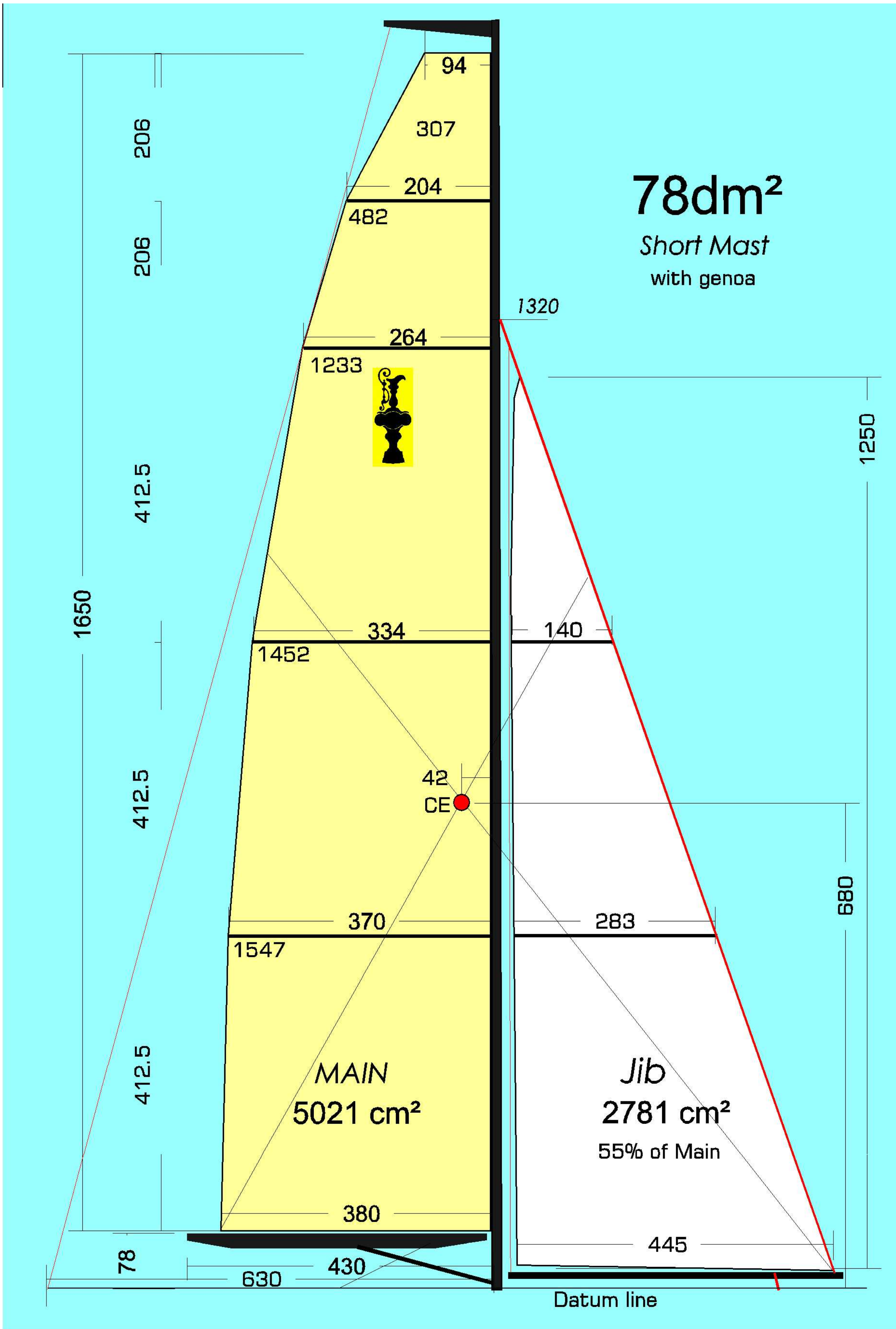


All my models shall go for this routine work

Generally I use Peel Ply just to remove the excess of resin.
The Peel Ply ribbons will be removed after two hours max from the polymerization process start.

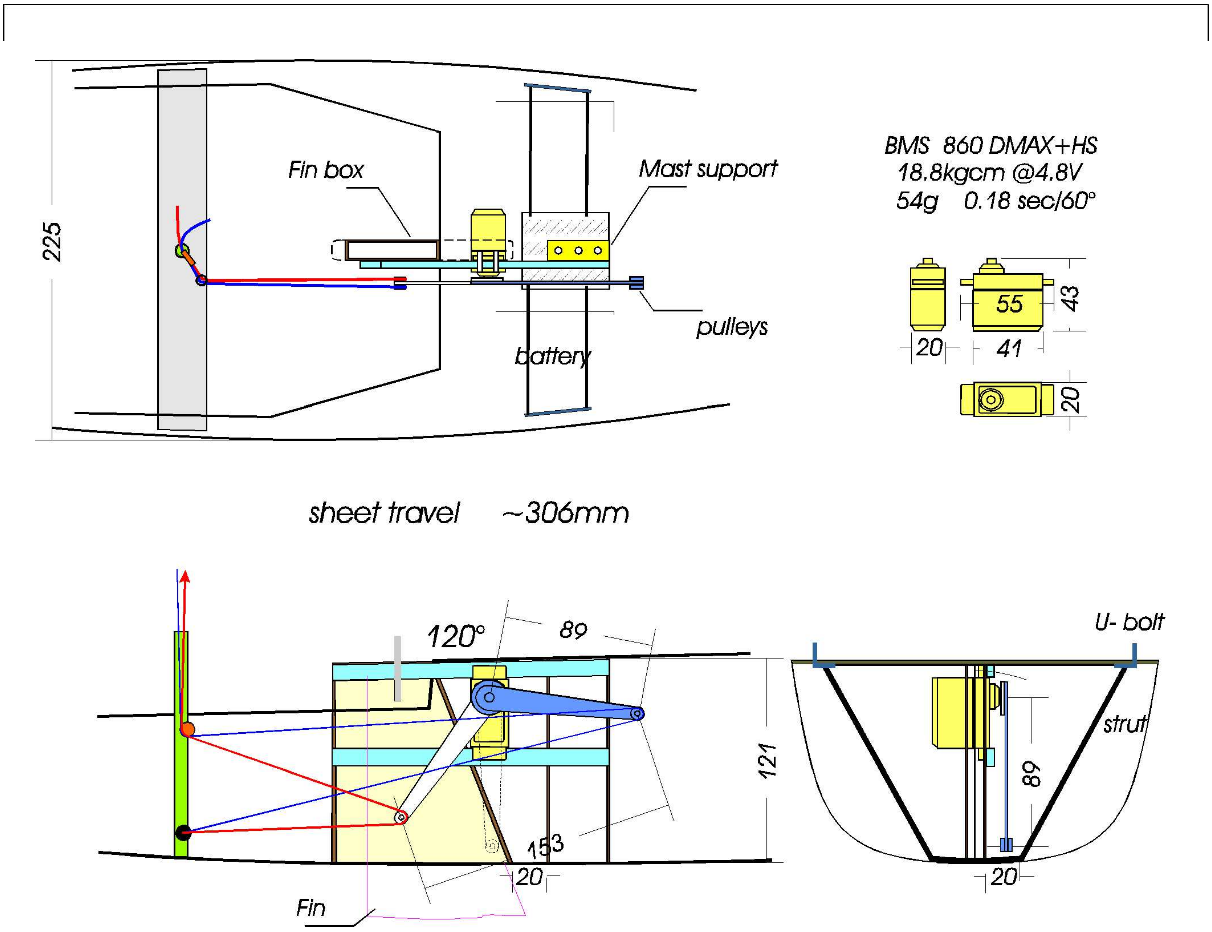

black color
before wet
sanding

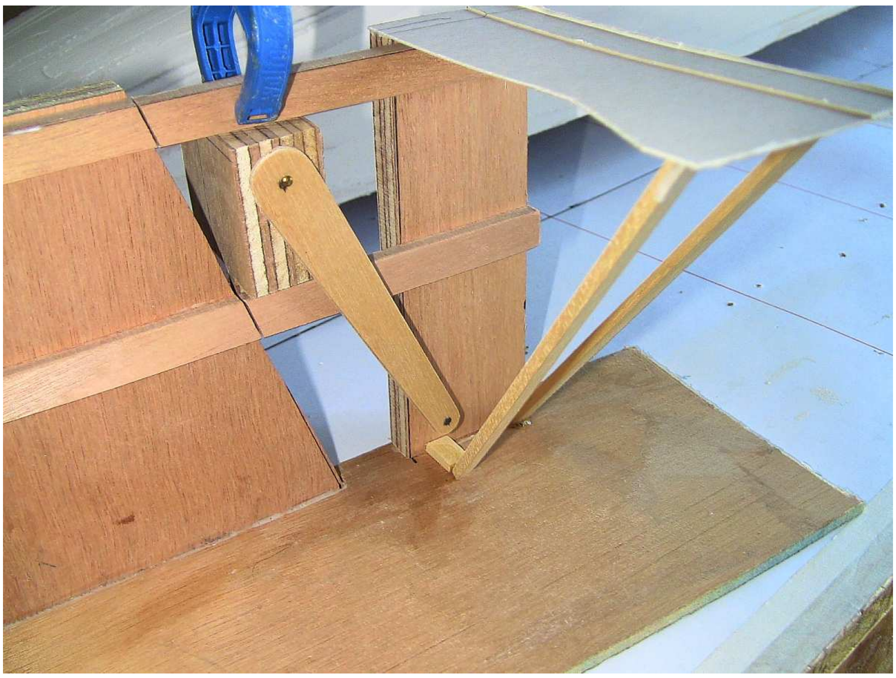
The Hull after wet sanding and ready for wax application

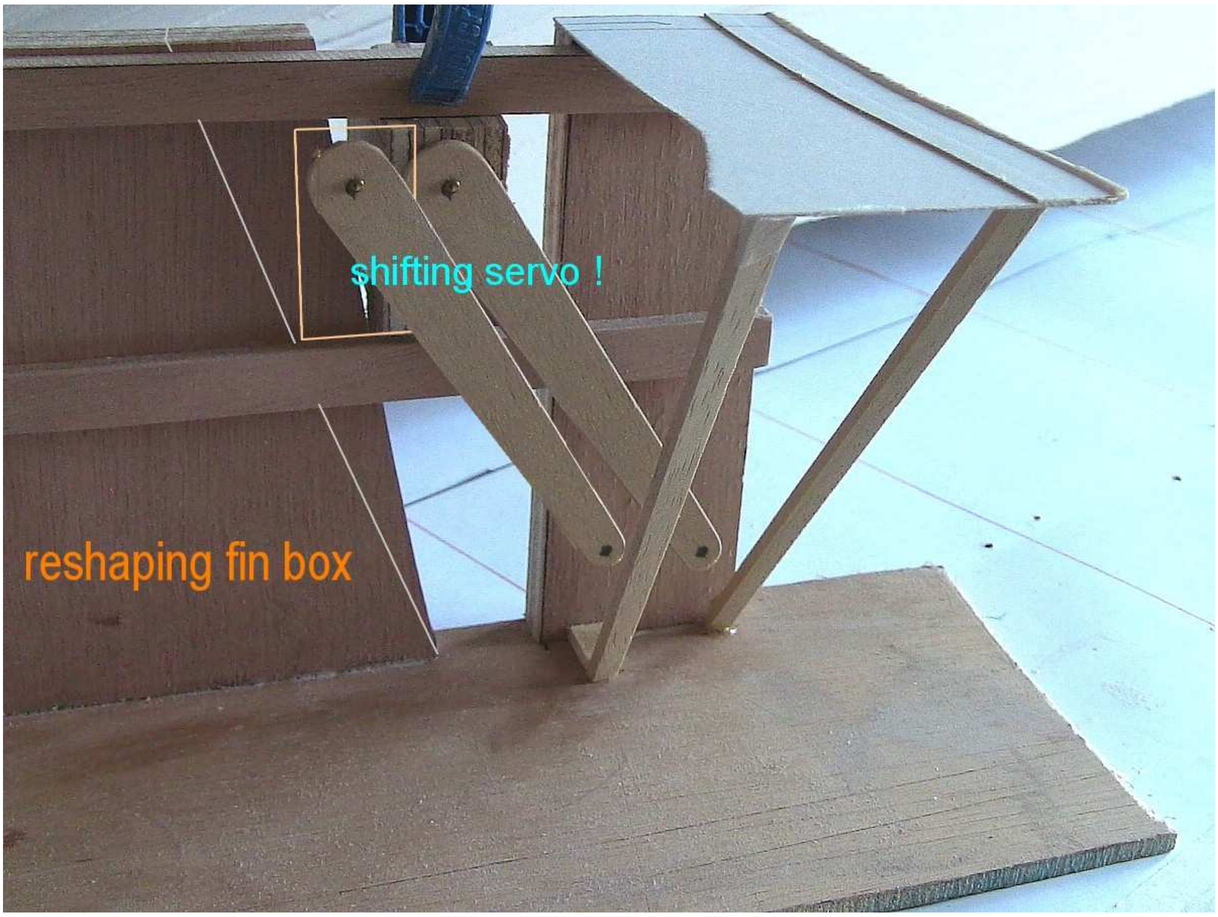


Typical Sail Plan for an AC120 class model

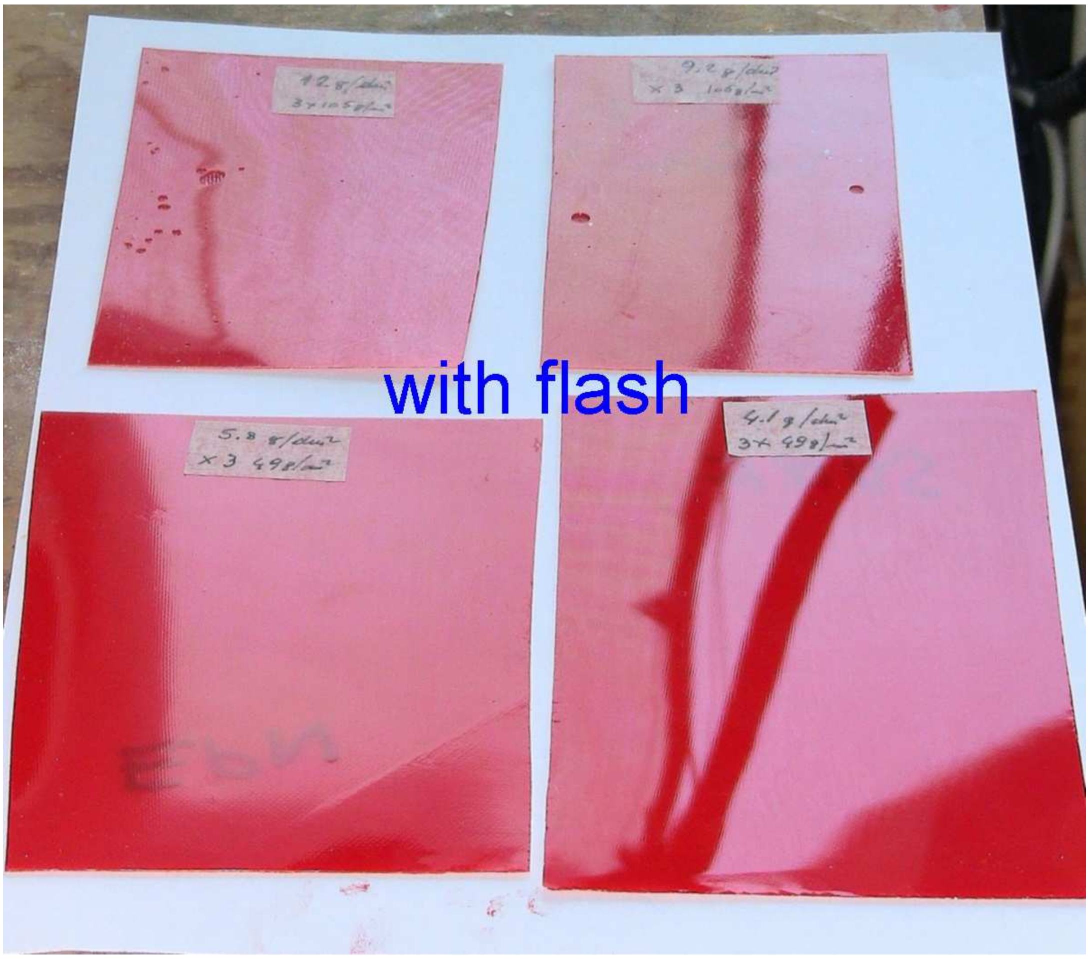
Vertical Servo Arm in order to keep the weight as much as possible close to the centerline



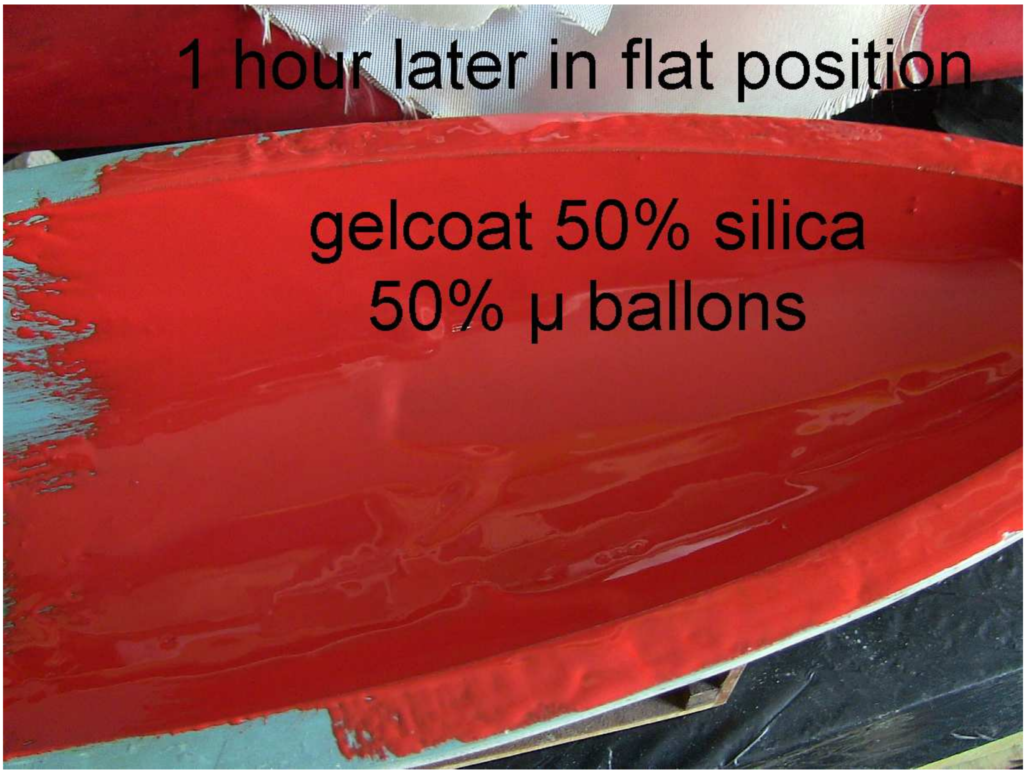


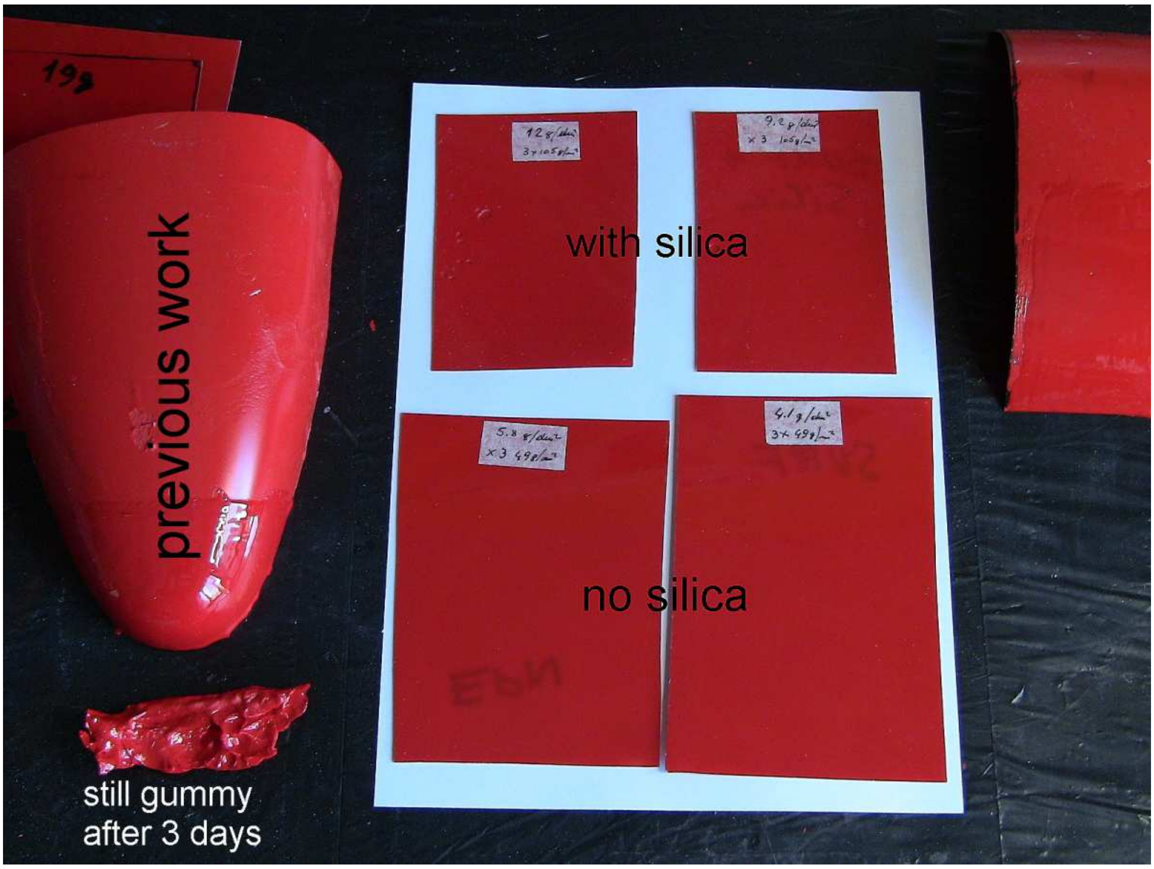


The servo position can be chosen as the Fin Box allow.
There nevertheless the interest to move the weight above the LCB or Hull center of gravity

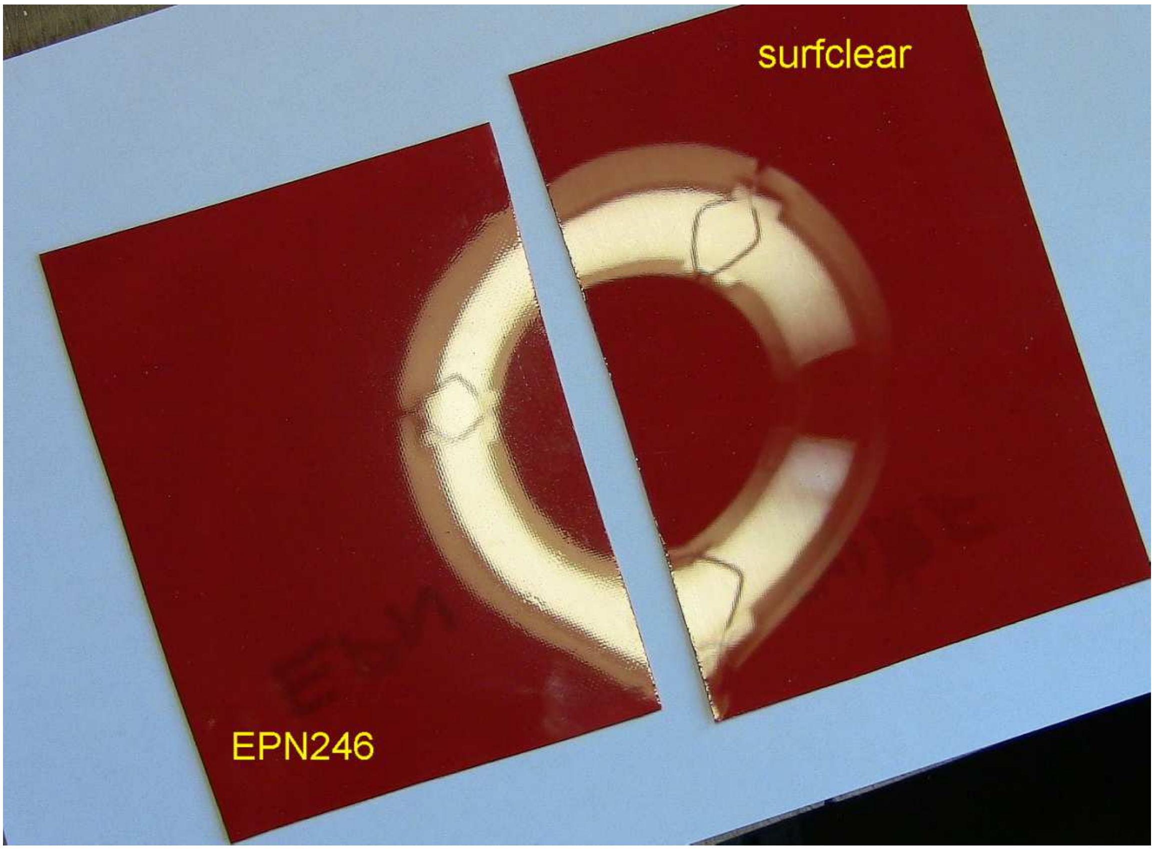


Samples with cadmium powder, resin and silica gel





About smoothness verified with flashing light



The Real NZL20 was equipped with dual Fin while the Bulb was kept in between
For the AC120 only one Fin used

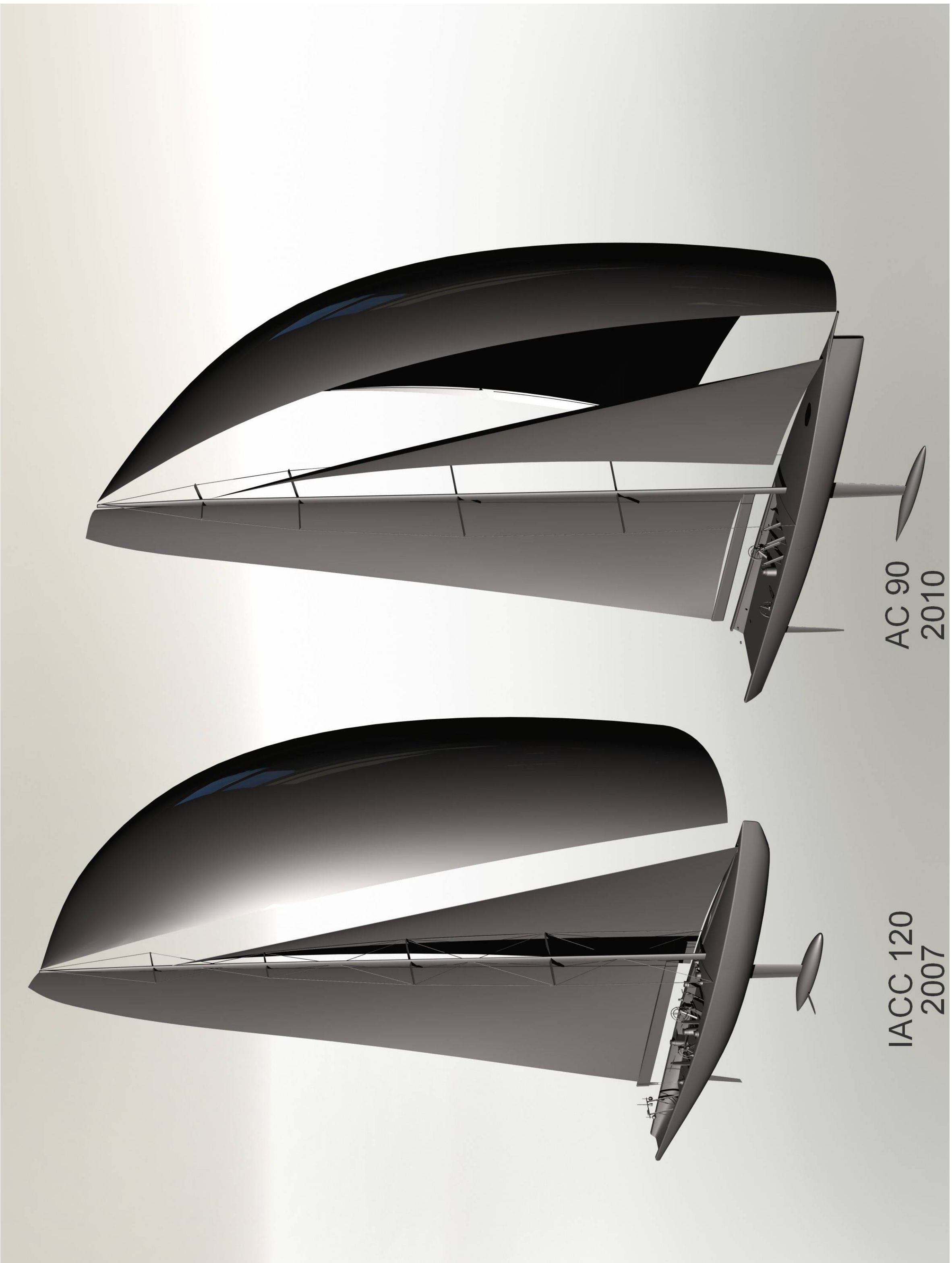
AC33

All started at the time after the 32^{nd} America Cup 2007 when some indications where given for the future America Cup event.
Press published some drawing view and indicating that the future Boats would use more sail surface, no Genoa but with a Bowsprit

The Alinghi Syndicate, winner of the Cup in 2007, proposed to introduce a new design concept with the AC90.
My model was called AC33

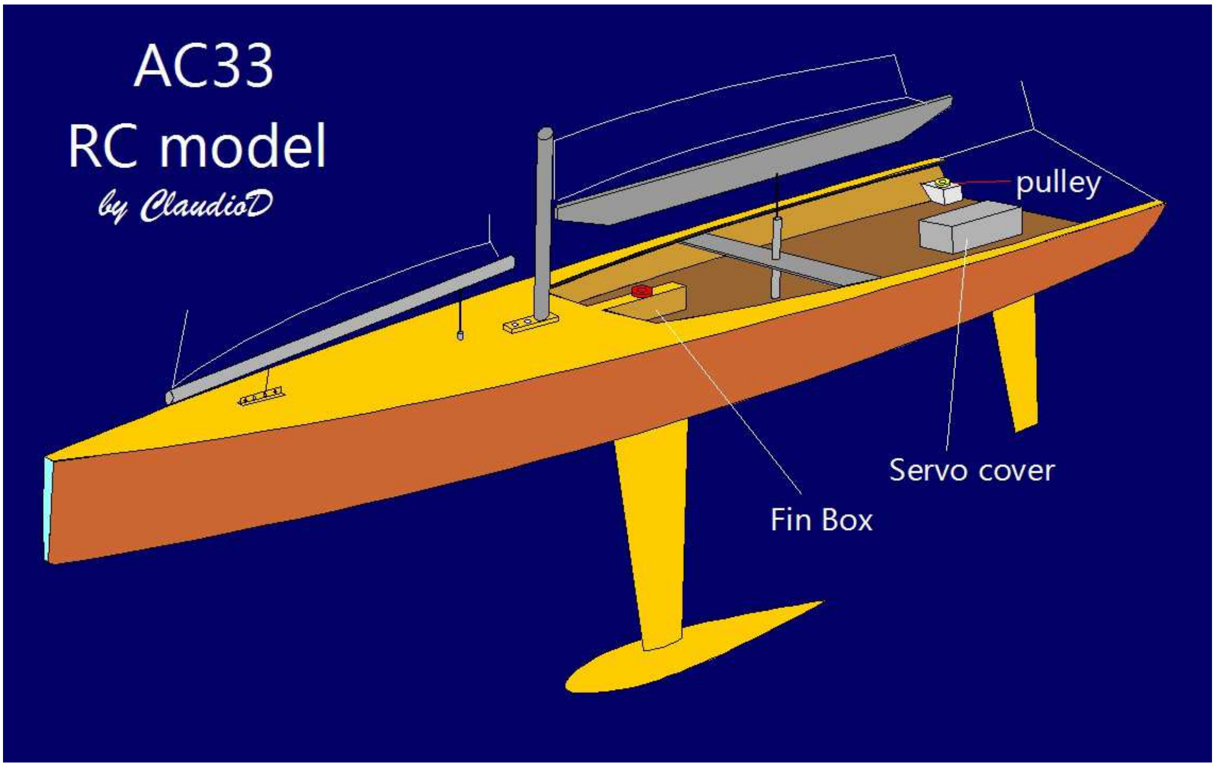
I used the Class M Rules but also the AC120 Sail Plan

This is the anticipated view of what could be the boats for the new America Cup.

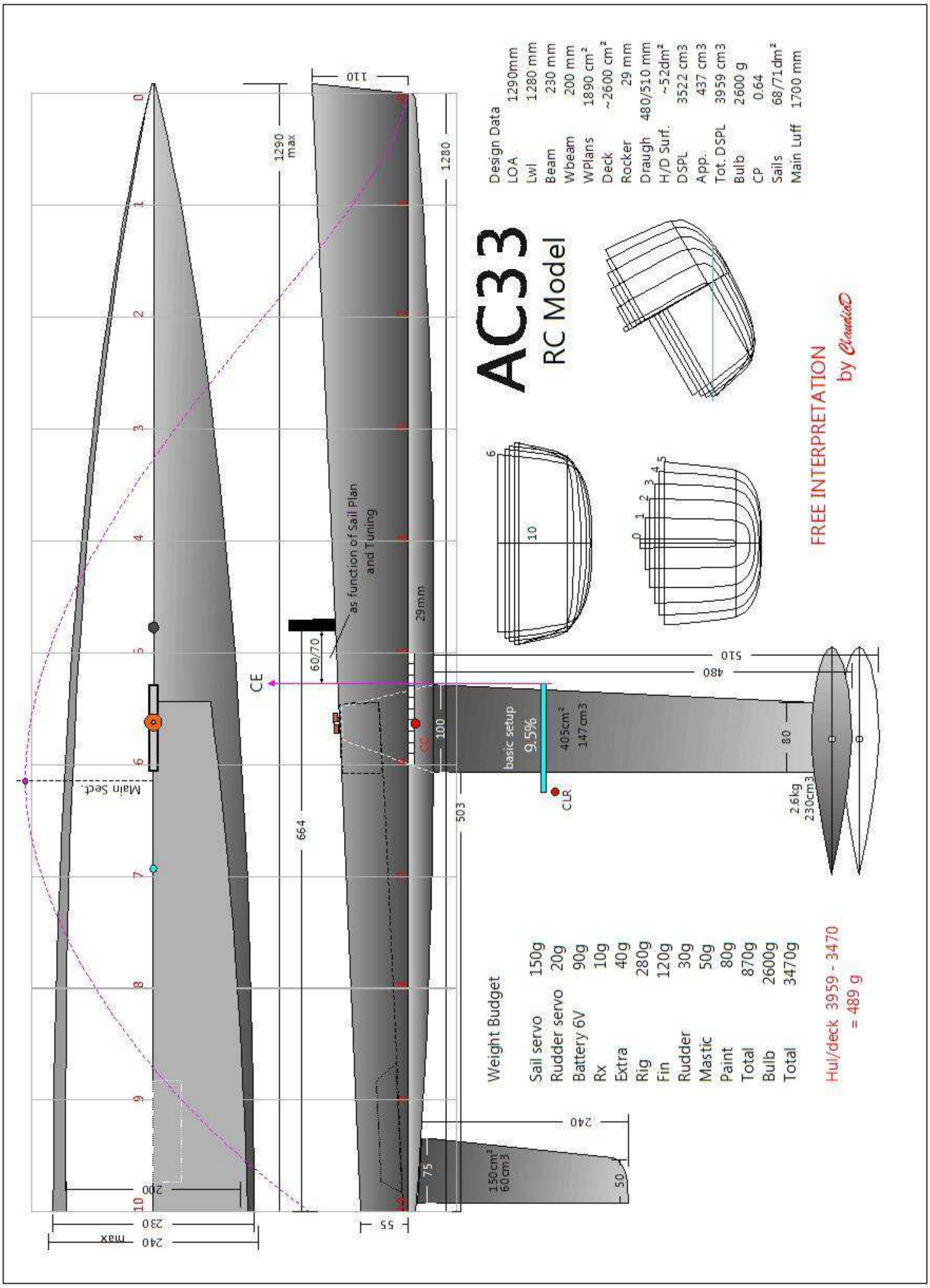


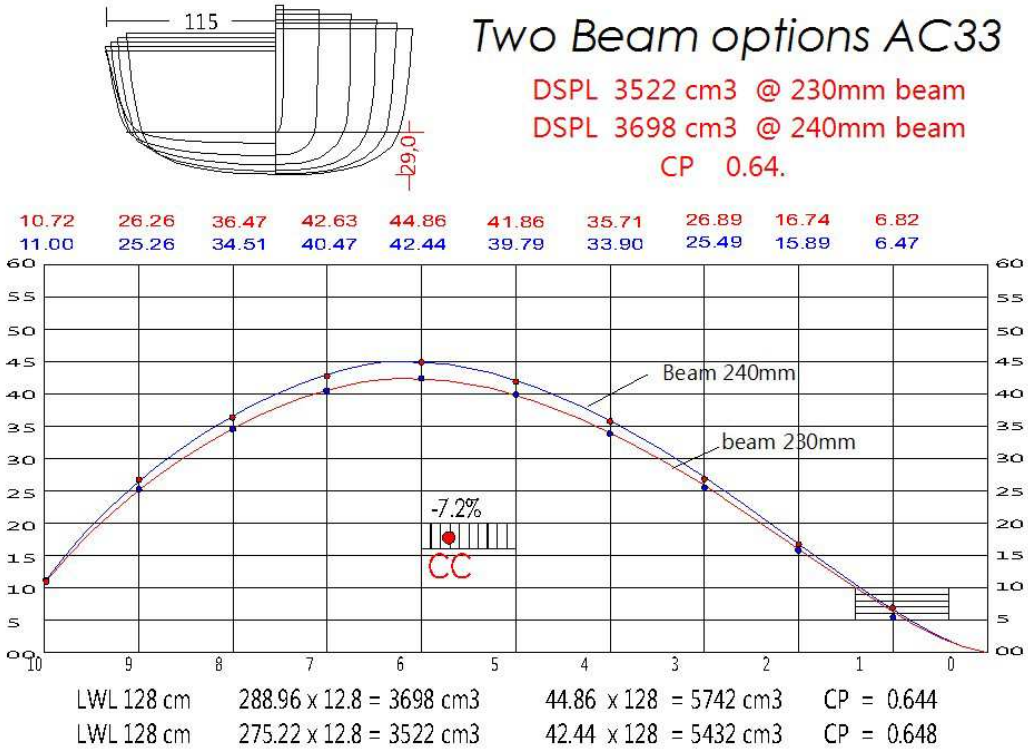
Very happy to discover what the Nautical Press presented as such that I started designing the New America Cup RC Model.
I was happy also because the RC model could be 'launched' before the America Cup Event.
In 2009 a new Rules were established for the 33^{rd} America Cup

This was my drawn 3D artistic view:



My first drawing fort AC33.
No Bowsprit since not accepted by the Class M Rules





While preparing for the construction, a new idea about the use of fabric tissue replacing one layer of Glass tissue popped in my head.

The motivation was due to the possibility to have various colored surface difficult to obtain with the classic painting methods.

The cotton fabrics of "Kaffe Fassett" were a source of inspiration since my wife used for Patchwork and Quilt.

Typical sample Kaffe Fassett Cotton fabric

Strip Planking

Strip Planking almost complete

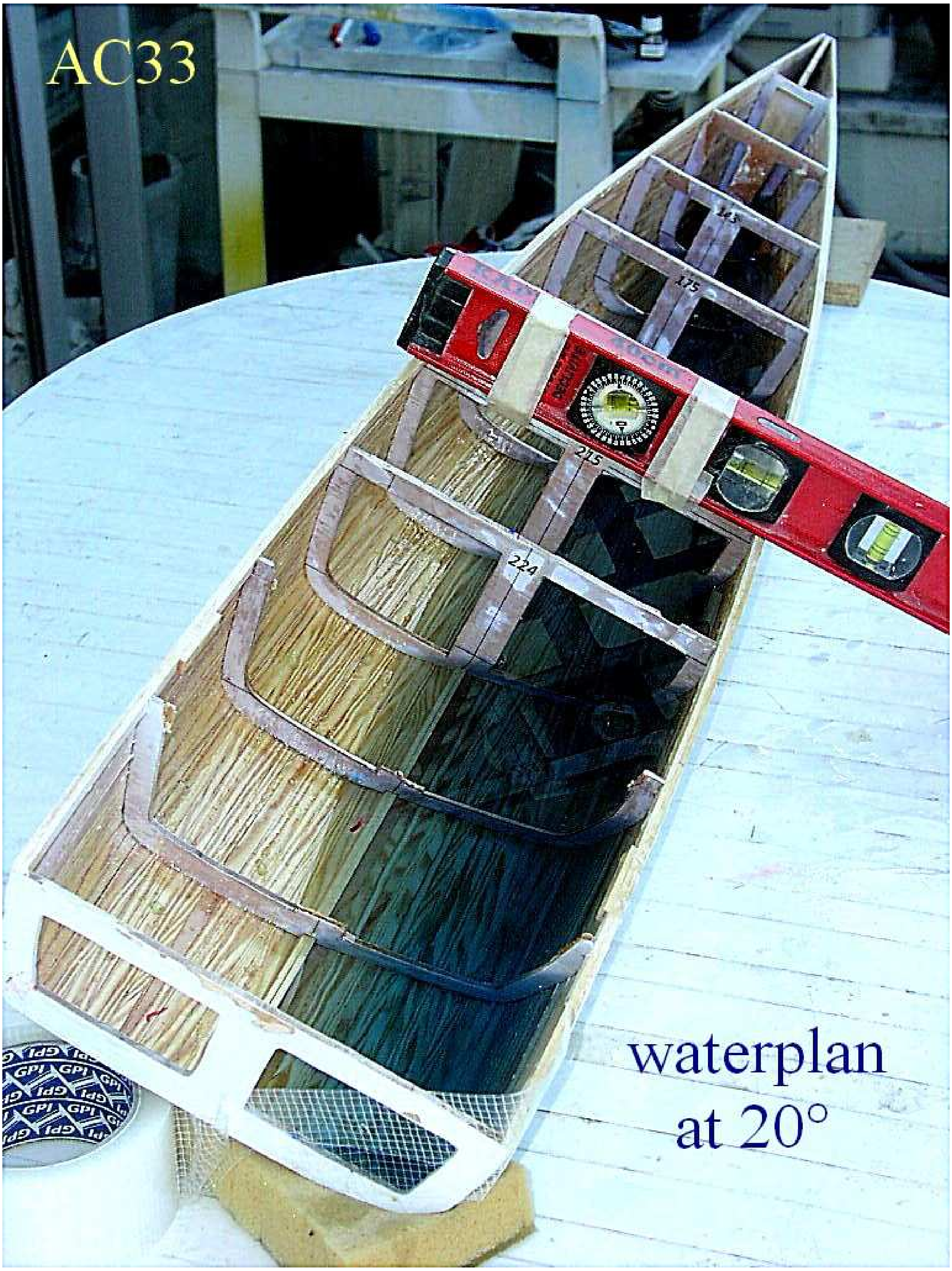
The other Side

Filler

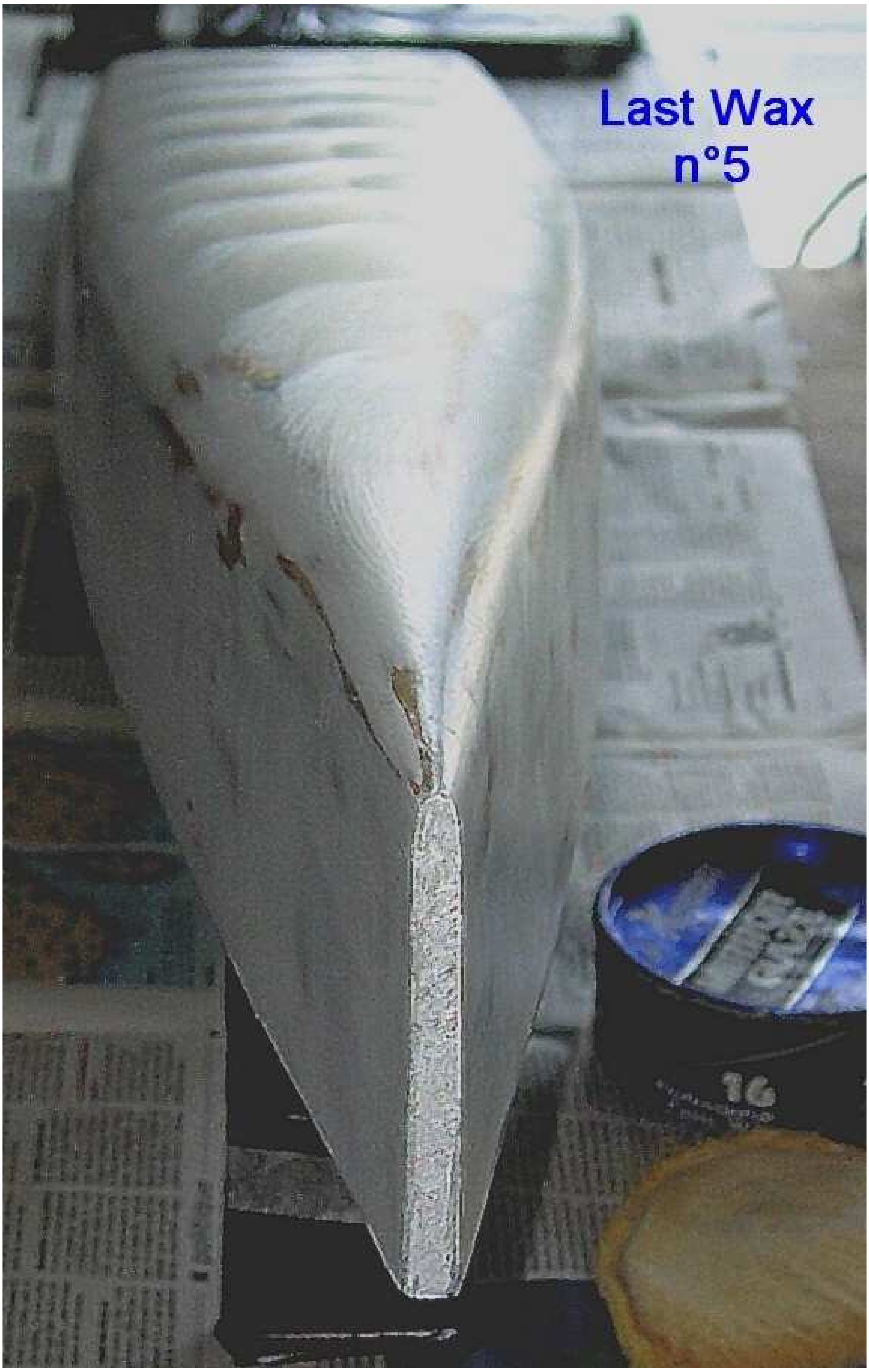

Primer coat
AC33


Hull epoxy-glass
laminated and
peel ply

Water Plan verification at 20° tilt



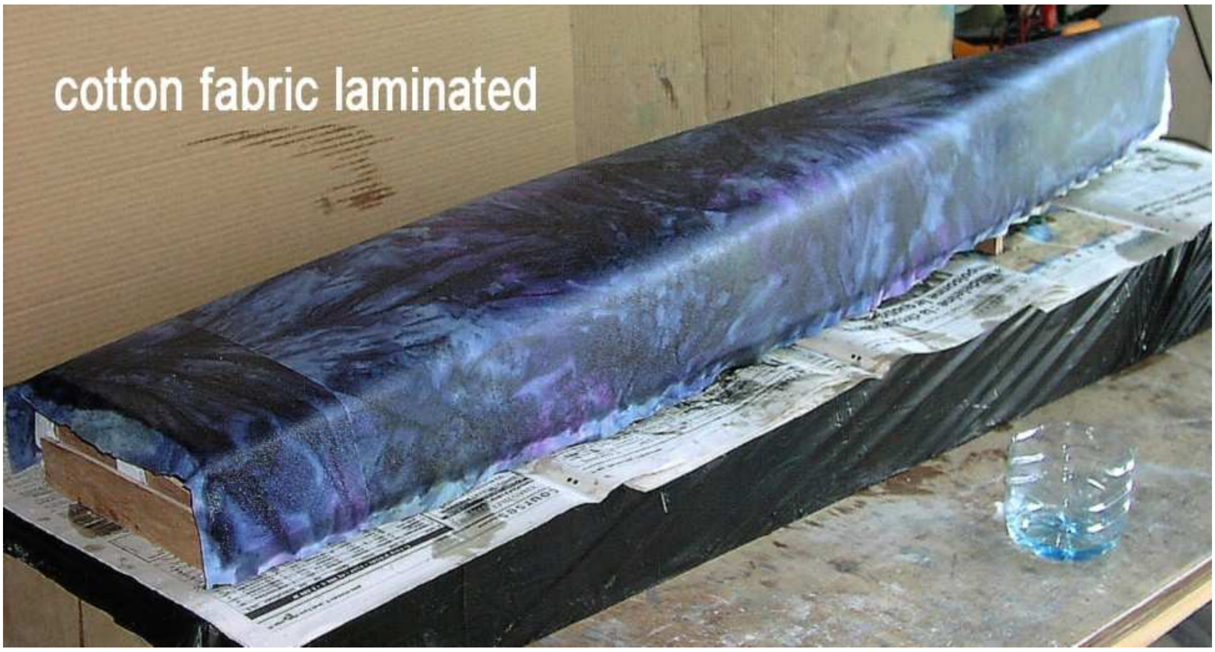
Colored water with blue ink



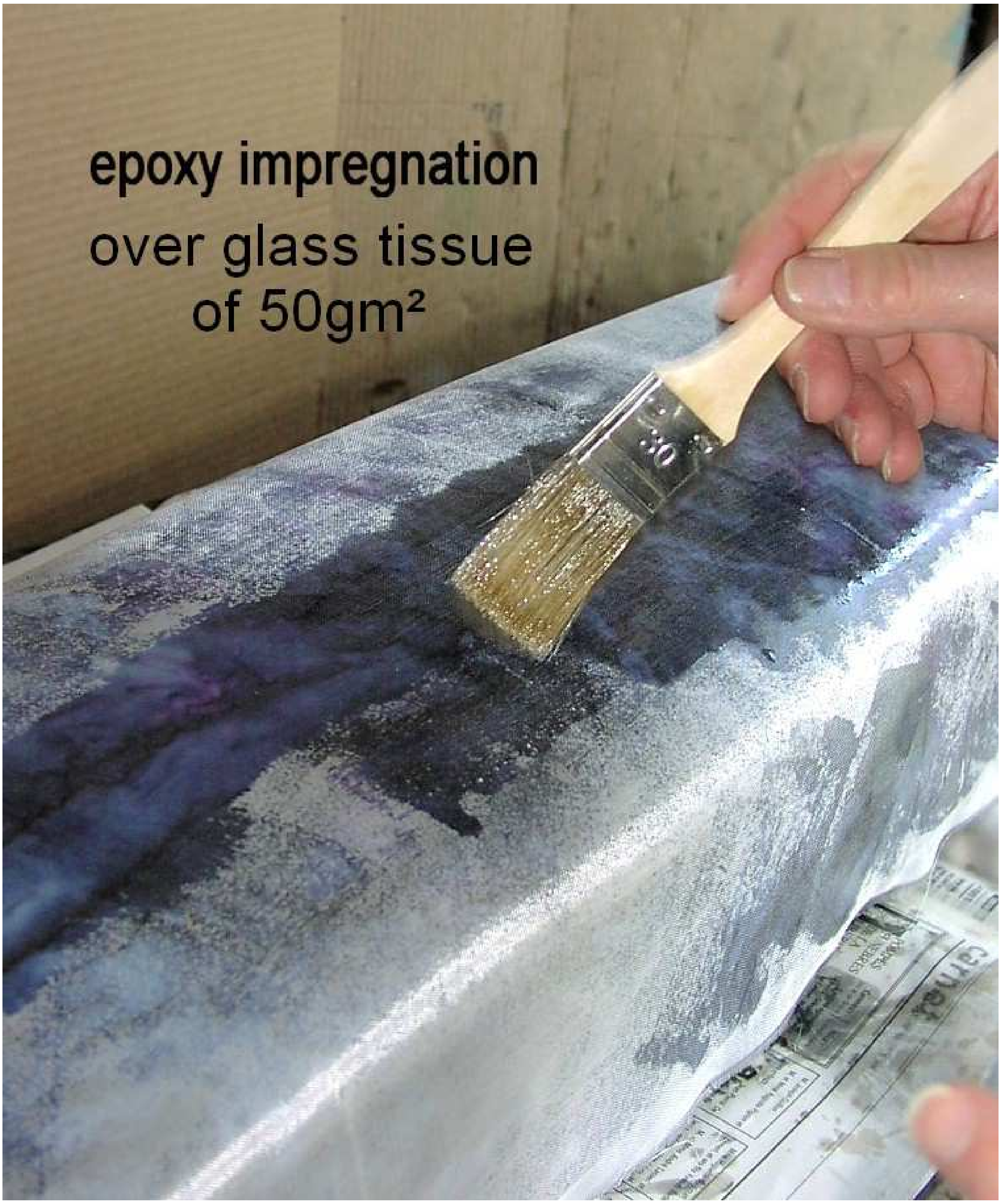
Before start hull lamination on male mold, several coats of wax are applied (here Mirror Glaze used)


2nd layer
105g/m²


cotton fabric
112g/m²



After lamination with the Cotton Fabric, 2 layers of Epoxy glass of 50g/m² are added



Care shall be taken with the brush to avoid creases.
Brushing diagonal movement from center line to the exterior


oblique brushing
to avoid fabric
creasing


End of
lamination

Hull de-molded with back light

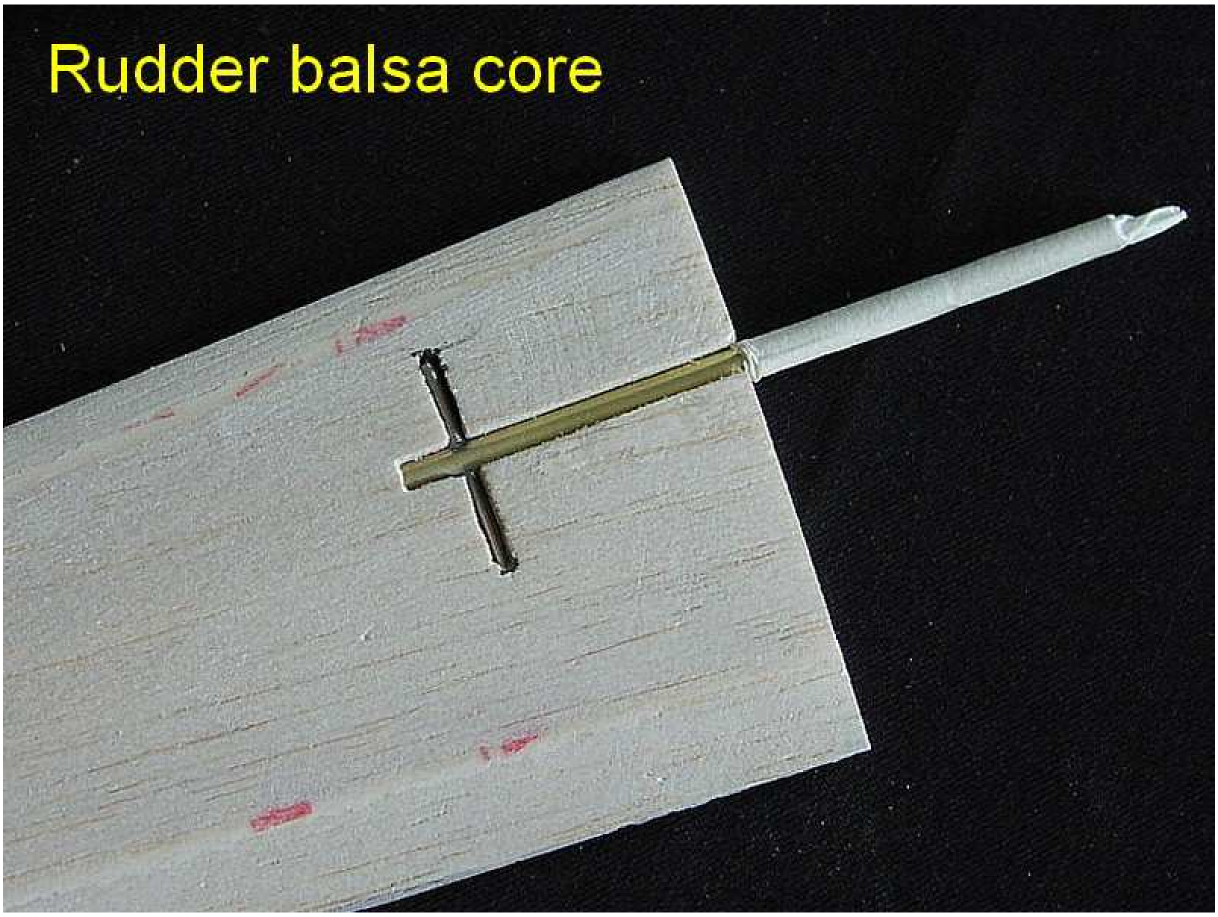
Cotton tissue apparently is absorbing more epoxy resin than Glass tissue, therefore an increase of hull weight it is normal.

Because of the direct lamination without vacuum, an uneven surface will be present. A layer of contrasting paint will be used during wet sanding to smooth the surface.

Progressive surface appearance during wet sanding

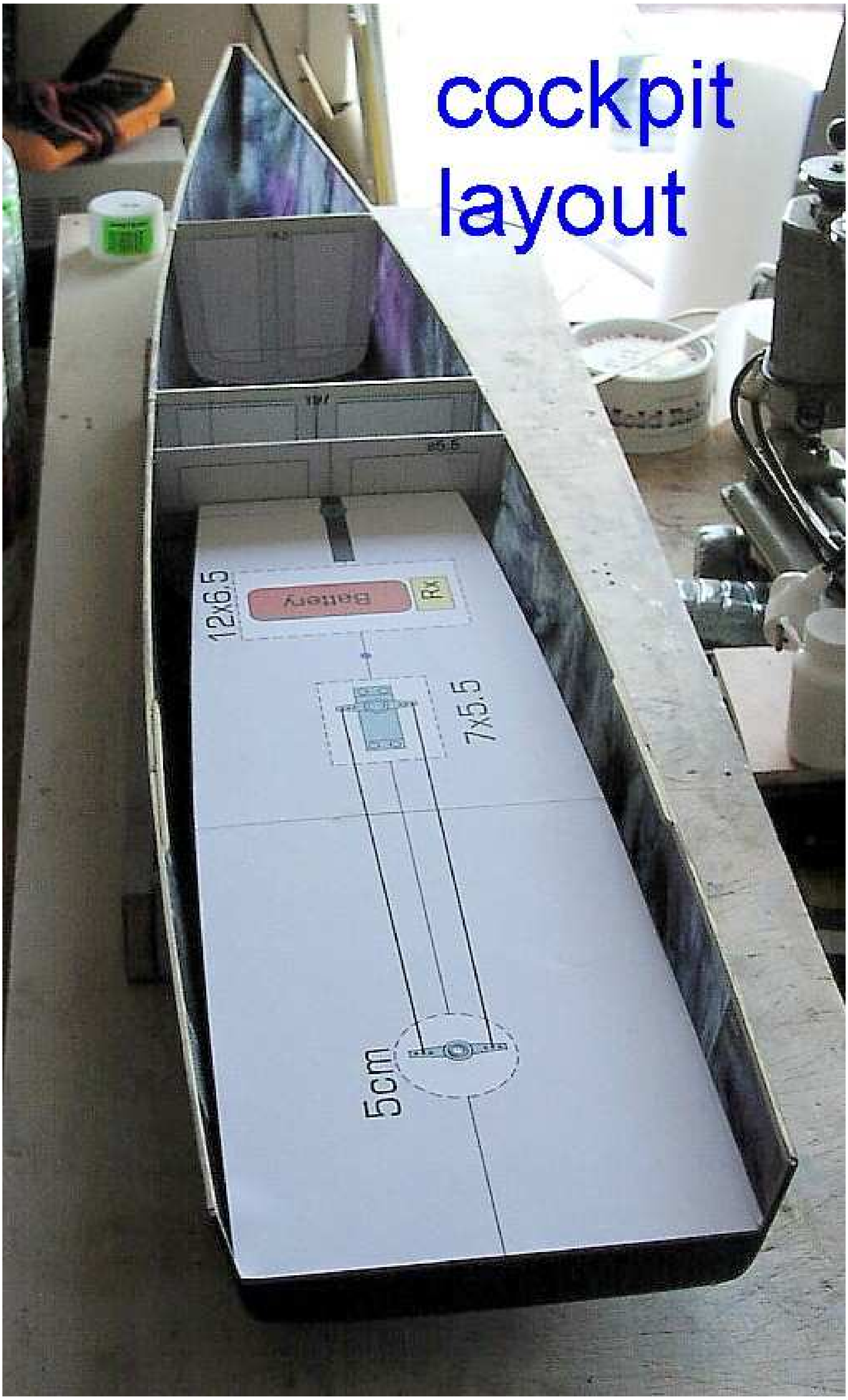

Wet Surface
after sanding

Glass tissue reinforcement patches

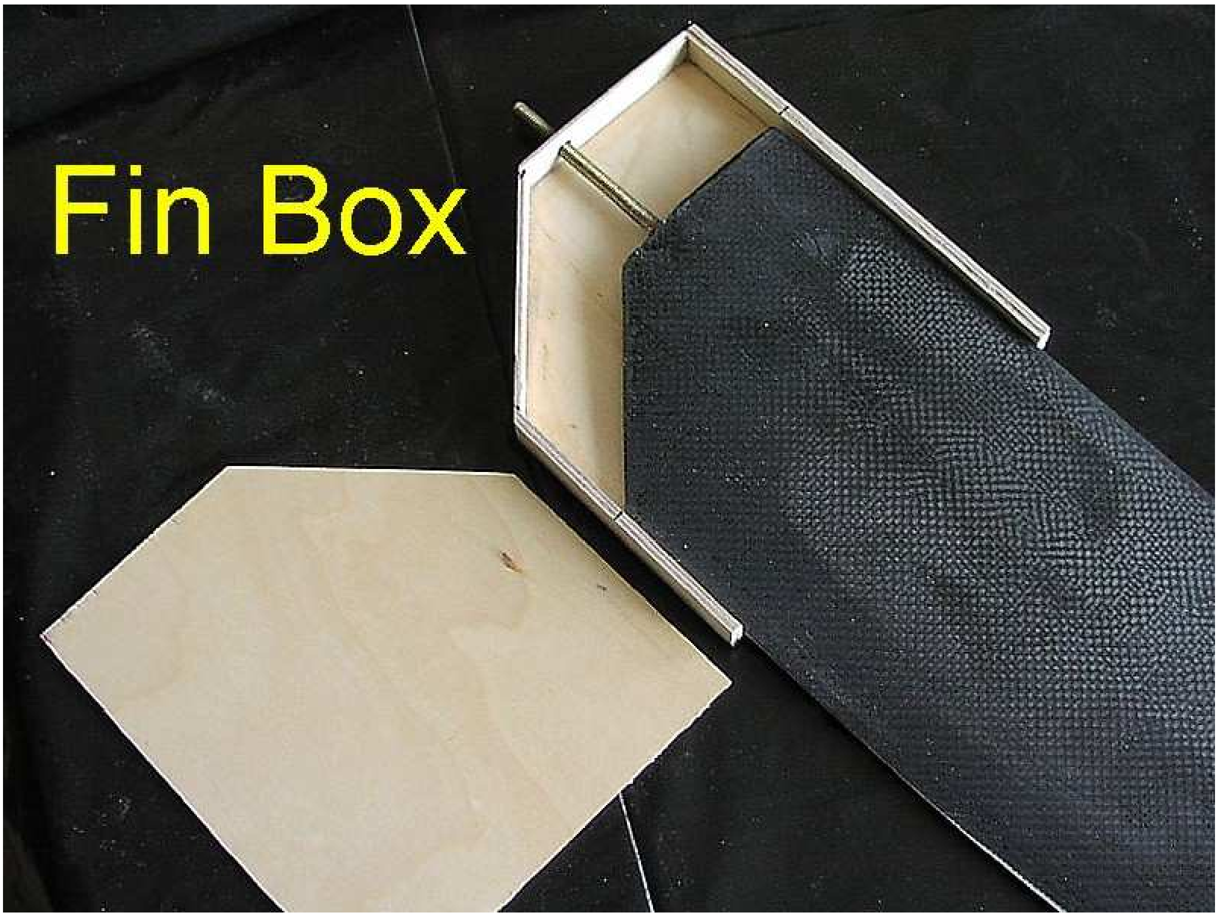

Rudder balsa core


Fin Balsa core

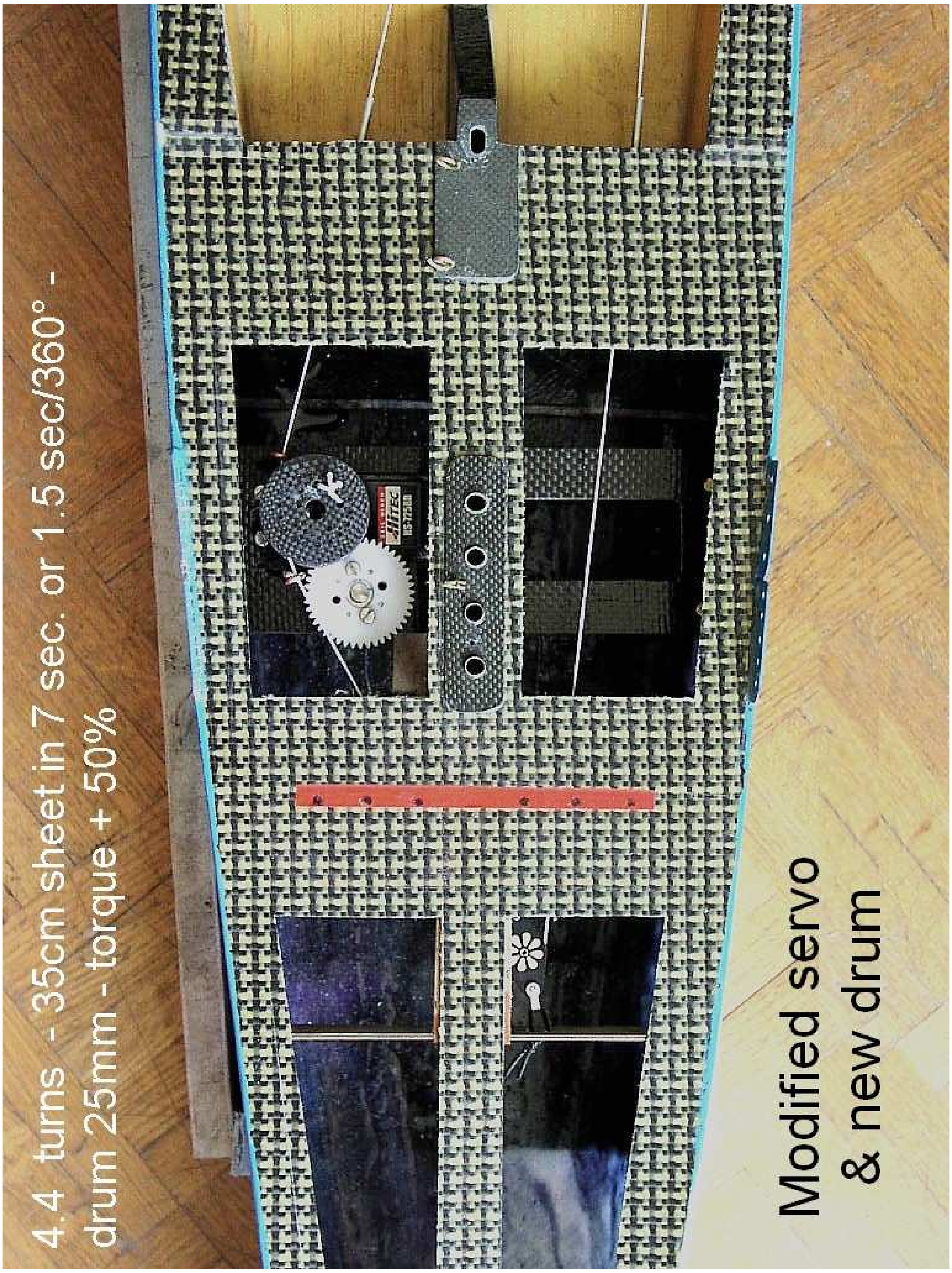
Rudder weight 25g



Preparing Hull integration


Fin Box


cockpit floor
lamination
kevlar & glass
& 1mm balsa



For the AC33 I have modified the HS725HB servo and built a new Drum


Jib multiple Hooks


AC
33

Class M Sail Plan

AC 33 showed to be very fast and stable with both tested Rig AC120 and Class M.
Notice that AC120 sail Plan is larger than Class M.

AC 100

Rules Short List

LOA	1000 mm
LWL	850 mm
DSPL	2750 g
Sail Plan	5500 cm²

The America Cup was just ending in 2007 when an Italian Editor proposed a package sold once a week with parts of the Luna Rossa. Two options a static and an RC Model.
Boat length : 100cm.

I do not have a record of how many have been sold, but probably not less than 500 models.

The Italian Editor organized a Forum dedicated to the Luna Rossa. A couple of years later I was contacted by a skipper of Luna Rossa produced by the Editor, after having observed the AC120.

He asked if I was eventually interested to design an AC100.

Initially I was reluctant since the model was a much smaller turnout the AC120 and therefore suspecting constructional problems.

Compared with the real-scale America Cup boat another architectural concession was required and probably ending up with a floating balloon.

Went back to my desk and CorelDraw and drawn an AC100 simply scaling down an AC120.

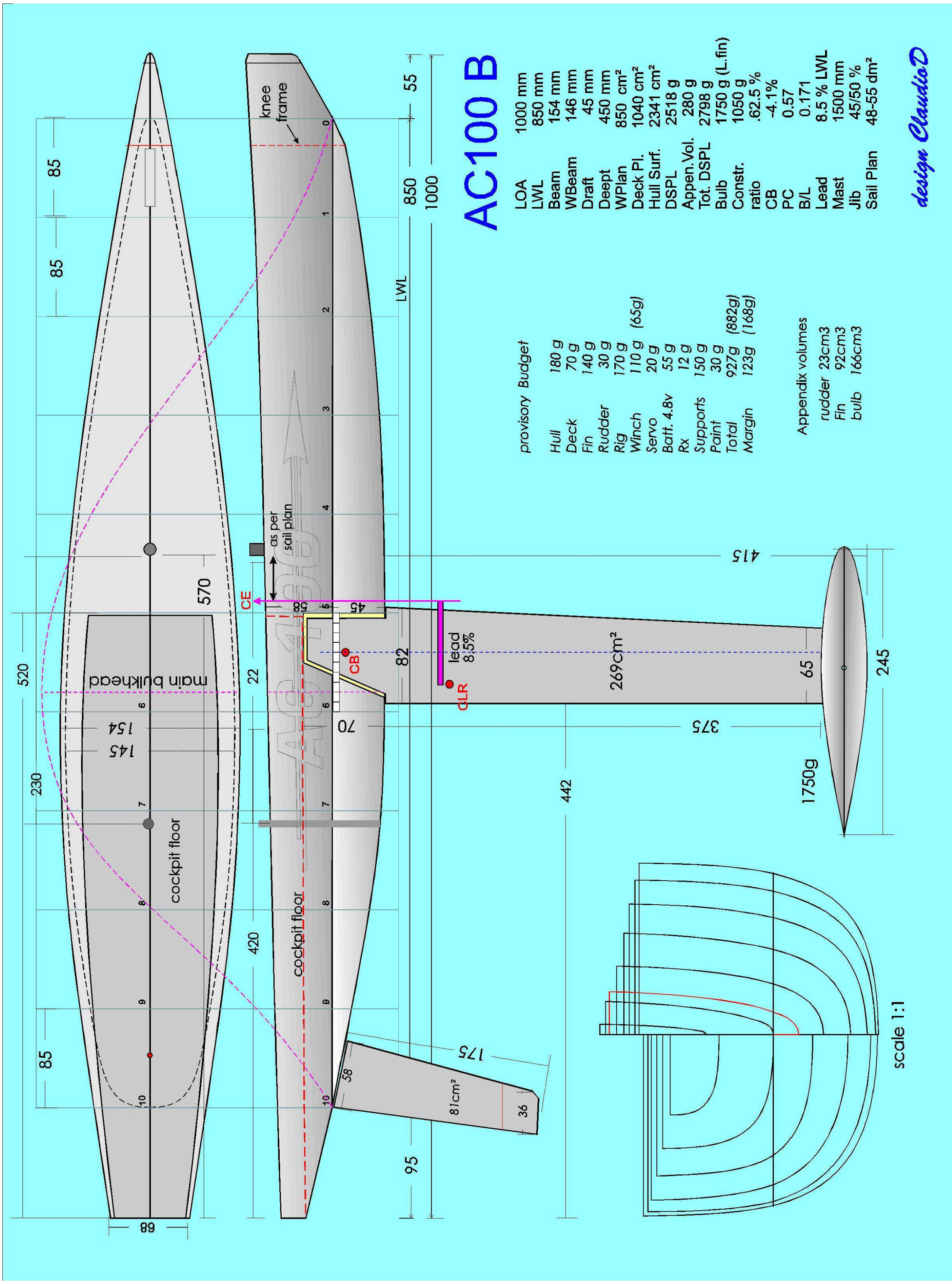
This exercise did not give the expected results as I was suspecting.

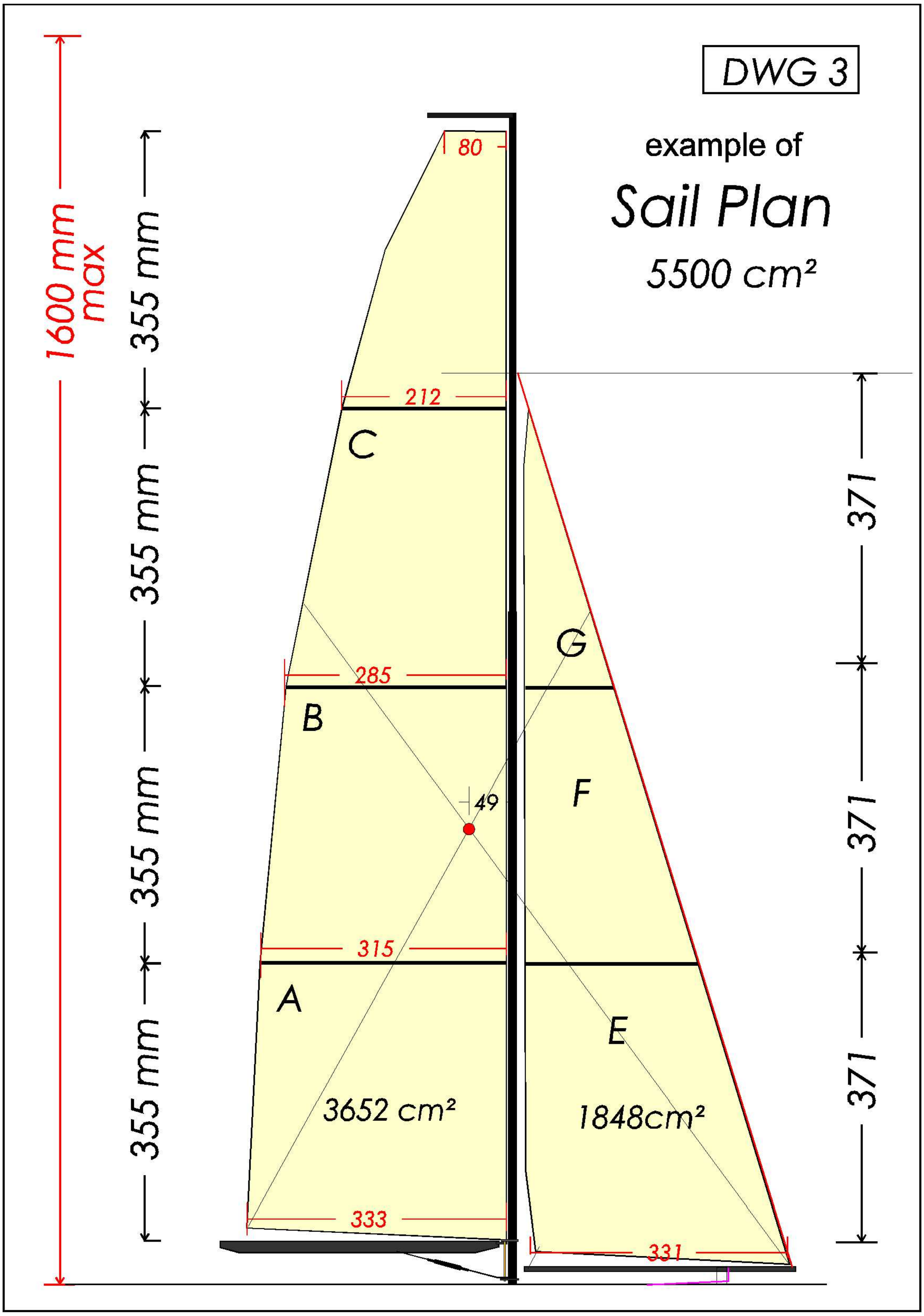
I initiated from a blank paper and finally something acceptable went up.

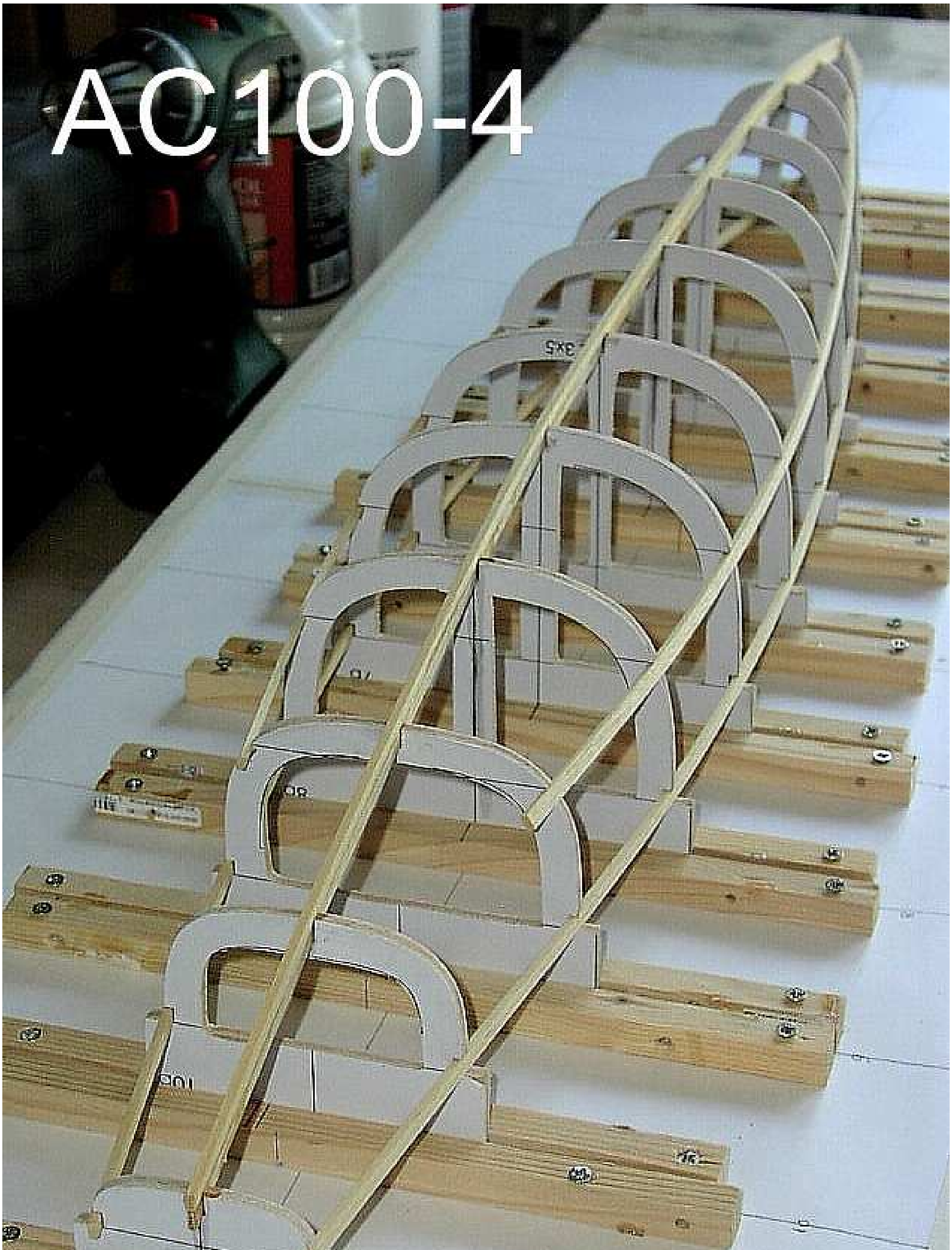
So I did it!

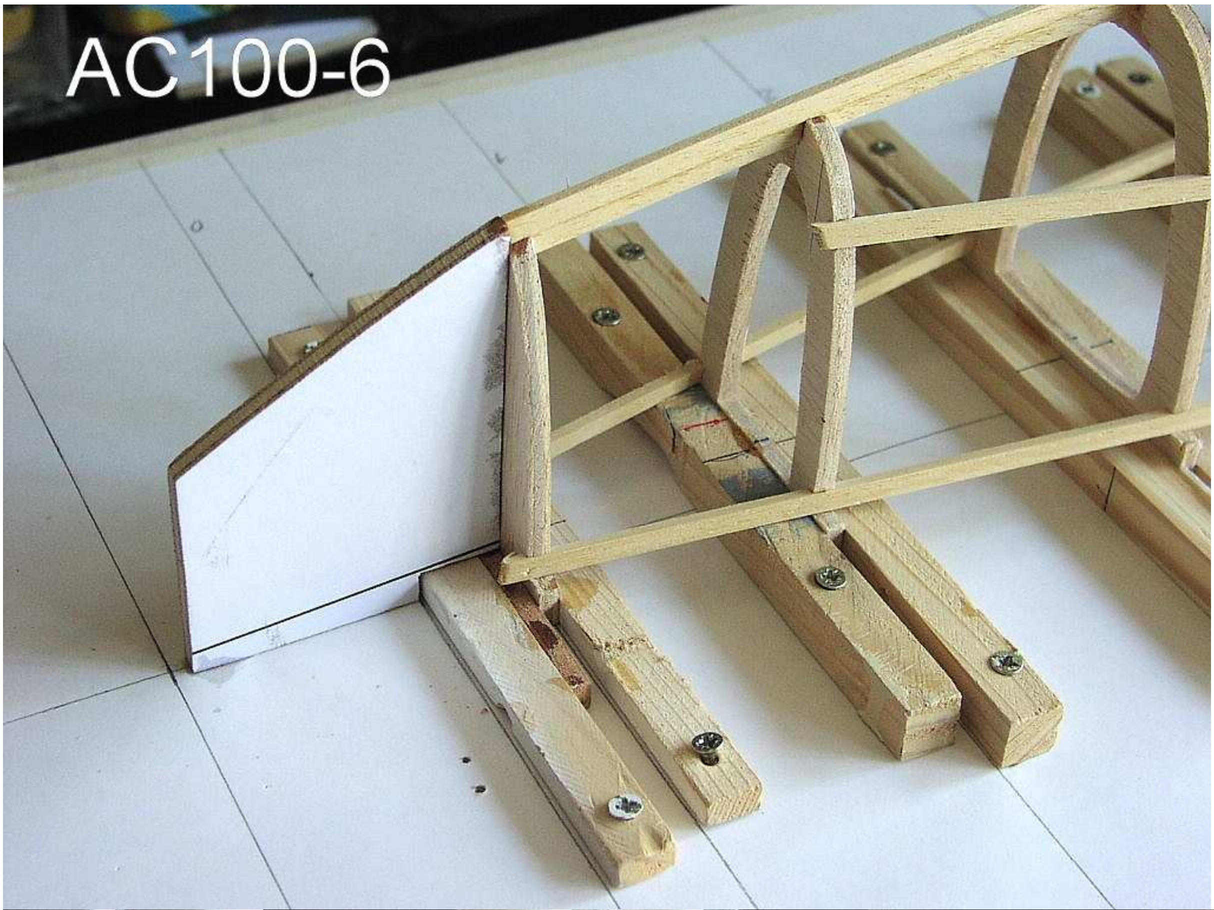
The first design model, the AC100 A, was abandoned since too light and creating difficulties to the builders.

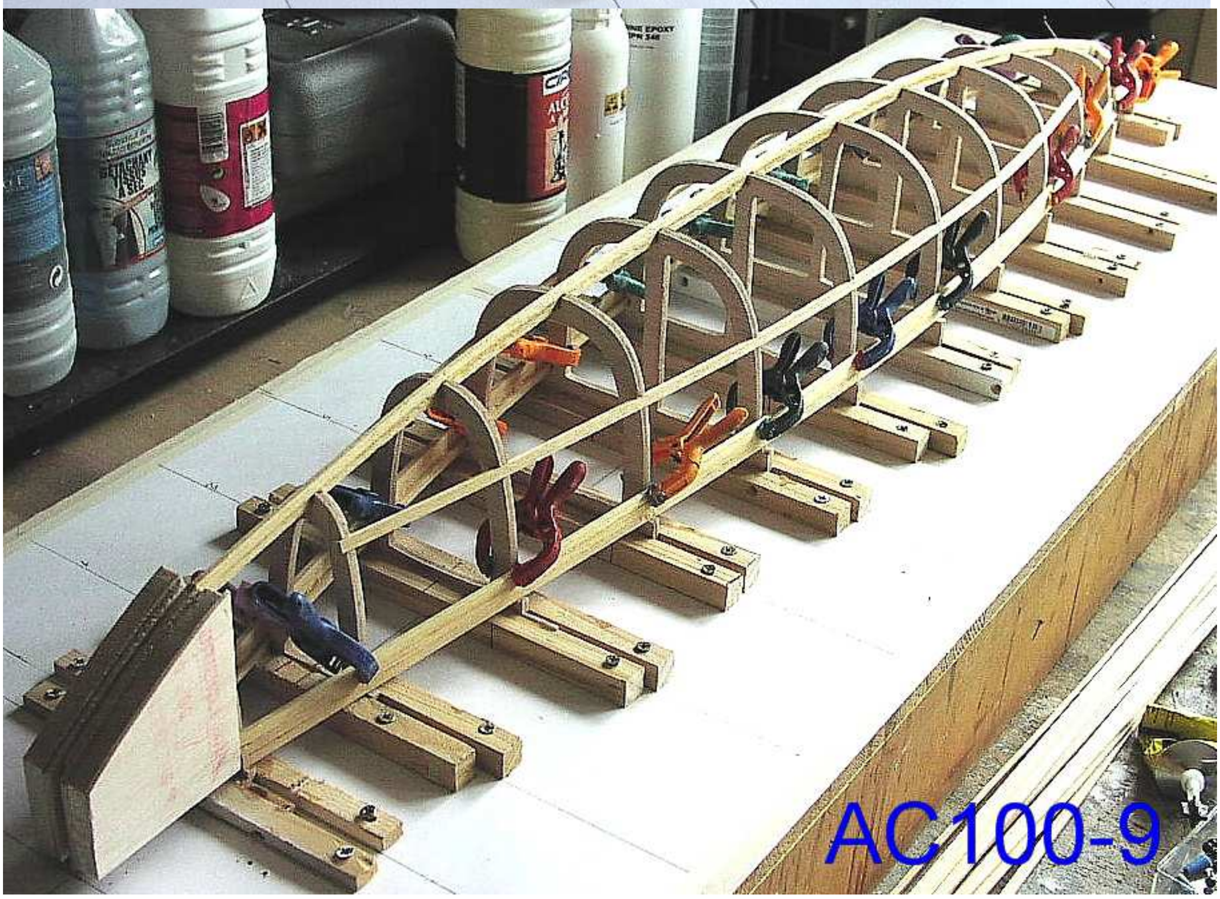
The official model was the AC100-B


AC100 B
LOA 1000 mm
LWL 850 mm
Beam 154 mm
WBeam 146 mm
Draft 45 mm
Deept 450 mm
WPlan 850 cm²
Deck Pl. 1040 cm²
Hull Surf. 2341 cm²
DSPL 2518 g
Appen.Vol. 280 g
Tot. DSPL 2798 g
Bulb 1750 g (L.fin)
Constr. 1050 g
ratio .62.5 %
CB -4.1%
PC 0.57
B/L 0.171
Lead 8.5 % LWL
Mast 1500 mm
Jib 45/50 %
Sail Plan 48-55 dm²
provisory Budget
Hull 180 g
Deck 70 g
Fin 140 g
Rudder 30 g
Rig 170 g
Winch 110 g (65g)
Servo 20 g
Batt. 4.8v 55 g
Rx 12 g
Supports 150 g
Paint 30 g
Total 927g (882g)
Margin 123g (168g)
Appendix volumes
rudder 23cm3
Fin 92cm3
bulb 166cm3
design ClaudioD
knee frame
LWL
as per sail plan
CE
CB
CLR
lead 8.5%
269cm²
1750g
81cm²
main bulkhead
cockpit floor
cockpit floor
scale 1:1


DWG 3
example of
Sail Plan
5500 cm²
1600 mm max
355 mm
355 mm
355 mm
355 mm
80
212
C
285
B
49
315
A
3652 cm²
333
G
F
E
1848cm²
331
371
371
371


AC100-4


AC100-6


AC100-9


ONYX
stern


hull removed
for internal
epoxy coating


after internal
coating
ready
for
sanding
june 18


after gross sanding


polyester filler


105g/m² satin


just laminated !


sanding is finish !!


1st Wax


copper nails to trace
fin position


5
copper nails
inside


preparing for
gelcoat covering

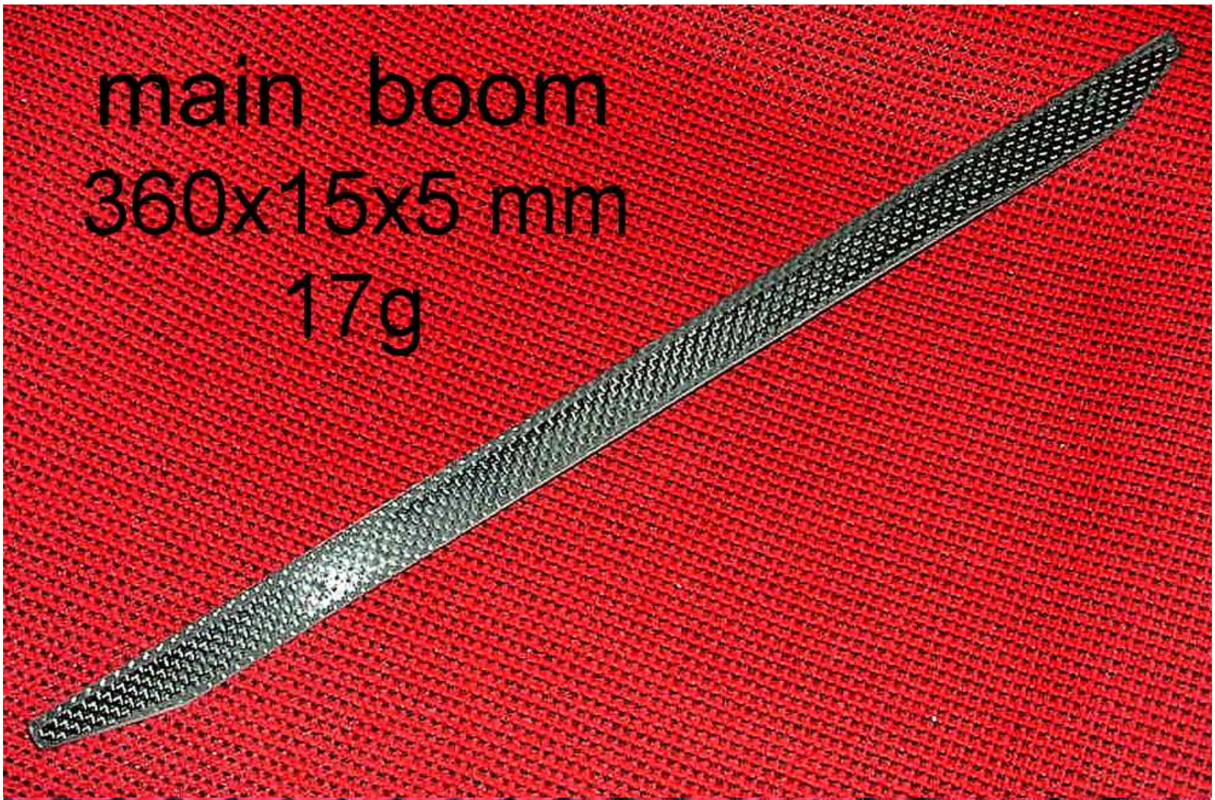

1st coat
epoxy gelcoat 230g
mixed with
epoxy resin 25g


theory :
1.65g/dm² + 0.8g/dm² x 2 resin = 4.9g/dm²
4.9g/dm² x 23.5dm² hull surf.
= 115g hull weight
practice :118g


deck line
trimmed
AC 100


Rudder press


mast + crane & step
main boom - jib boom
JADEVER


main boom
360x15x5 mm
17g


turnbuckle
detail


boom hinge
detail

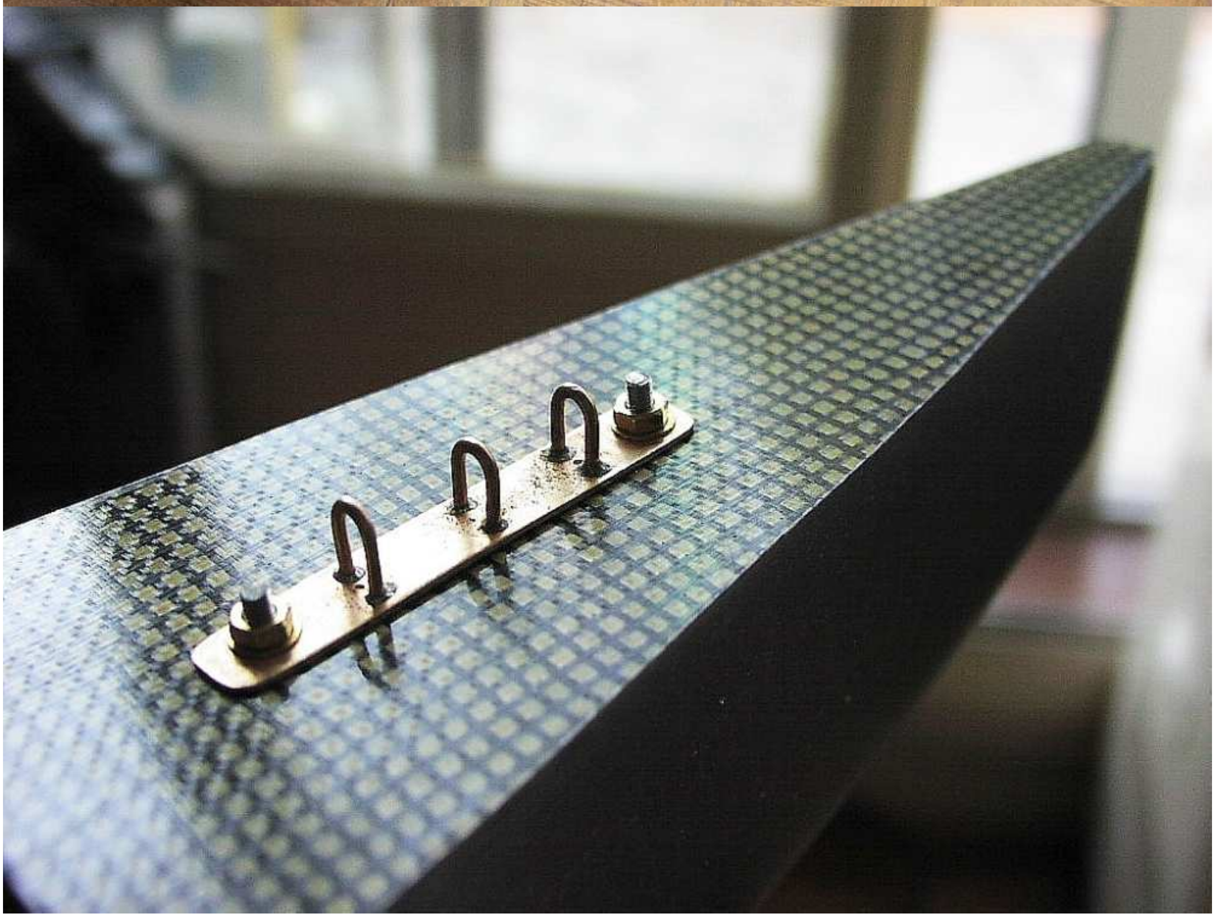

boom details

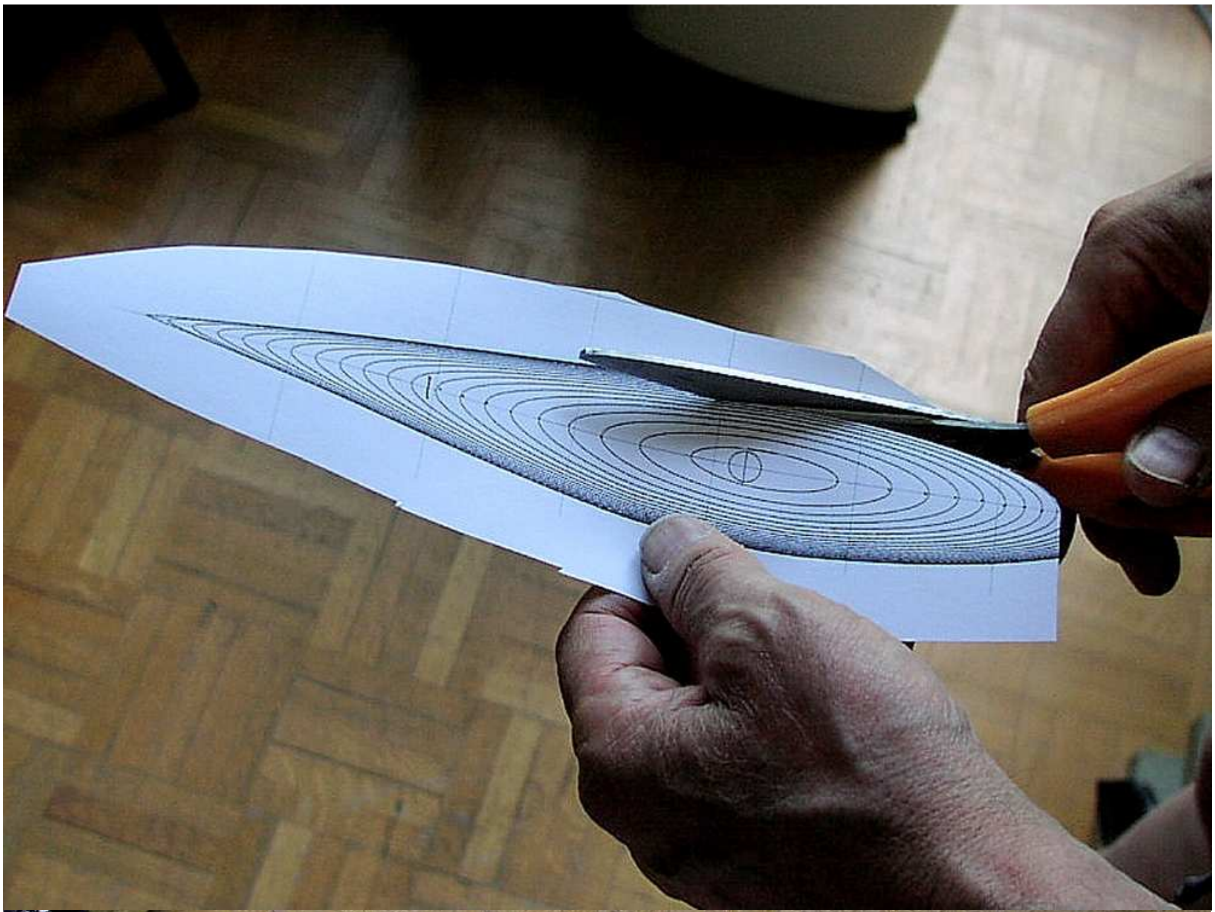

full main boom


110 mm long
crane


Gourmet
TEFAL
5 kg
1g:0 - 1kg
5g:1kg - 5kg
66 g
cl. dl.
on / off
TARA
sensitive computer


complete hull
no bondings
yet






1/2 bulb slices
glued on 1mm
lead sheet


slices ready
for bonding


1/2 bulb
ready for
bonding


cyanolite
bonding


remember
glowes are
mandatory


TEFAL
Gourmet
944 g
5 kg


882 g
first sanding

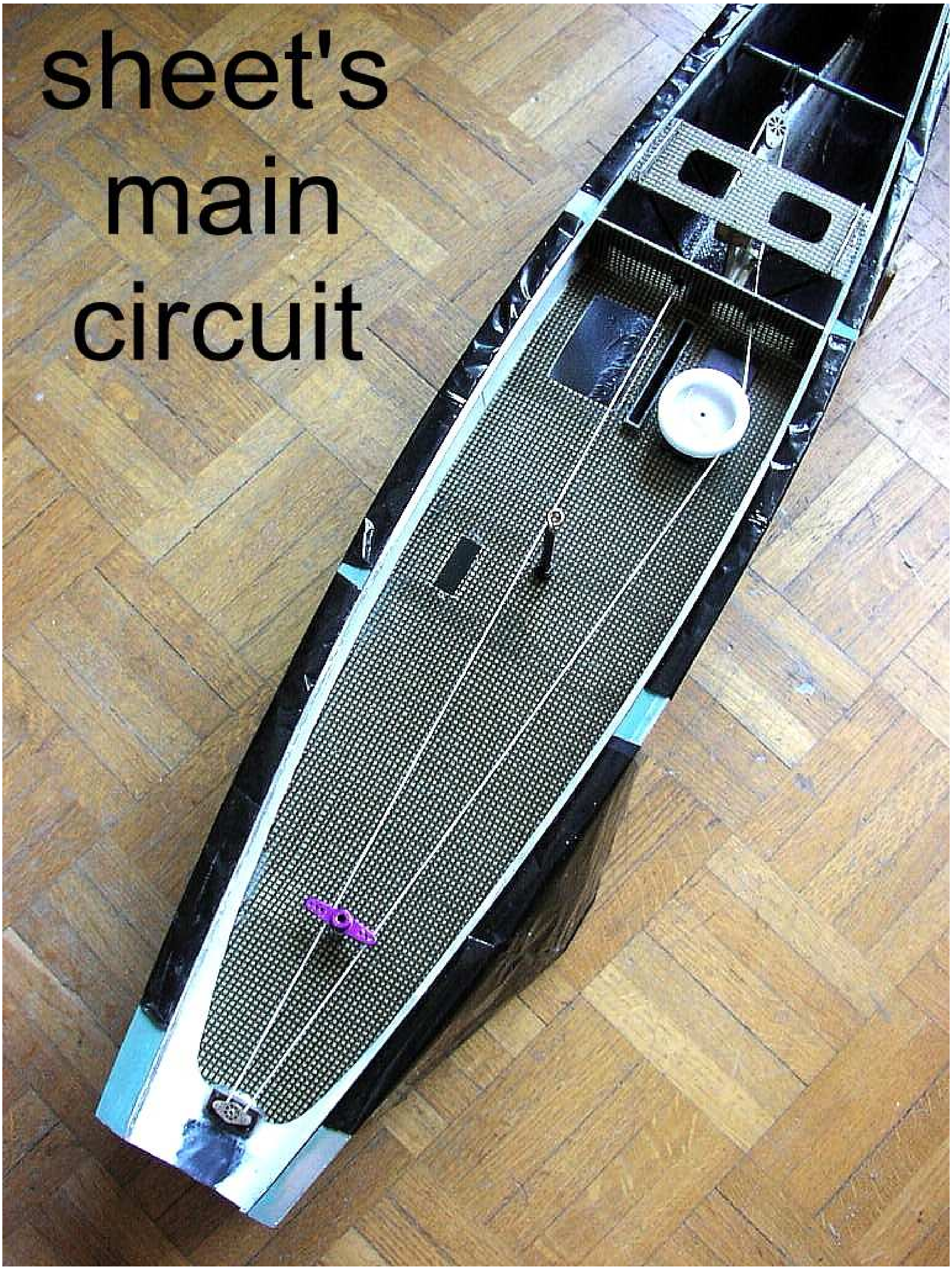

TEFAL
5 kg
1785g
on / off
TARA
sensitive computer

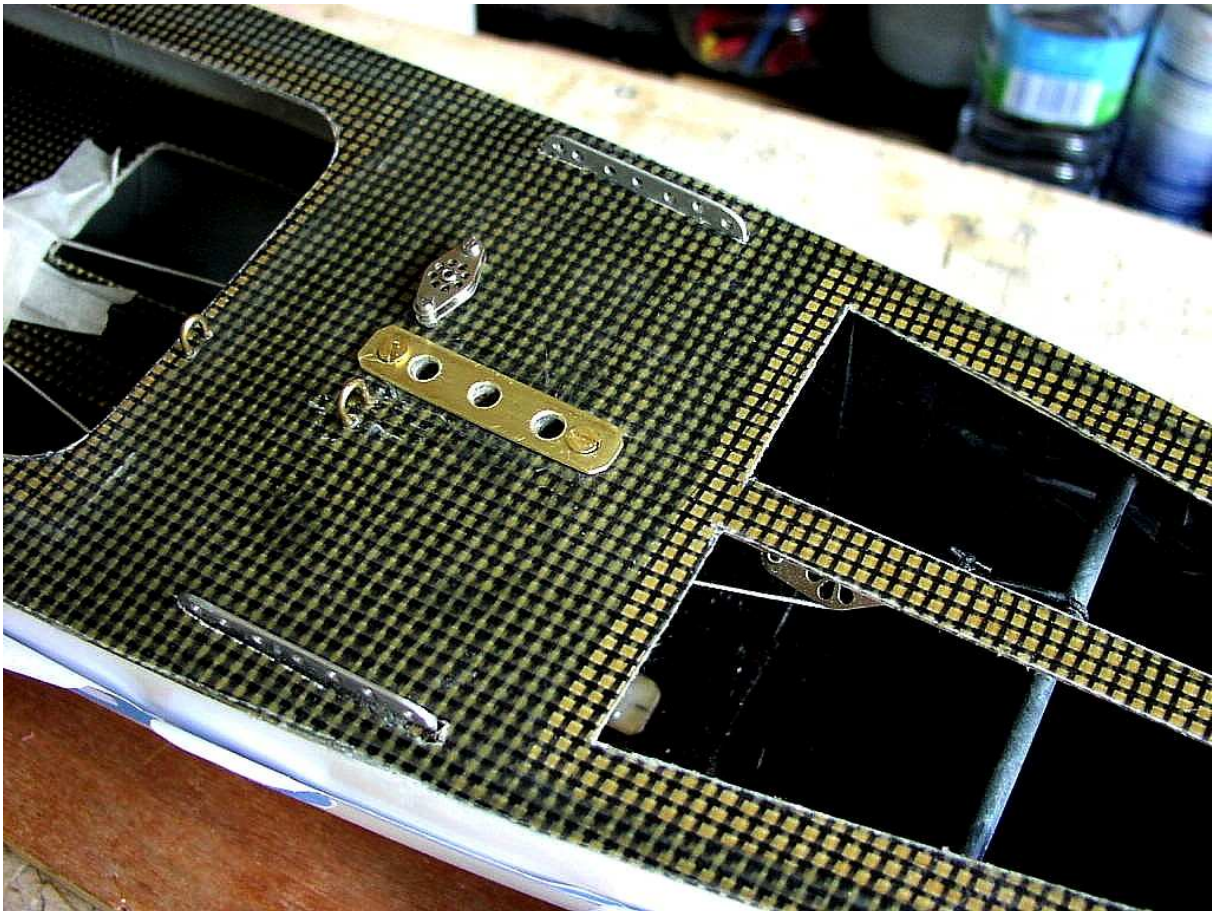

1750g


AC 100

Just a chair to search for total Centre of Gravity


Avant-Première
2/8/10
AC 100
1


sheet's
main
circuit




769g


counter weight
OK

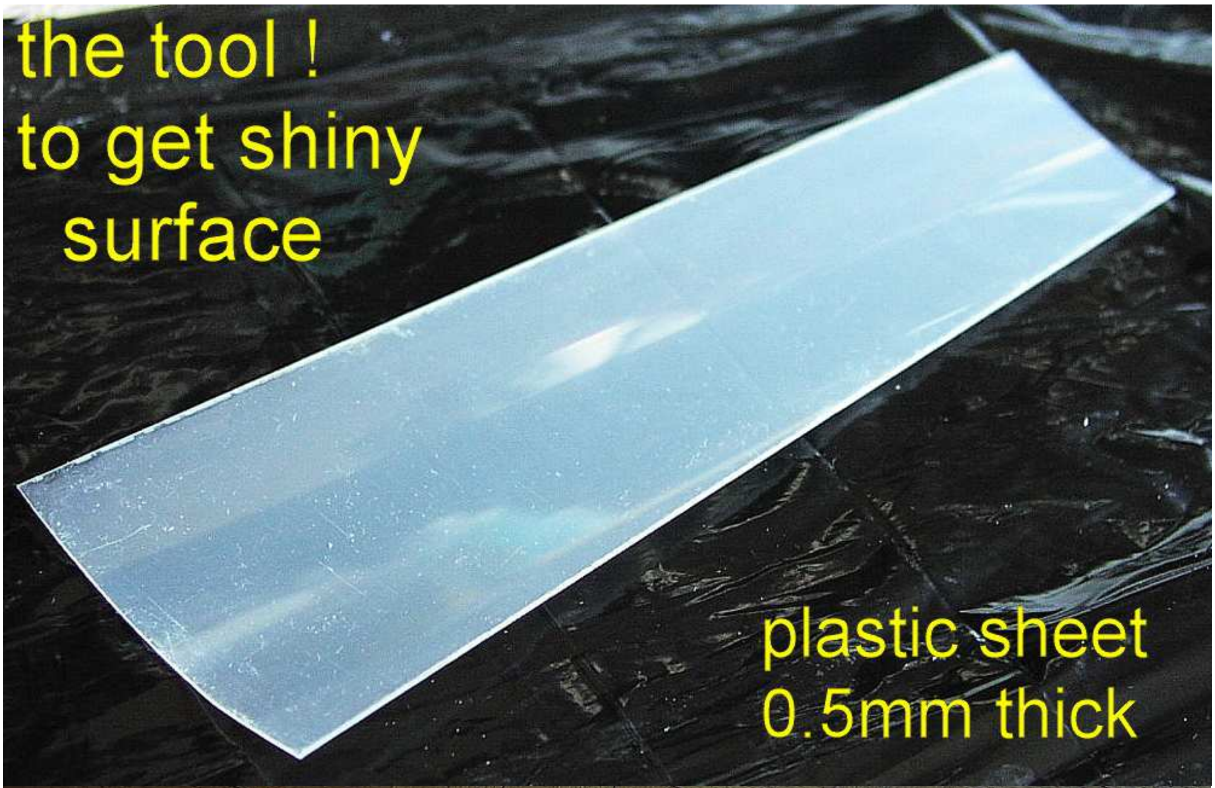

4mm treaded brass


Gourmet
TEFAL
5 kg
74


Coupe du Monde 2010
Keno
ASTA MOBILE


new fin out
of press

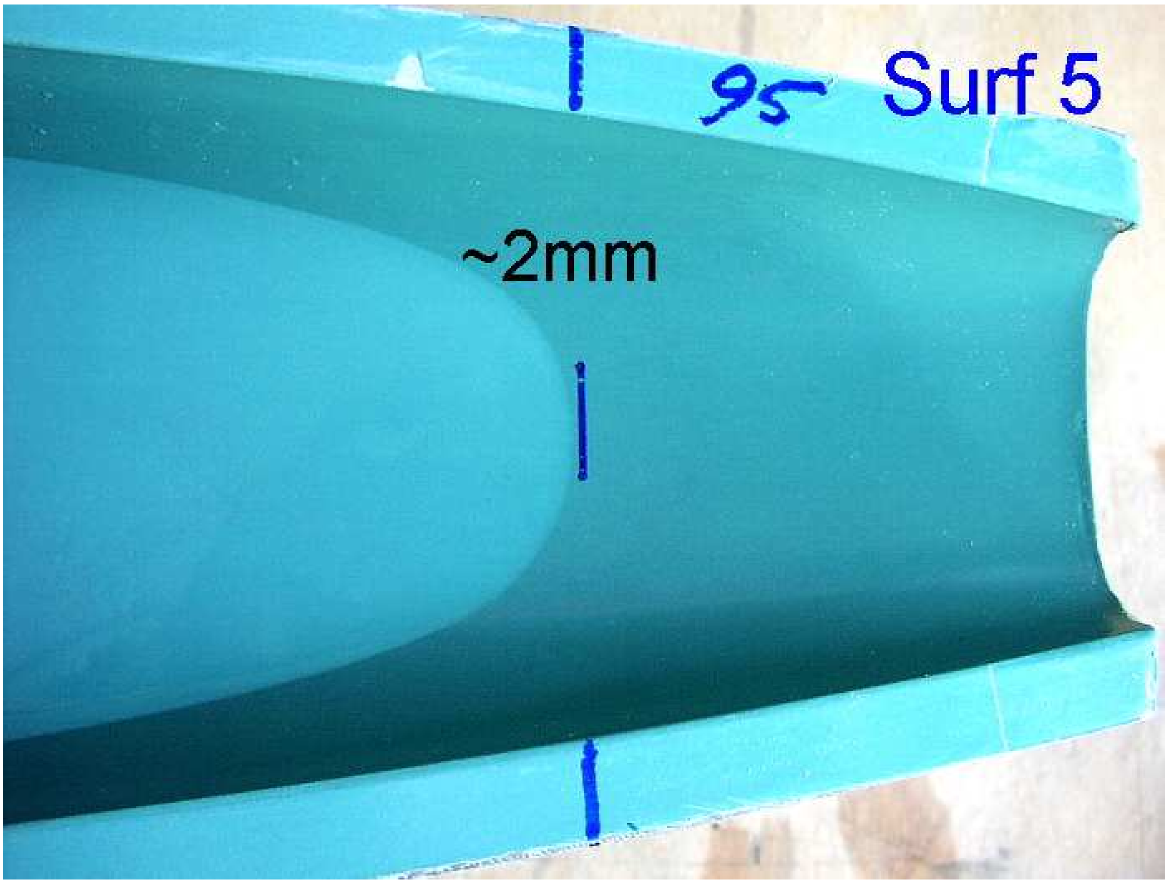

just out the
press
TEFAL
Gourmet
198
5 kg


the tool !
to get shiny
surface
plastic sheet
0.5mm thick

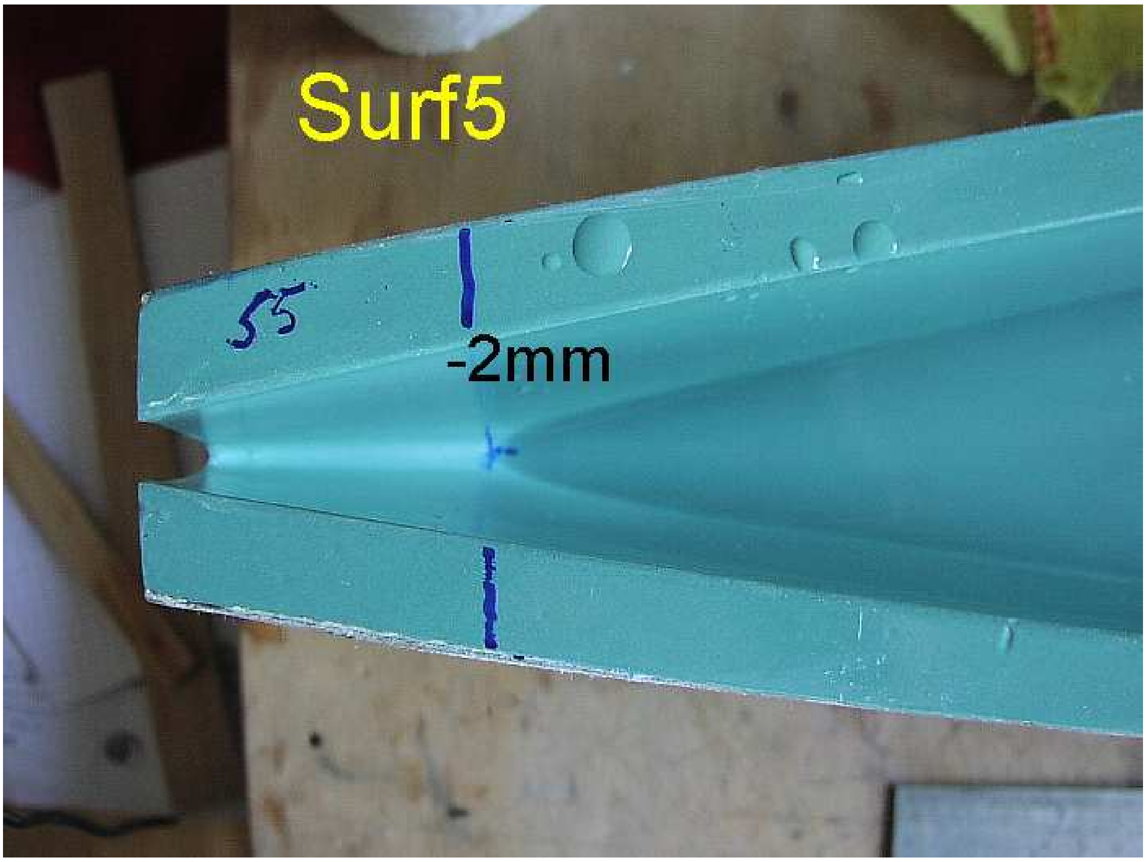

Surf6

The Mold is also used to verify the Water Plan just filled with water.

The Mold is also used to verify the Water Plan just filled with water.



95
Surf 5
~2mm



Surf5
55
-2mm


AC 100


AC 100


AS 100
AS 100

In August 2010 the AC100 B was launched in the Villepey Pond near Frejus in France.
It proved since the beginning a very well balanced boat and also surprisingly fast Model.

Some Video I made and visible on You Tube

https://youtu.be/R4MM_z_q3aI

https://youtu.be/EdyHr9nLUYY

https://youtu.be/_UWjuL5hQ_Y

https://youtu.be/UggSPHMYwRk

Ten Rater (10R)

Rules Short List

Rating: L x S x 8 = 10

Example 1 : LWL 1.25mt x Sail Area 1m² x 8 = 10

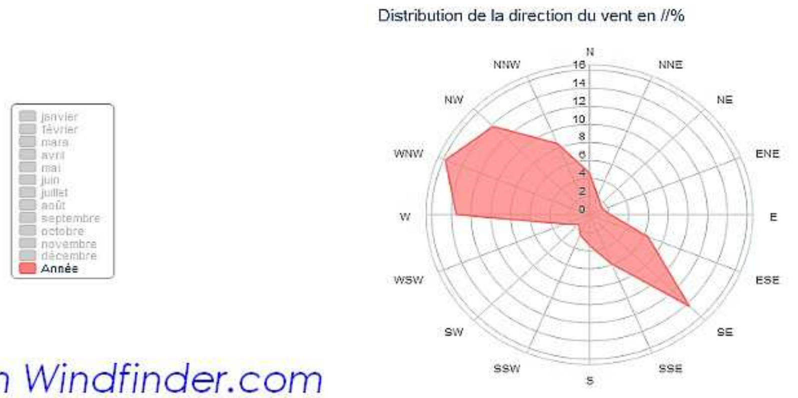
Hull length 1.3 to 1.8 m
Displacement 5 to 7 kg
Sail area 0.9 to 1.1 m²
The draught, measured to the datum water plane, shall not exceed 700 mm.

In my design list the Ten Rater had been always a Must that one day I should build.
This model is the oldest design known.
10R designed in 1897 was already using a long deep Fin.
Only 105 years later America Cup Boats adopted this type of Fin.
Official Rules were issued in 1890.

Before discussing my designs, I should come back to the Local Meteorological conditions that need to be considered in order to decide the characteristics of Model Design:

In my area close to Toulouse city in France we can expect the following:

Mois de l'année	janv. 01	févr. 02	mars 03	avril 04	mai 05	juin 06	juil. 07	août 08	sept. 09	oct. 10	nov. 11	déc. 12	Année 1-12
Direction du vent													
Probabilité du vent >= 4 Beaufort (%)	33	35	40	35	33	24	22	20	23	30	30	26	29
Vitesse du vent moyenne (kts)	9	9	10	9	9	8	8	8	8	8	8	8	8
Temp. de l'air moyenne (°C)	7	8	12	15	18	23	25	25	22	17	12	8	16



data from Windfinder.com

From above diagram it can be observed that the average Wind Speed is 8 kt from June to December nevertheless 25% of the time the wind may blow up to 14kt and more.

It is also noted that the predominant winds are only two, one from the North-West and the other from South-East warm and fast during summer.

To avoid surprises better to take into account above data, for instance considering wind speed of 15 kt …

Above 10kt wind will be better to think about another Rig !

Certainly a so called "All Round" model may be a serious option.

I will take into account several parameters like :

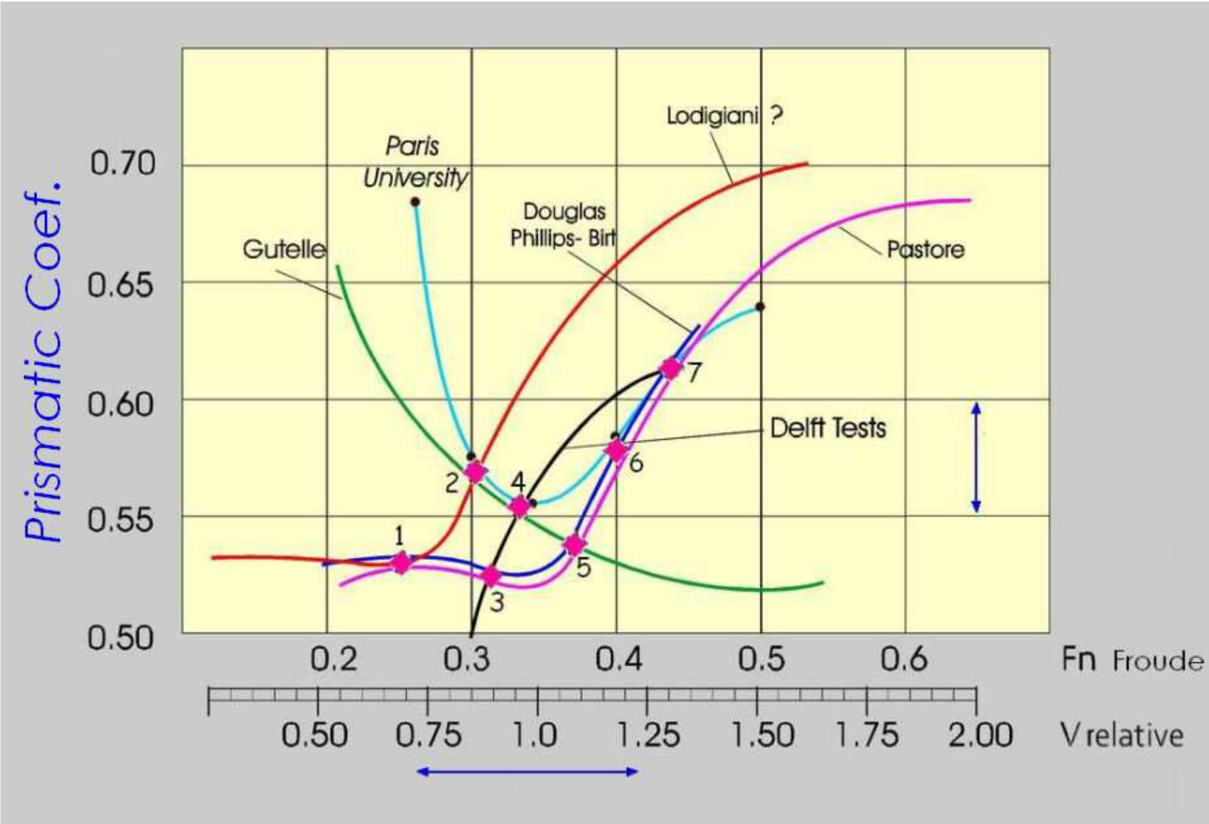
Prismatic Coefficient
Sail Plan & Area
Displacement
Main Section
Draught
LWL
Appendix surfaces and shapes
Bulb
Beam at deck and water level
Entrance and Exit water angles
Curve of Area
Rudder Control wheel

Prismatic Coefficient:

Because of the weather conditions, I have learn that the Prismatic Coefficient should be chosen carefully.

Reading various books I have collected the data about the Prismatic Coefficient and found a lot of variations as depicted in the diagram.

It appears to me that the Naval Architecture is far to be a precise science.



Who I shall trust ?
For instance the University of Paris propose a PC 60 from Vr 0.75 to 1.4
Living in Delft and close to the TNO for my Job in Technological Research, I decided to use the Delft University Data.

The Froude number:

$$Fn = V\ (m/s) / \sqrt{9.81\ LWL\ (m)}$$

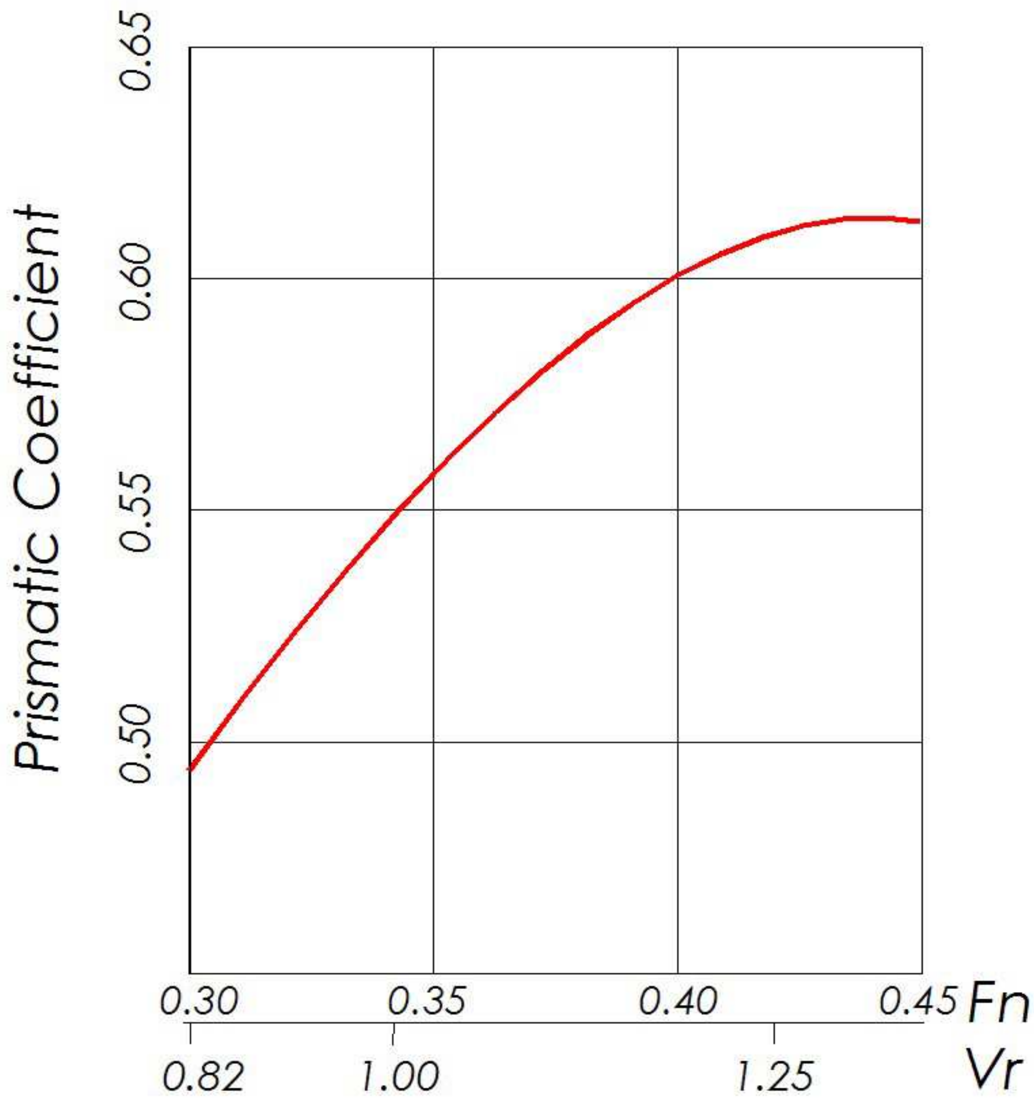
Removing from the above formula the ($\sqrt{9.81}$) is obtained the relative speed Vr, thus:

$$Vr = V / \sqrt{LWL}$$

When the boat is sailing, it produces a wave from the bow to the stern. Vr = 1 means that the produced wave is as long as the LWL (water line length) of the boat.

Assuming that the boat speed will be below 0.35 Fn or 1.0 Vr, the Prismatic Coefficient should lie between 0.54 and 0.56 according to the Delft diagram

To obtain a Vr = 1 it is necessary, nevertheless, to have strong wind and calm waters, therefore rarely achieved.



If the expected Wind Speed along the season is relatively high, above 10-12kt then the Cp of 0.57- 0.58 could be more appropriate.

Off course Sail Rigs are tailored for the purpose

There are water ponds where the wind may be strong while the waves remain small.

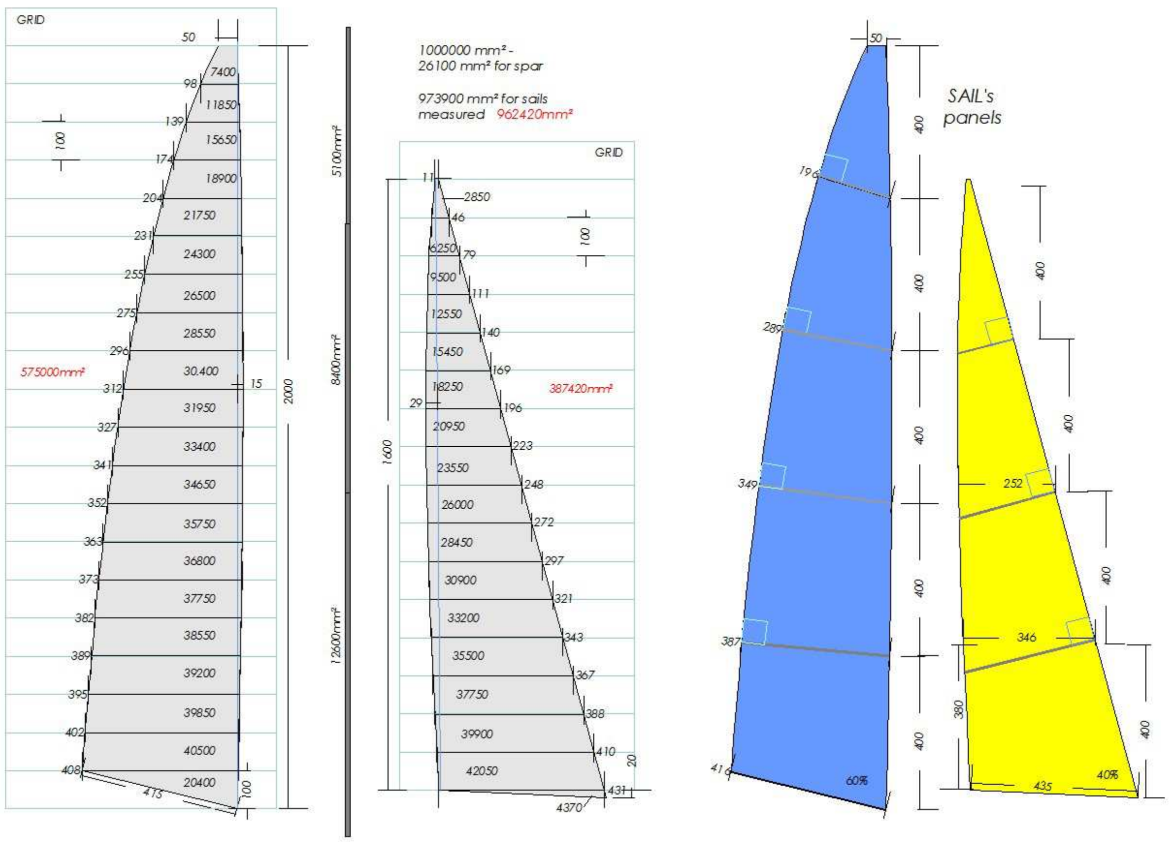
High Pc is forgiving better at low wind speed than a Low Pc with high wind.

The "All Round" with Cp of 0.57 is probably a good compromise.

Sail Plan & Area:

The Sail Area is determined by the Rating: L x S x 8 = 10

With 10Rater the Sail Area may vary from 0.90m² to 1.2m²



Here an example for 0.96m² and Main Luff length of 2.0mt
Taking the above example of Sail Plan we get :

10 / 8 x 0.96 = 1.30mt LWL

Displacement:

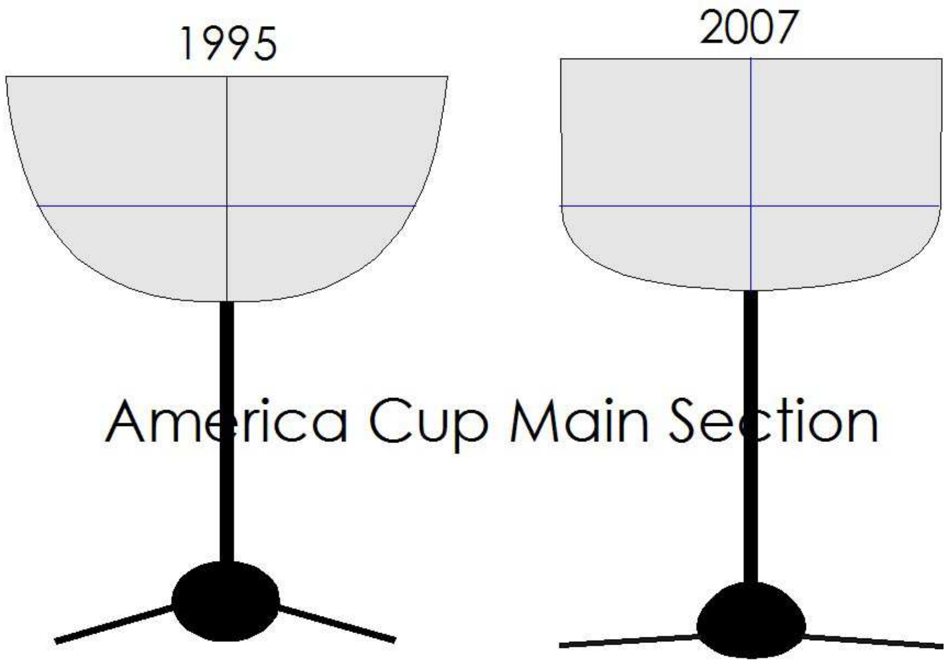
According to my research around various 10Rater Clubs I can say that the Displacements are varying from 4.6kg to 5.8kg
The majority of plans are close to 5.4kg.

It is evident that with a low wind condition, the heavier boat will have more difficulty to reach a good speed compared with a lighter boat. Designing a Hull, one should find a compromise between the LWL and the total length LOA.

A long Hull is heavier.

The section shapes shall be favoring the lengthening of the Water line when heeling.

Main Section :



Watching since some years the America Cup real-scale evolution, I was confused since in one of the 'learning lesson' I was understanding that the lower wet area is given by the Circle shape.
The above drawing of similar displacement is just suggesting the contrary where probably the "AC Rules" forced such a choice.

I could imagine that the "square hull" could offer better directional stability once heeled, but nobody confirmed my thinking.

I do recall the capacity of the AC120 to carry on sail surface and being fast and stable once well balanced.

I will try to draw a "square hull" for one of the 10R in the following pages.

Draft/Draught

The 10R rules specify a max draft of 770mm from the bottom of the hull.

Taking into account that the larger the Fin and Rudder surface are, larger will be the Wet Area responsible of an important source of frictions.

LWL

The length of the Water Line is dependant from the Rules hence from the Sail Surface.

Appendices surfaces

Since I'm designing models, my personal "rule" is that the Appendices Surface should be:

5.5 to 6.5 % of Sail Area

and split as 3/4 for the FIN and 1/4 for the Rudder.

It is expected that the a racing Modeler will have 2 sets of Appendices

The choice for the Fin and Rudder will as function of the wind speed expected, hence the Boat speed.

Bulb

Bulb weight will defined by the design and tuning activity.

Deck Beam and Floating Plan

Is function of the Boat design and Displacement

Hull Entrance and Exit angles

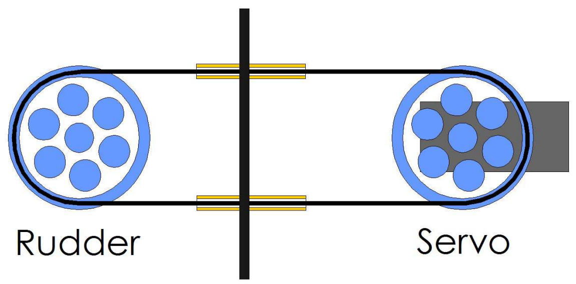
Part of the Hull Design, nevertheless I will try to use most narrow Hulls.
To contrast the "nose down" effect, the Water Plan entrance will be narrow while at the deck level the Bow will be relatively wide.

Curve of Area

For me is the most important parameter being the "Identity Card" of the Model.
The Curve should be smooth and uniform.
The Curve shape may shows as fine are the Entrance and Exit lines.
The Curve is identifying the Displacement hull volume.
The Curve indicates also the Prismatic Coefficient.
The Curve indicates the LCB position.

Rudder Stock

To reduce the risks of water leak I will in principle use a Pulley rather than a Horn.
The Rudder Stock Pulley will be outside the Hull for easy removal of the Rudder.



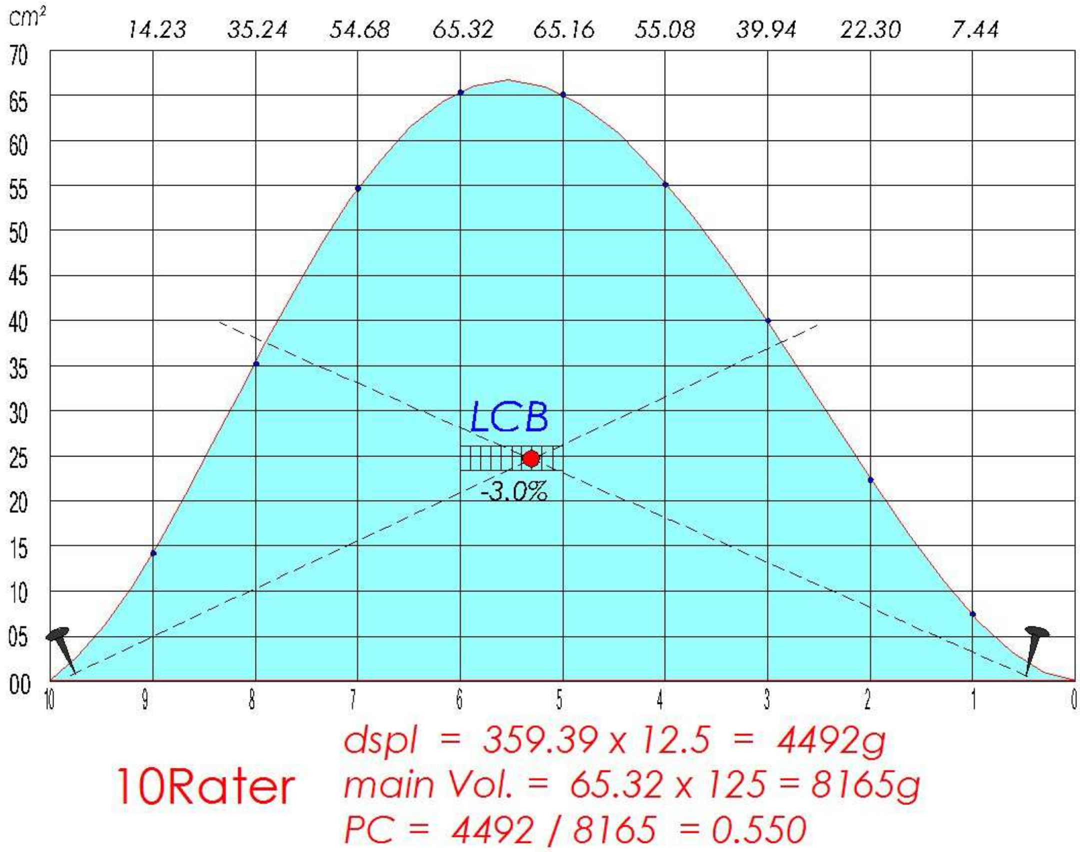
I will explain the method I use to draw a Hull.

Let start with the research of the Main Surface Area:

Knowing:

- the wanted Hull DSPL
- the wanted Prismatic Coefficient
- the wanted LWL

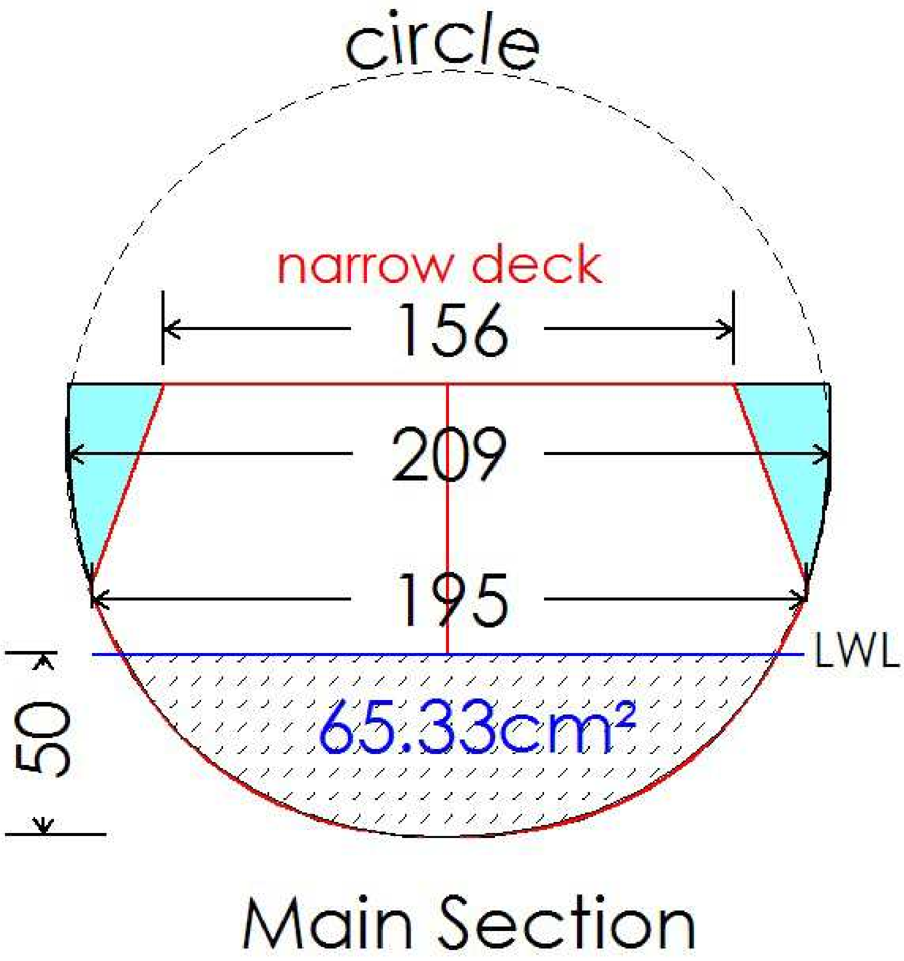
Main Surface Area = DSPL / (PCxLWL)



Example with COA :

Main surface = 4492g / (0.550 x 125cm) = 4492 / 68.75 = 65.33cm²

The above COA diagram shows 65.32cm² for the Main surface area. where LWL = 125cm and Hull volume = 4492cm3 or grams of fresh water.



Here the Main section construction based upon a Circle with a Diameter of 209mm, hence offering the lowest Wet Area.

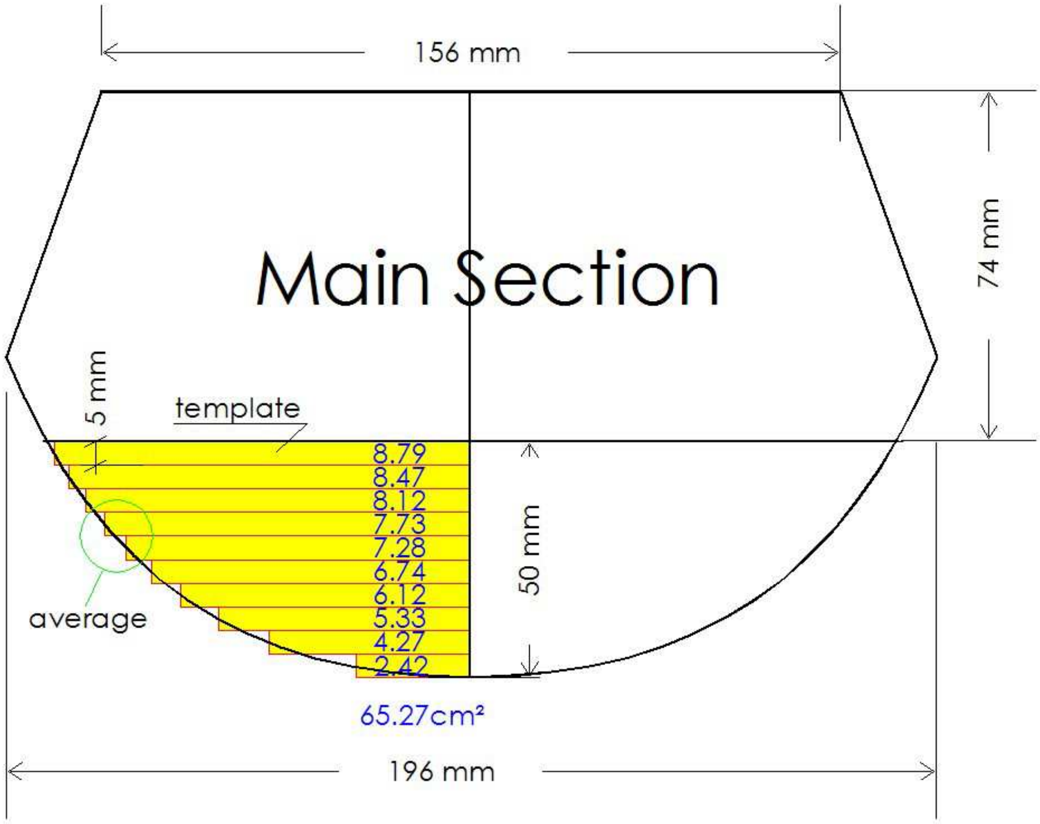
Double choice having a "full" shape or " Narrow Deck" shape. With the Narrow shape a small weight gain is obtained, but more important is a more rigid Hull structure.

The Main Surface is 65.33 cm^2

The following figure shows as the surface of the Main section is calculated, similarly for all the sections.

I use a "template" of 5mm of thickness and tracing the length from the Center Line to the extreme of the section curve limit average.

It is more complicate to explain than visualize the drawing :



First top template is 8.79cm wide for half of the section width.
The template height is only 5mm or 0.5cm, therefore:

$$8.79 \text{ x } 0.5cm = 4.395cm^2$$

but 4.395 cm^2 is only half of the total template length

$$4.395 \text{ x } 2 = 8.79cm^2$$

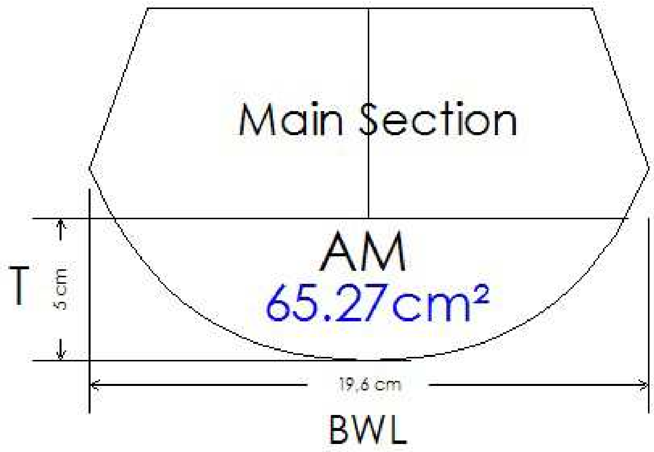
This is why I use directly the half width for the surface calculation of each template.
The sum of all template surfaces will be the Main Surface Area.

Explanation:
Why divide by 2, due to 0.5cm template thickness, if than it is necessary to multiply by 2 for the second half section?

Better to use the direct width of each template only and adding them to reach the Main Section Area.

Noted a small difference between the two drawing 65.33cm² and 65.27cm² simply due to redrawing tolerances = 6mm² or 0.03mm variation on the LWL vertical position, almost nothing !!.
There is another parameter used for Real-Scale models the Ratio: BWL/T and the Coefficient Cm, where Am is the immerged Main Surface .
How much is applicable to Models I do not know.

In the past the ratio BWL / T was supposed to be around 3.2 while for modern Hulls this ratio is grown up to 5.2, instead the Coefficient (Cm) is passed from 0.55 up to 0.75.



$$BWL / T = 3.92$$

$$Cm = AM / BWL \times T$$

$$Cm = 65.27 / 98 = 0.666$$

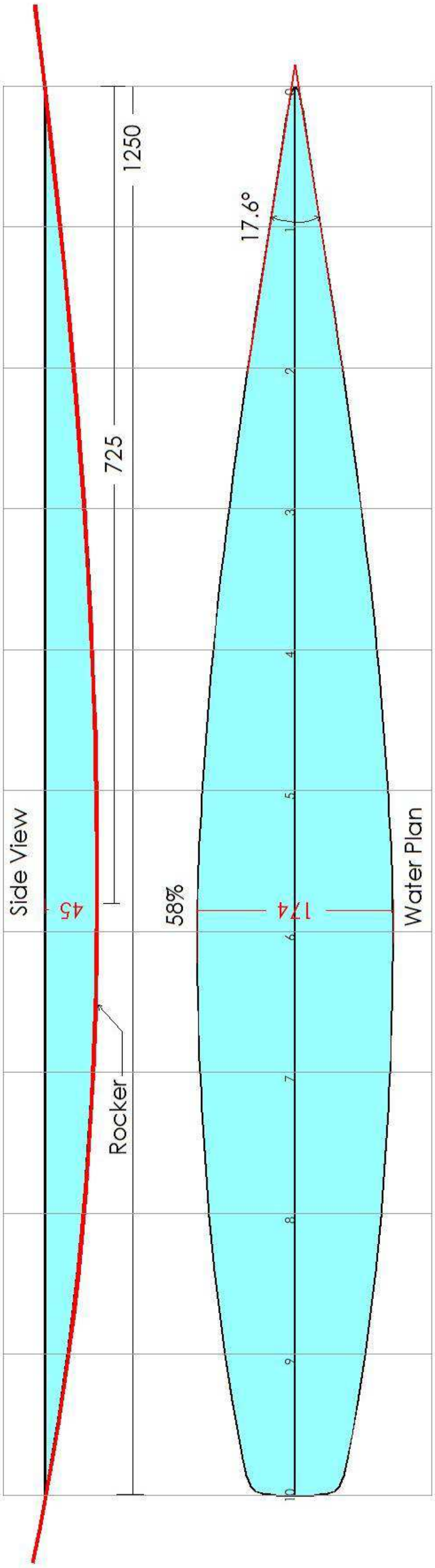
According to my readings, the WBL/T has been measured, showing a resistance increase for values, approaching to 5.2 at a relative speed of Vr = 1.2.
For what I'm concerned I will try to keep the Ratio BWL/T below 4.0.

The Water Plan & Side view

Another concern regards the so called "rocker" that identify how much the underwater Hull profile is drawn.

In the example next page, the max rocker is sitting at 58% of LWL from Bow.
It is noted that the Entrance angle in the Water Plan is 17.6°

This water Plan uses a "square hull" shadow.
I suspect turbulence at the exit of the water plan due to the rapid curvature change.
Probably I will drop the idea to copy the "America Cup" boats of 2007 until I can prove that this type of hull is superior to the "round shape".



Start of a new Design

Assuming to draw a new hull, I will fix the following parameters:

- **Prismatic Coefficient = 0.57**
- **Hull Displacement = 4800cm3**
- **LWL = 120 cm**

According to my formula:

Main Section Area =

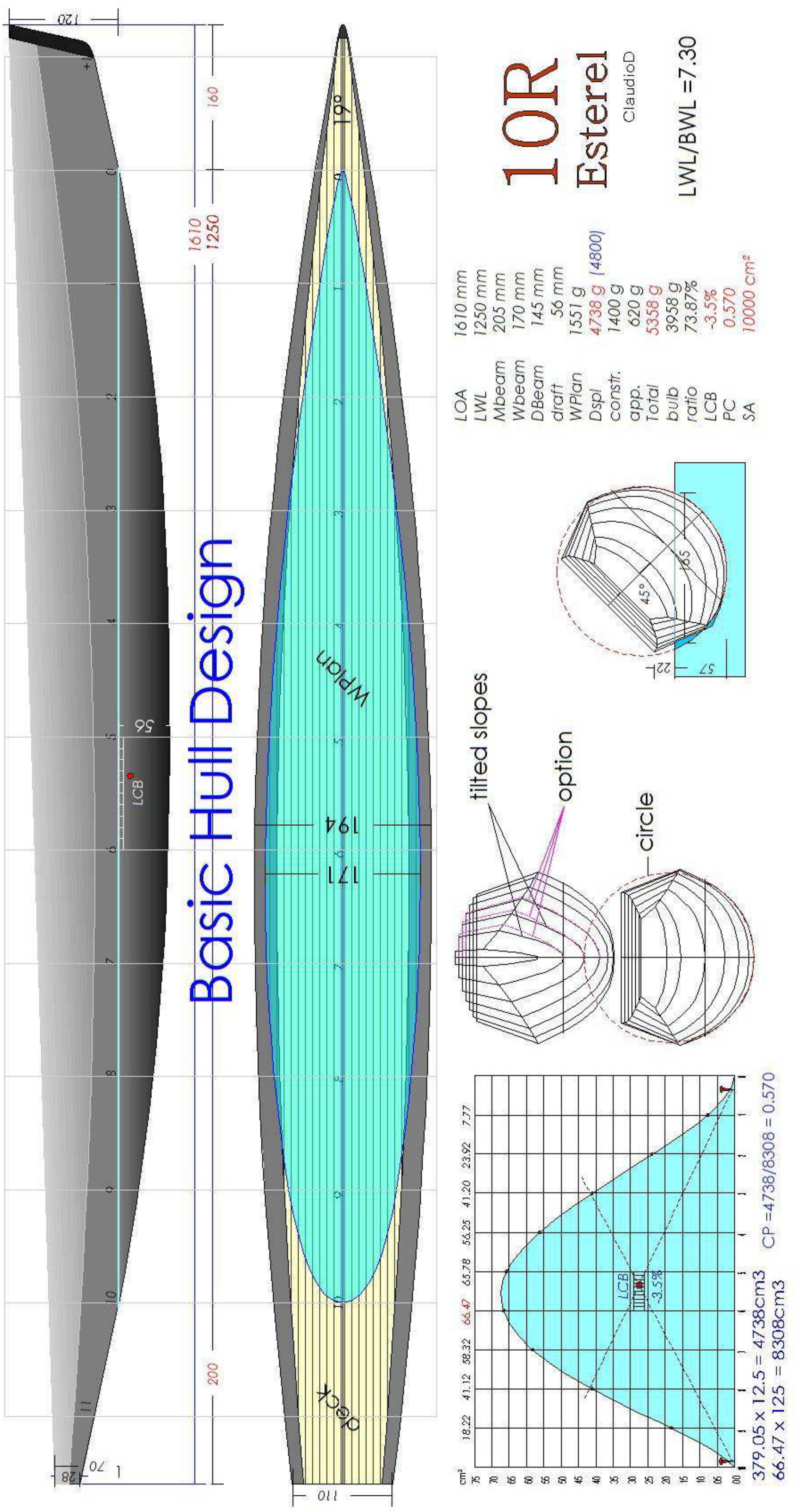
4800 cm3 / (0.57 x 120cm)
Dspl PC LWL

= 70.1cm²

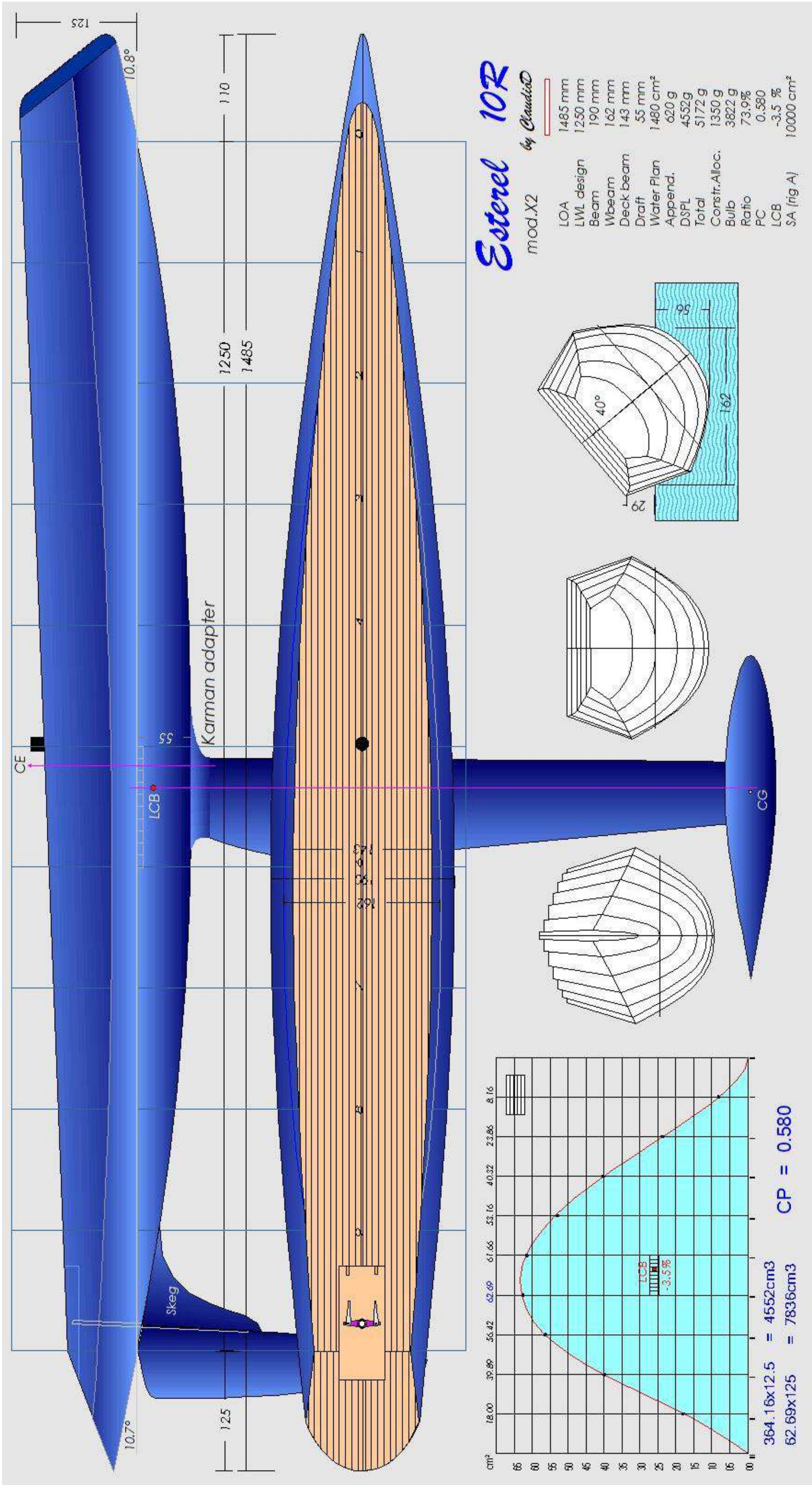
The 10R Esterel is a rather slender Model where the LWL/BWL Ratio is :

1250 / 171
= 7.30.

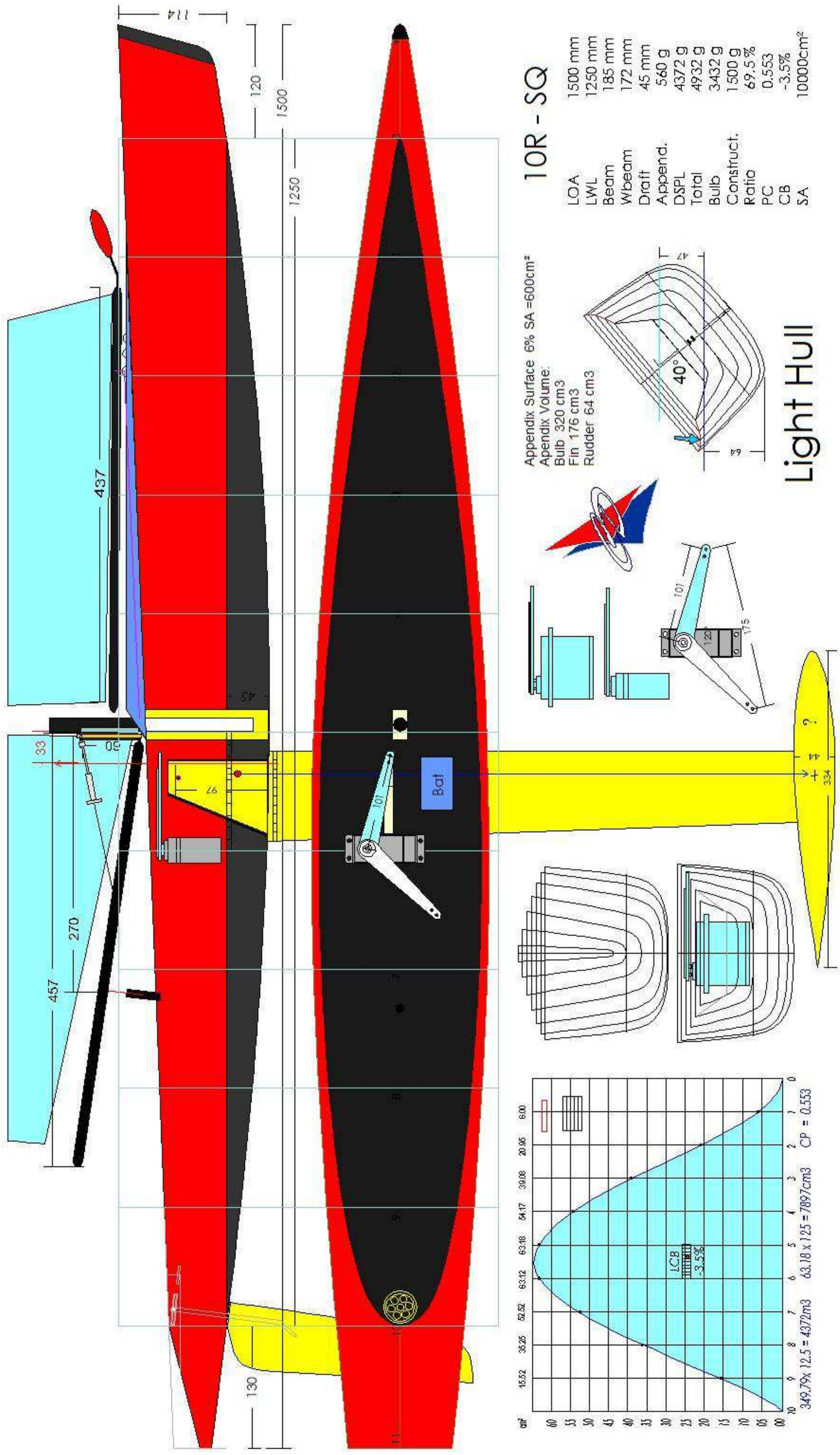
In principle should suffer less against Wave Drag and Pressure Drag.



Another design with reversed bow :

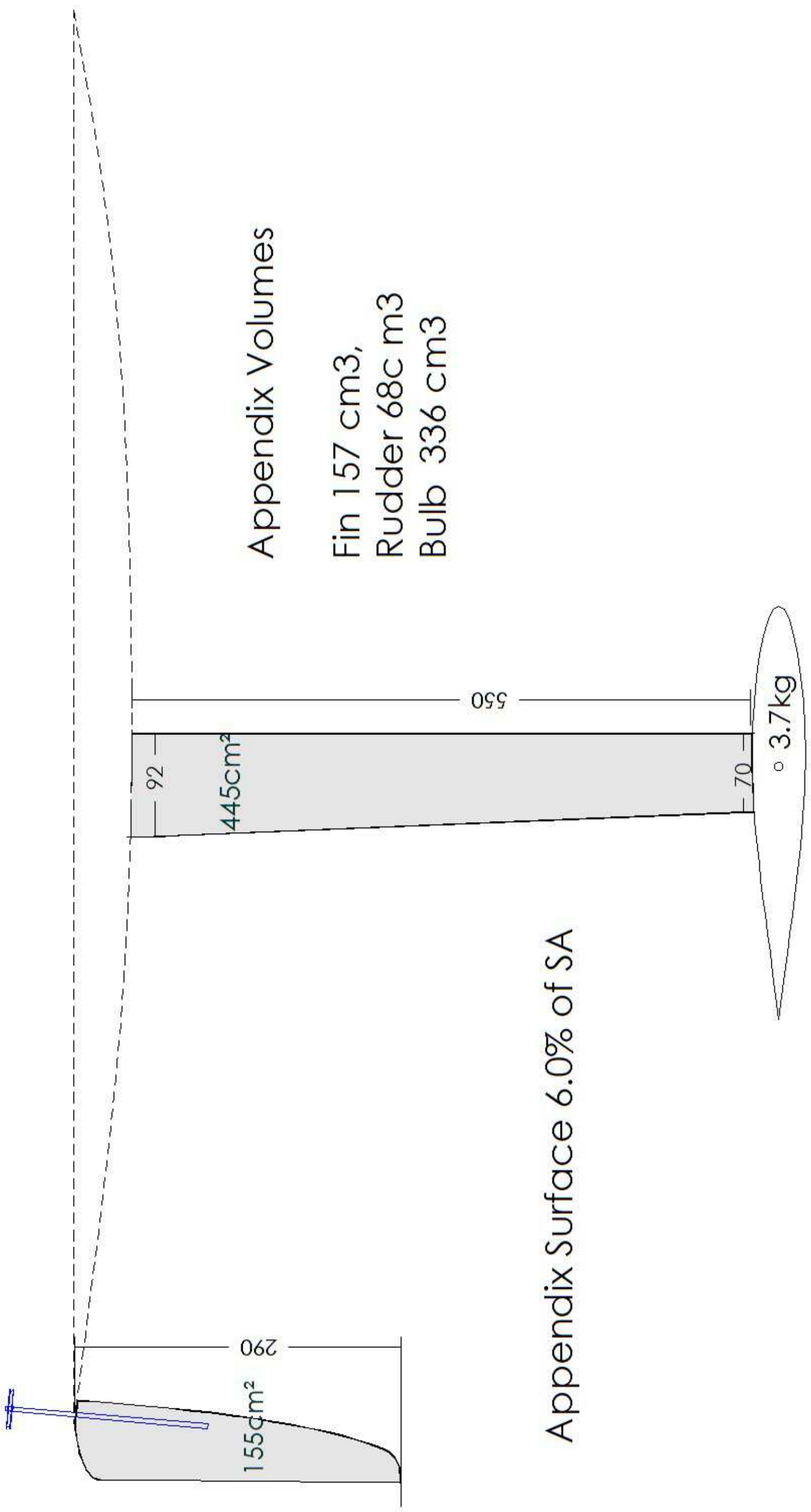


A
"Square"
Hull
Style
Alinghi
2007



The appendices

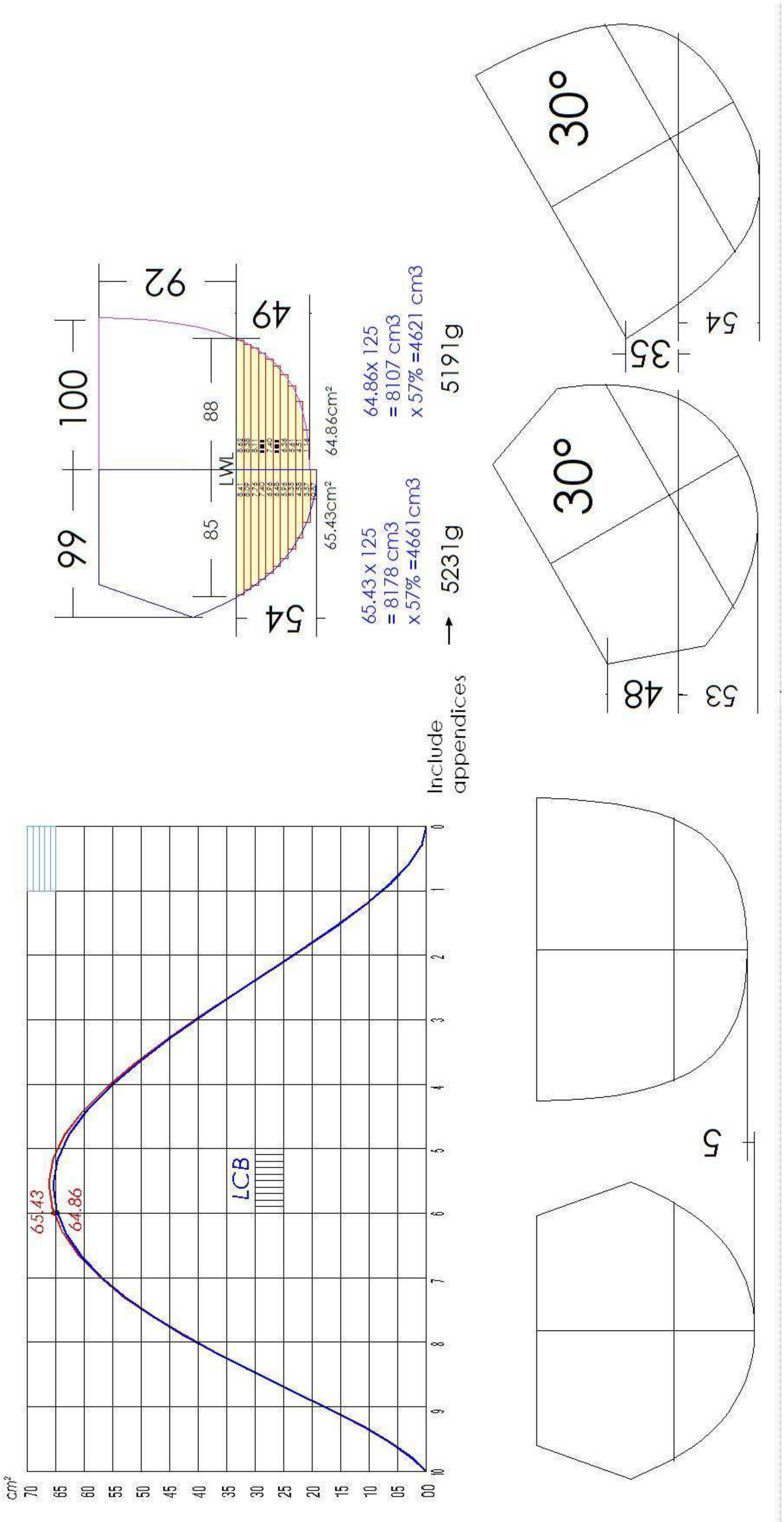
The appendices are the FIN and the Rudder.
According to a "rule of thumb" the appendices surface is varying from 5.5% to 6.5% as a function of the boat speed.
The profiles are narrow for the Fin for better efficiency and thicker for the Rudder in order to compensate for the "Stall" risks above an angle of 12°.



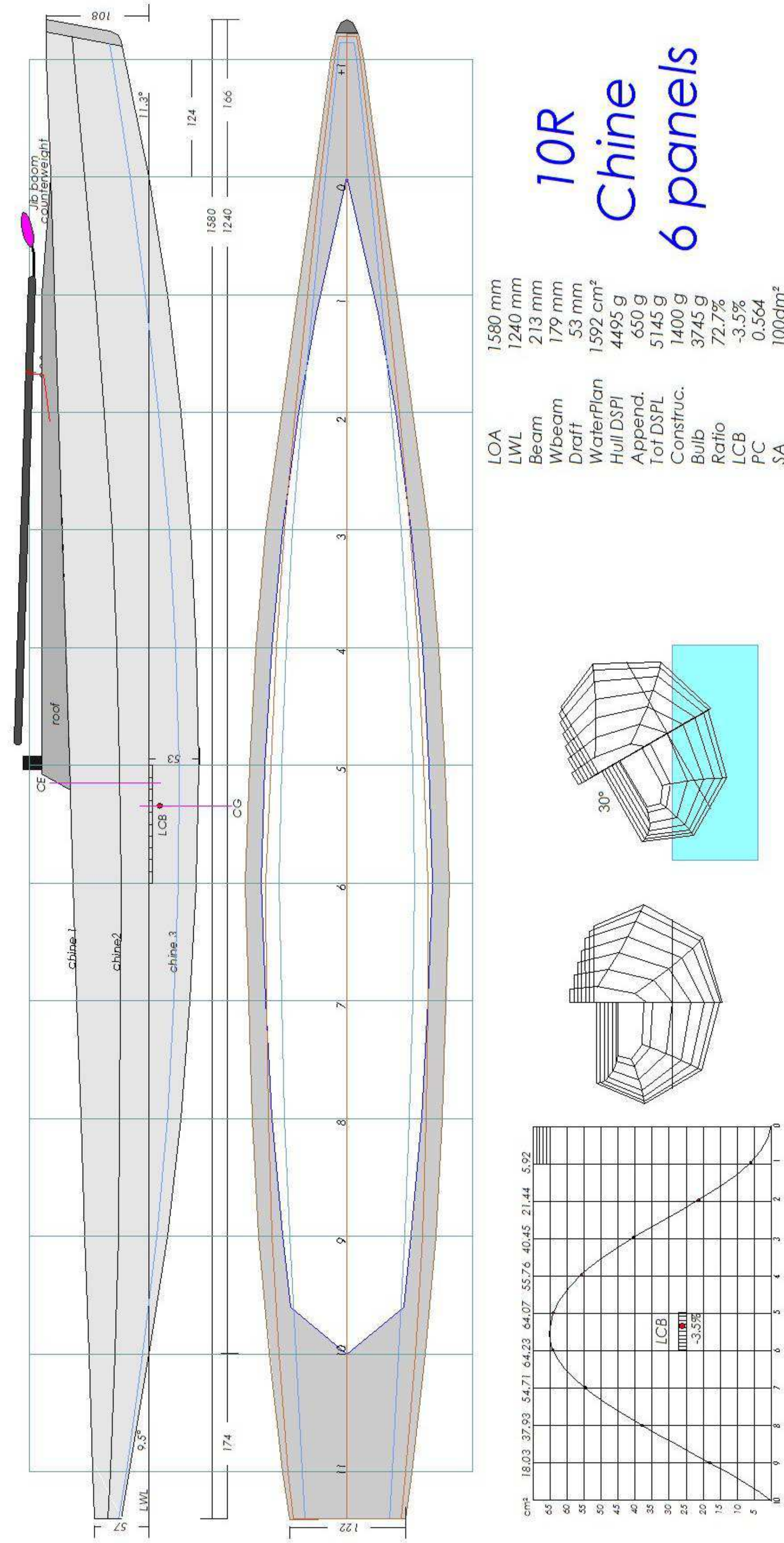
The Fin part inside the Hull is not drawn

Main section shapes

This exercise concerns the main section shape working around similar form.
The first includes the Narrow Deck while the other reduce the Draft from 54 mm to 49mm. Calculated for similar surfaces.
Interesting to note the distance from water plan at 30° where one exhibit 48mm and the other 35mm while the draft is almost the same.
My choice would for the smaller draft while reducing wave resistance when running.



6 Panels Chine Hull

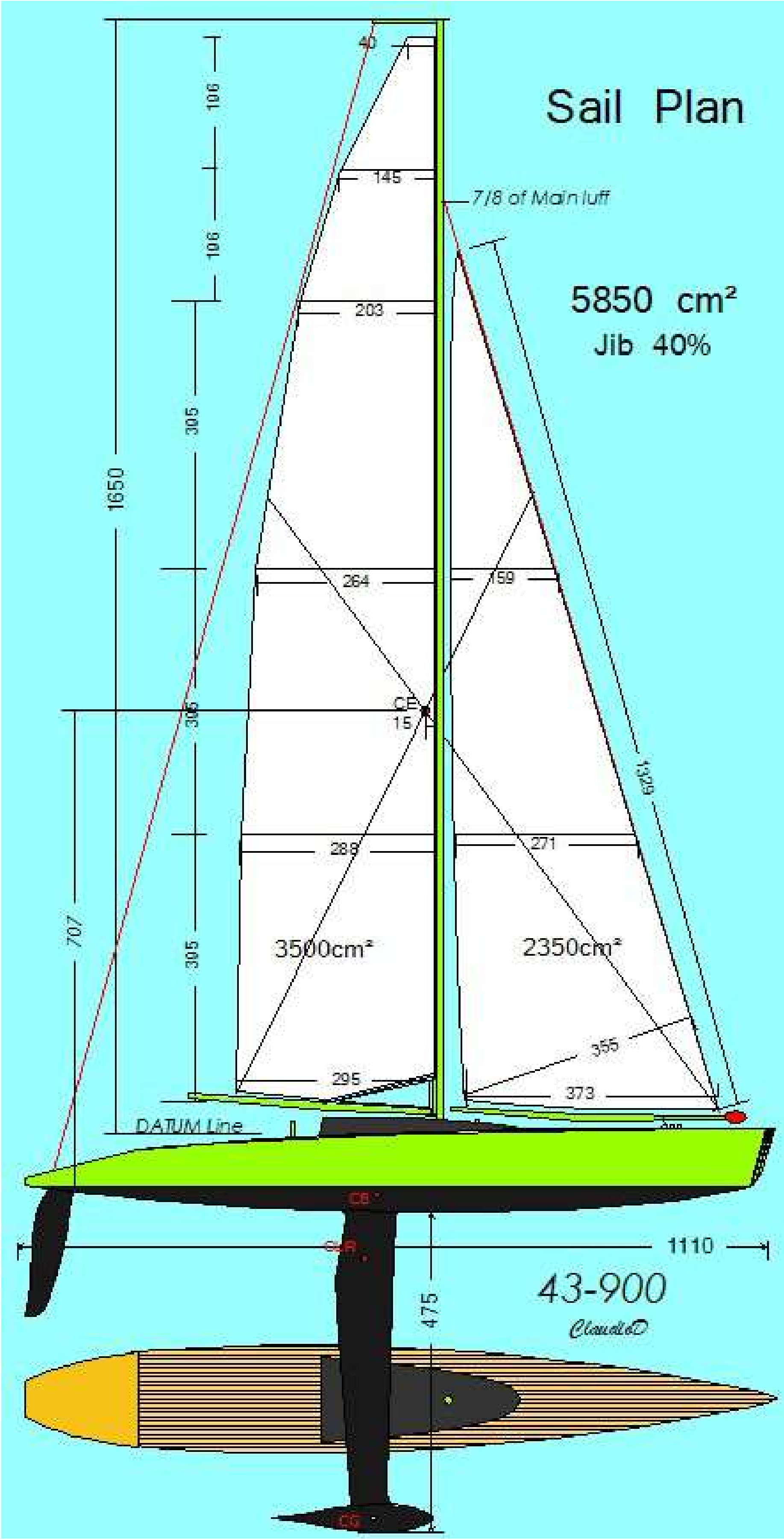


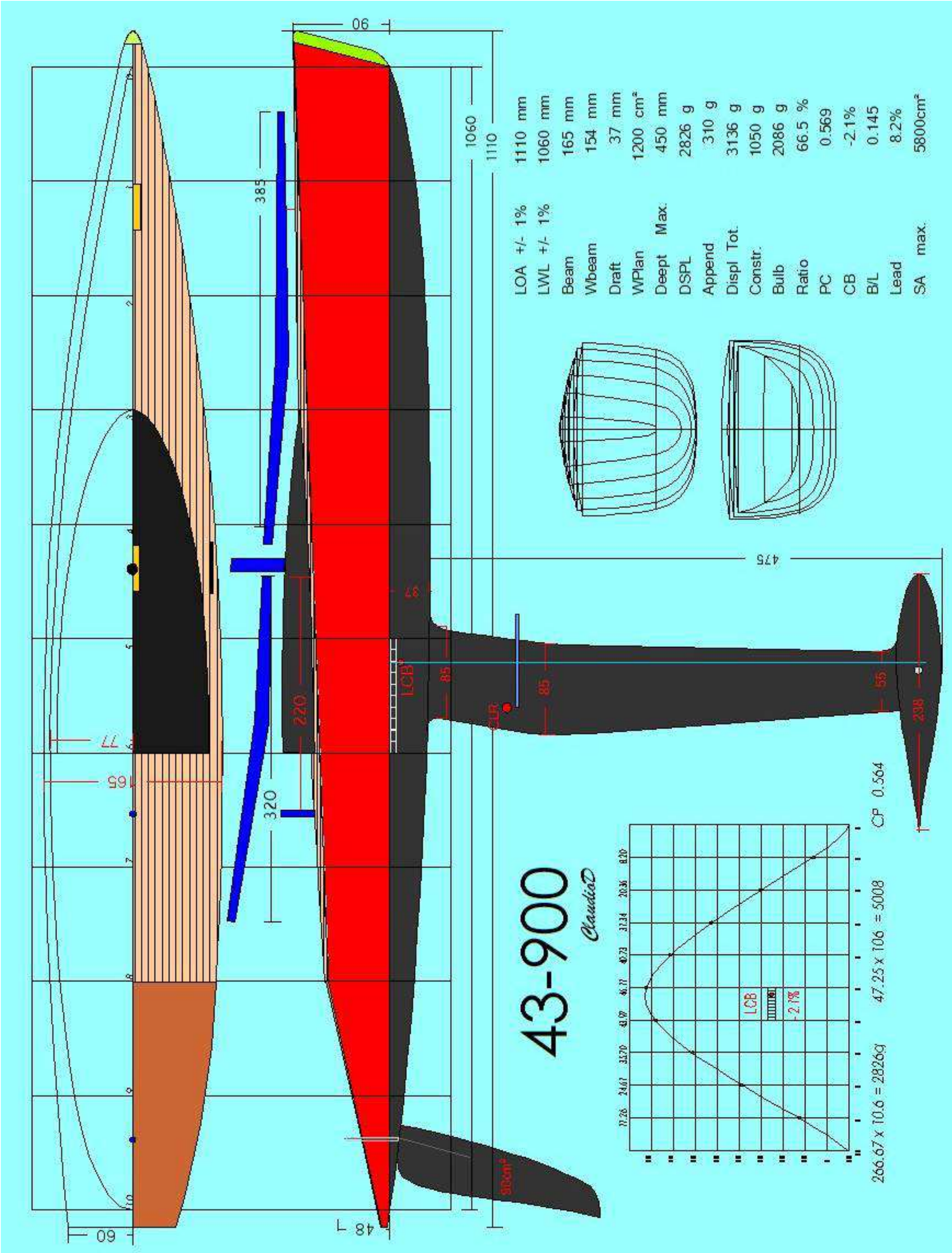
43-900

Experimental model

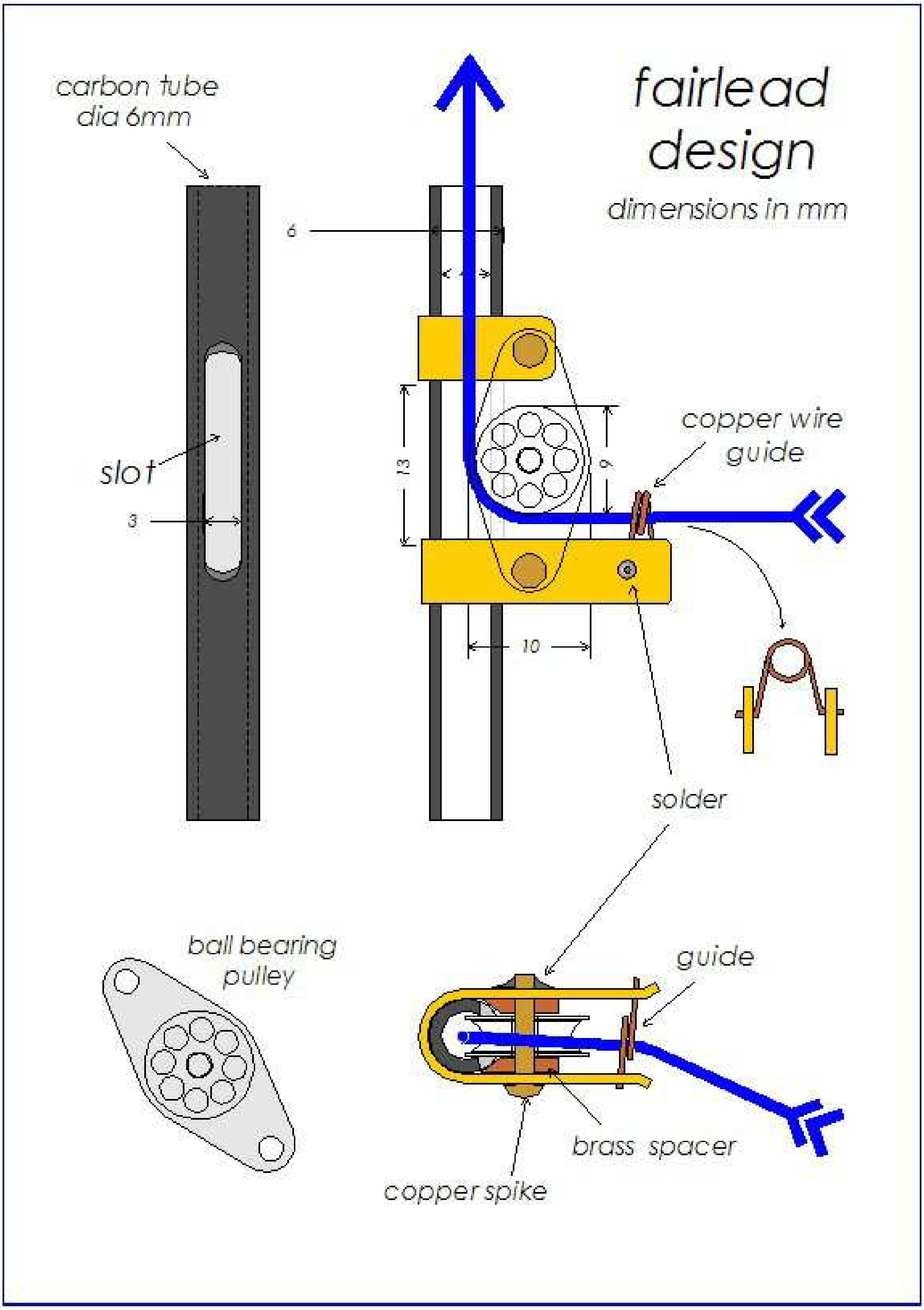
LOA	1110 mm
LWL	1060 mm
Beam	162 mm
Draft	475 mm

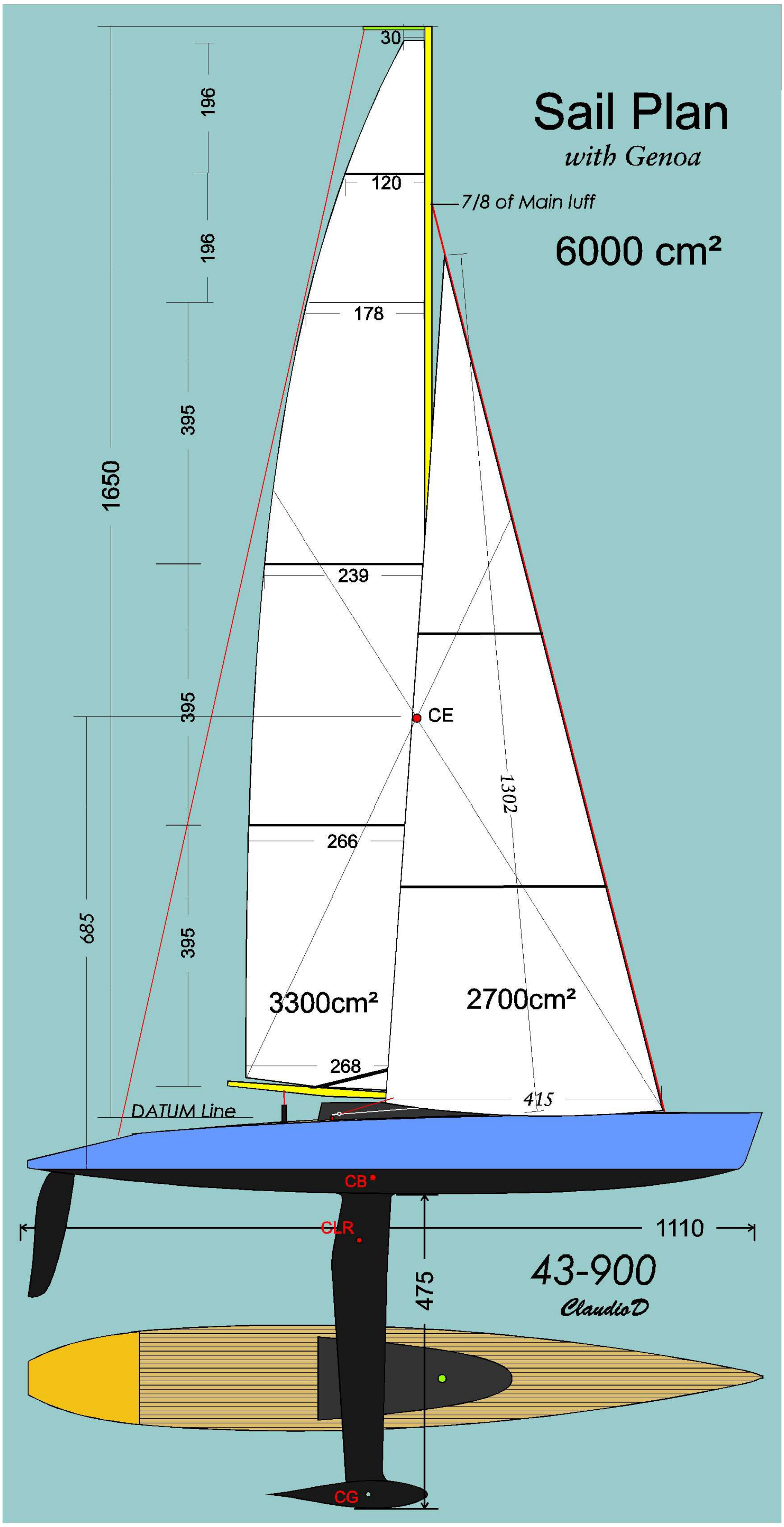
The basic idea was to experiment some constructional technique and details like the Genoa circuitry, the home made fairlead, radial boom, the sanding, the master preparation, the mold construction, etc.


Sail Plan
5850 cm²
Jib 40%
7/8 of Main luff
40
106
106
145
203
305
305
305
1650
264
159
CE
15
1329
288
271
707
3500cm²
2350cm²
355
295
373
DATUM Line
CB
CLR
1110
475
43-900
ClaudioD
CG



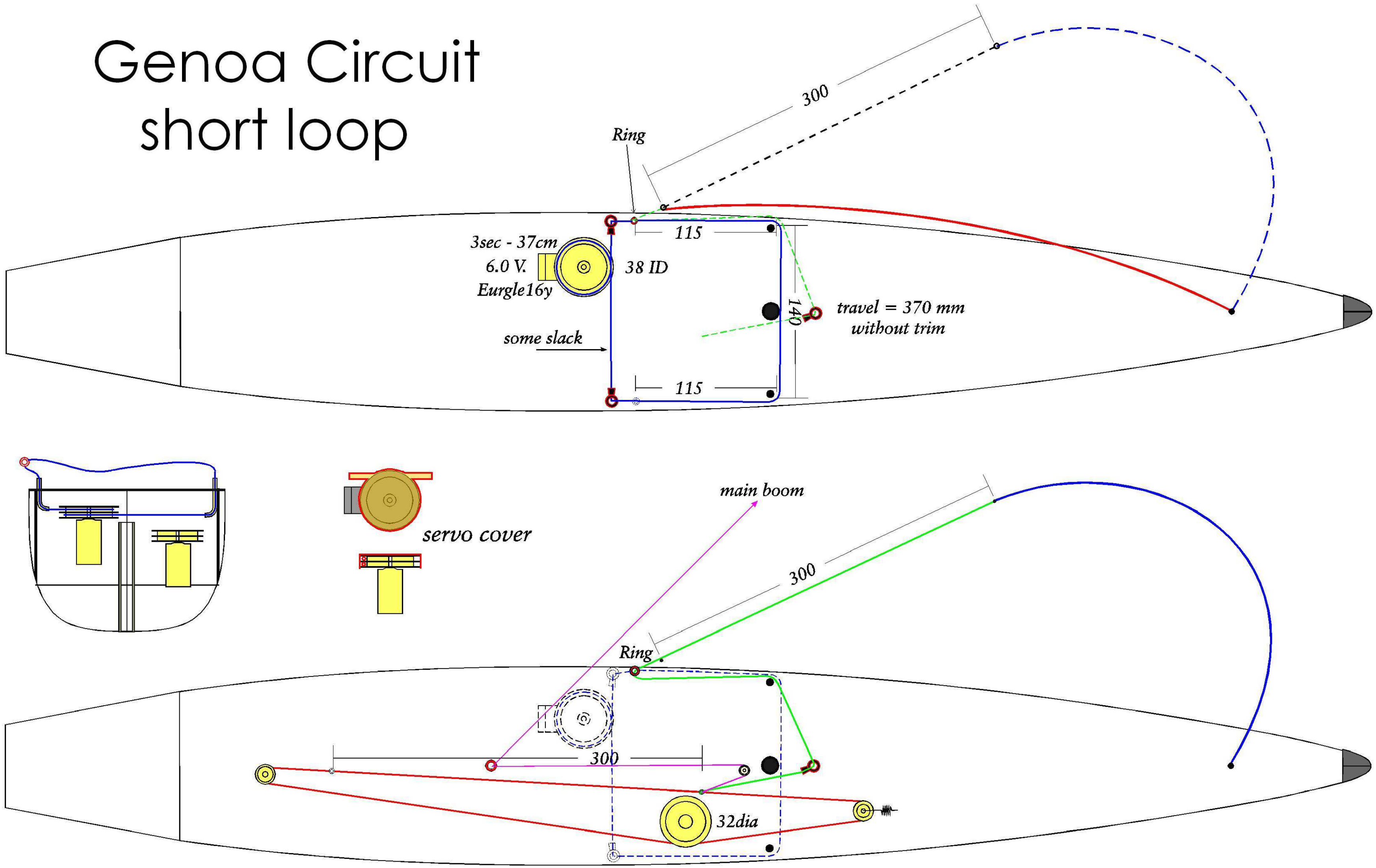
43-900
ClaudioD
LOA +/- 1% 1110 mm
LWL +/- 1% 1060 mm
Beam 165 mm
Wbeam 154 mm
Draft 37 mm
WPlan 1200 cm²
Deept Max. 450 mm
DSPL 2826 g
Append 310 g
Displ Tot. 3136 g
Constr. 1050 g
Bulb 2086 g
Ratio 66.5 %
PC 0.569
CB -2.1%
B/L 0.145
Lead 8.2%
SA max. 5800cm²
CP 0.564
266.67 x 10.6 = 2826g
47.25 x 106 = 5008
LCB
-2.1%


fairlead
design
dimensions in mm
carbon tube
dia 6mm
6
4
slot
3
13
9
copper wire
guide
10
solder
ball bearing
pulley
guide
brass spacer
copper spike

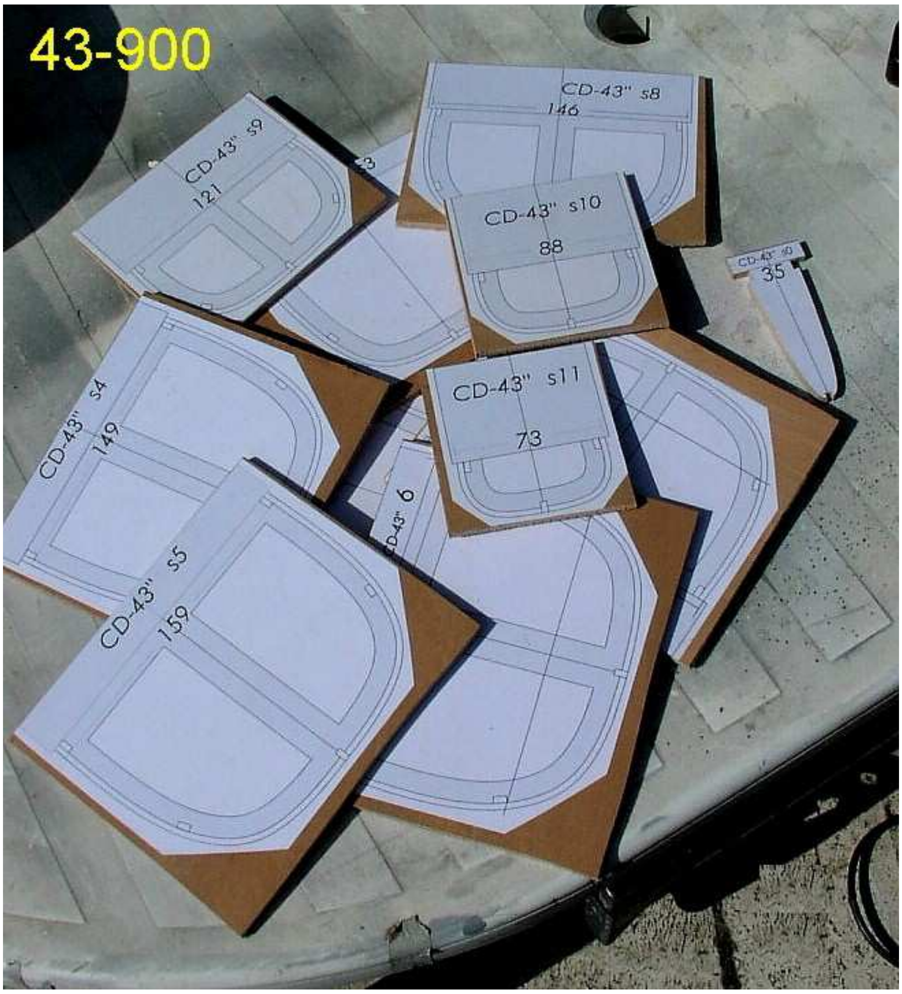


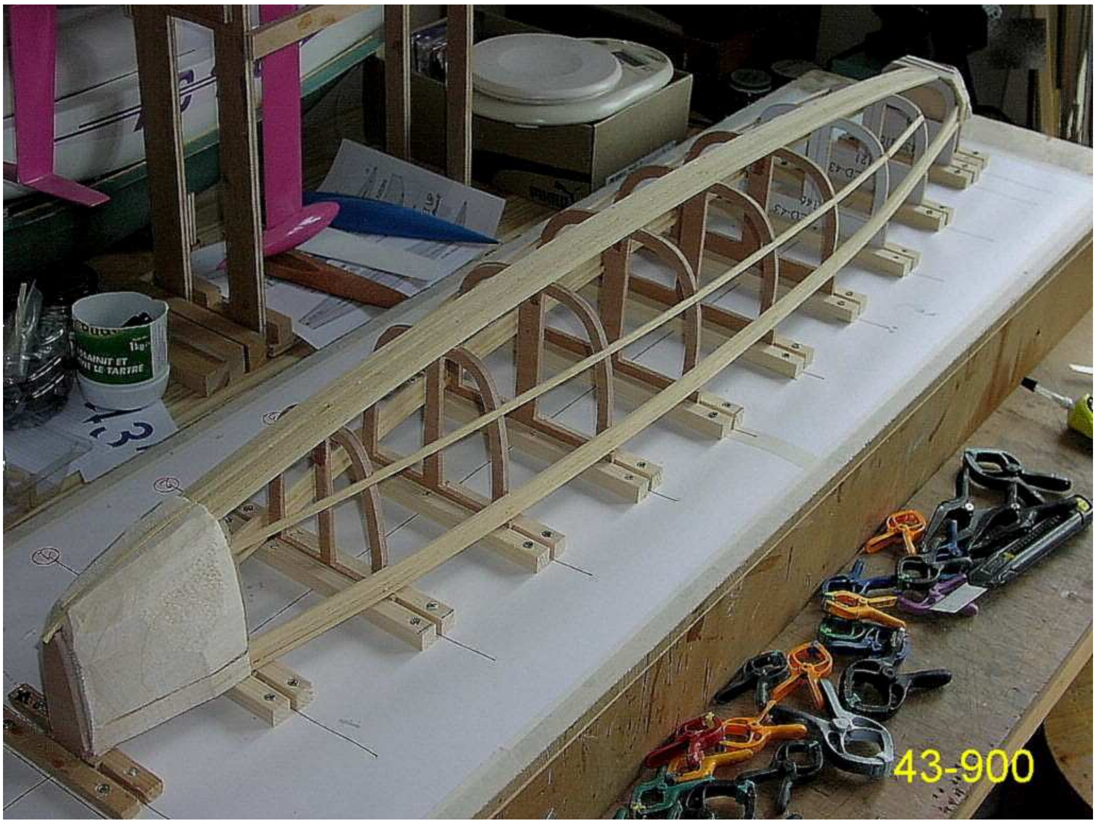
Sail Plan
with Genoa
7/8 of Main luff
6000 cm²
30
120
178
239
266
268
196
196
395
395
395
1650
685
CE
1302
3300cm²
2700cm²
415
DATUM Line
CB
CLR
CG
1110
475
43-900
ClaudioD

Genoa Circuit
short loop



Follow a series of Pictures describing the constructional phases






43-900


Trap65
AC100B
CD-43"
43-900

Most of the shadows are removed

Epoxy filler all over the hull


43-900

Supports used to allow external tissue laminations


43-900
1st layer 105g/m^2 twill


NICE CÔTE D'AZUR
7 NOVEMBRE - 22 NOVEMBRE 2009
Peel Ply
absorbing tissue
ribbon
CD-43"
43-900


43-900
CD-43"
pre paint tracer


after wet sanding
mini air bubbles
43-900


Wet Surface
after sanding
43-900


New coat
43-900


after sanding
wet surface
43-900

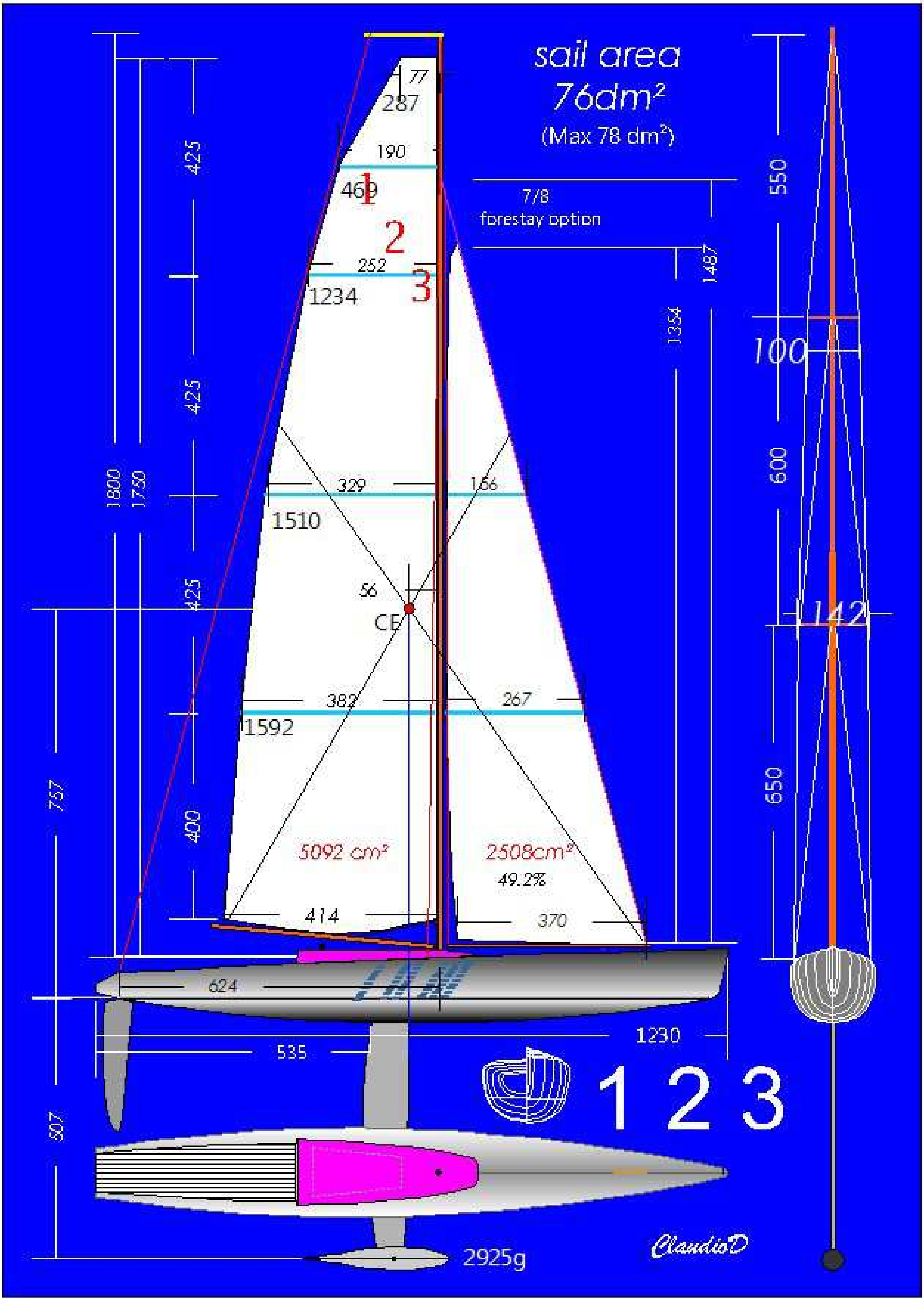
For the time being the 43-900 story is ending here.

'123'

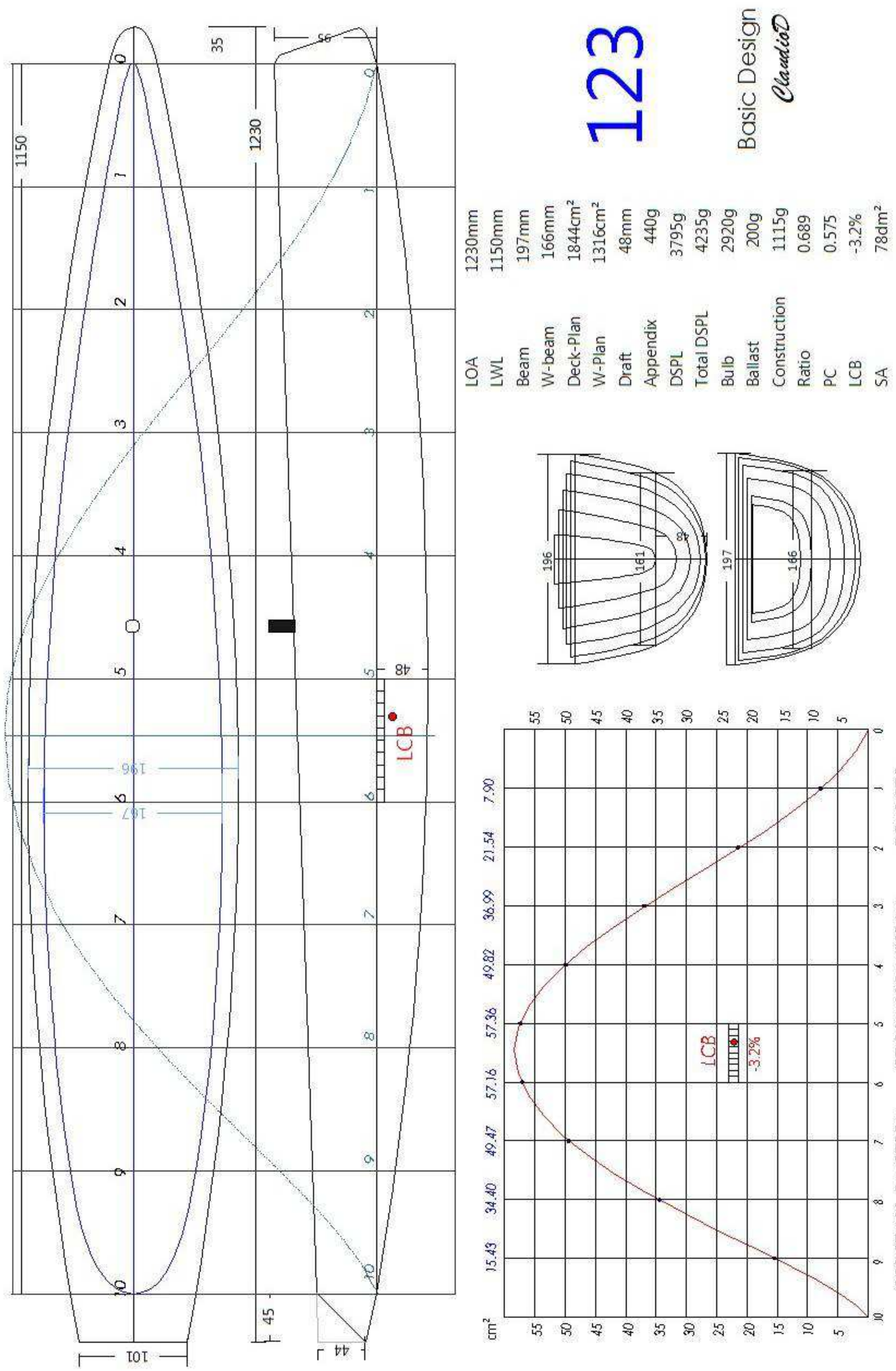
Born as "OneTwoTwo" project and changed in '123'
This model is developed in order to verify the possibility to drive the Main and Jib sails independently as on real boats.
Among that care has been taken to draw a model with a modern look outside the established Rules.

A bit shorter of a Class M.

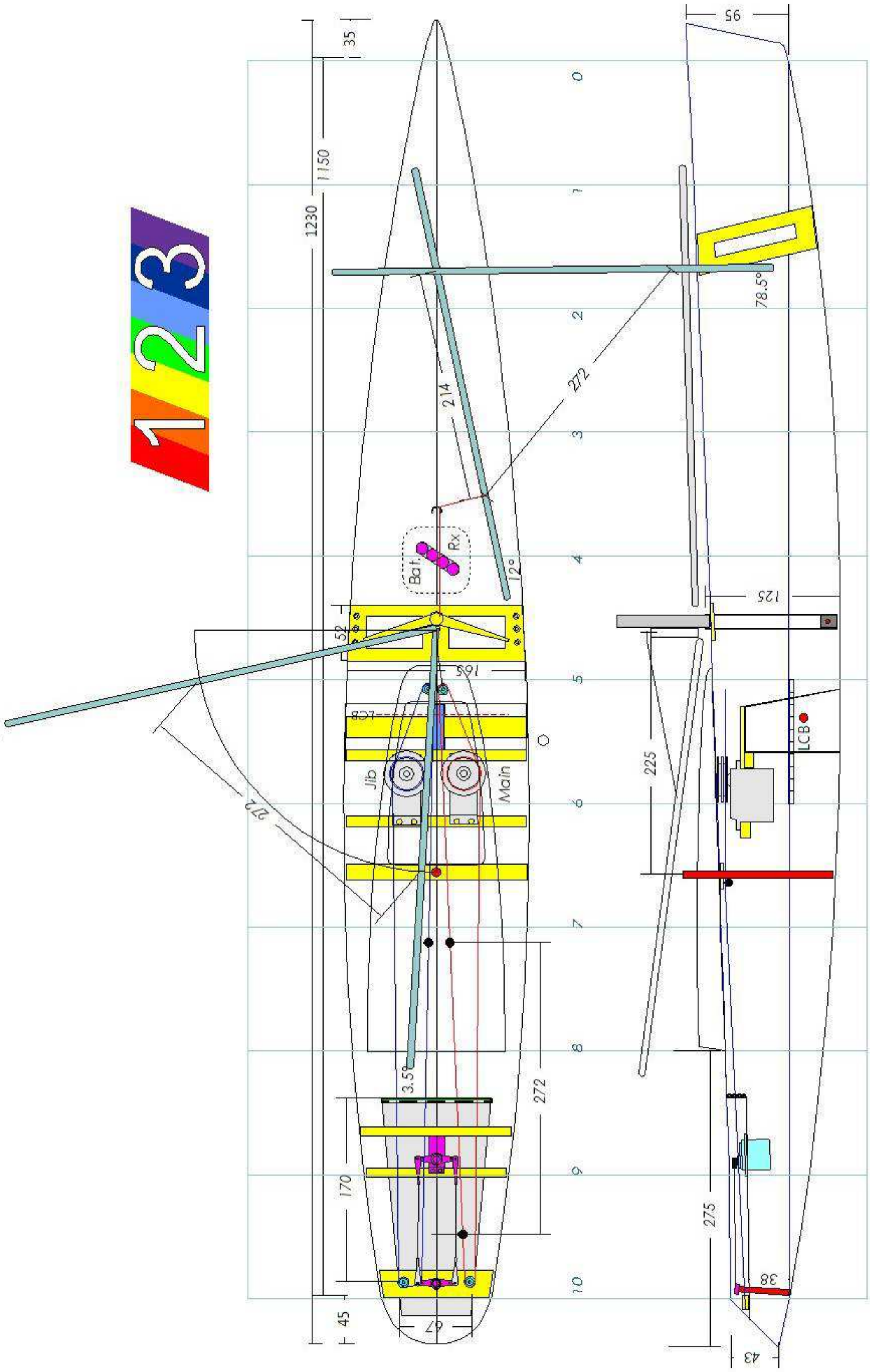
LOA	1230 mm
LWL	1150 mm
Beam	173 mm
Wbeam	155 mm
Draft	480 mm
Sail Area	7800 cm² max.
Dspl	4000 cm3 min.



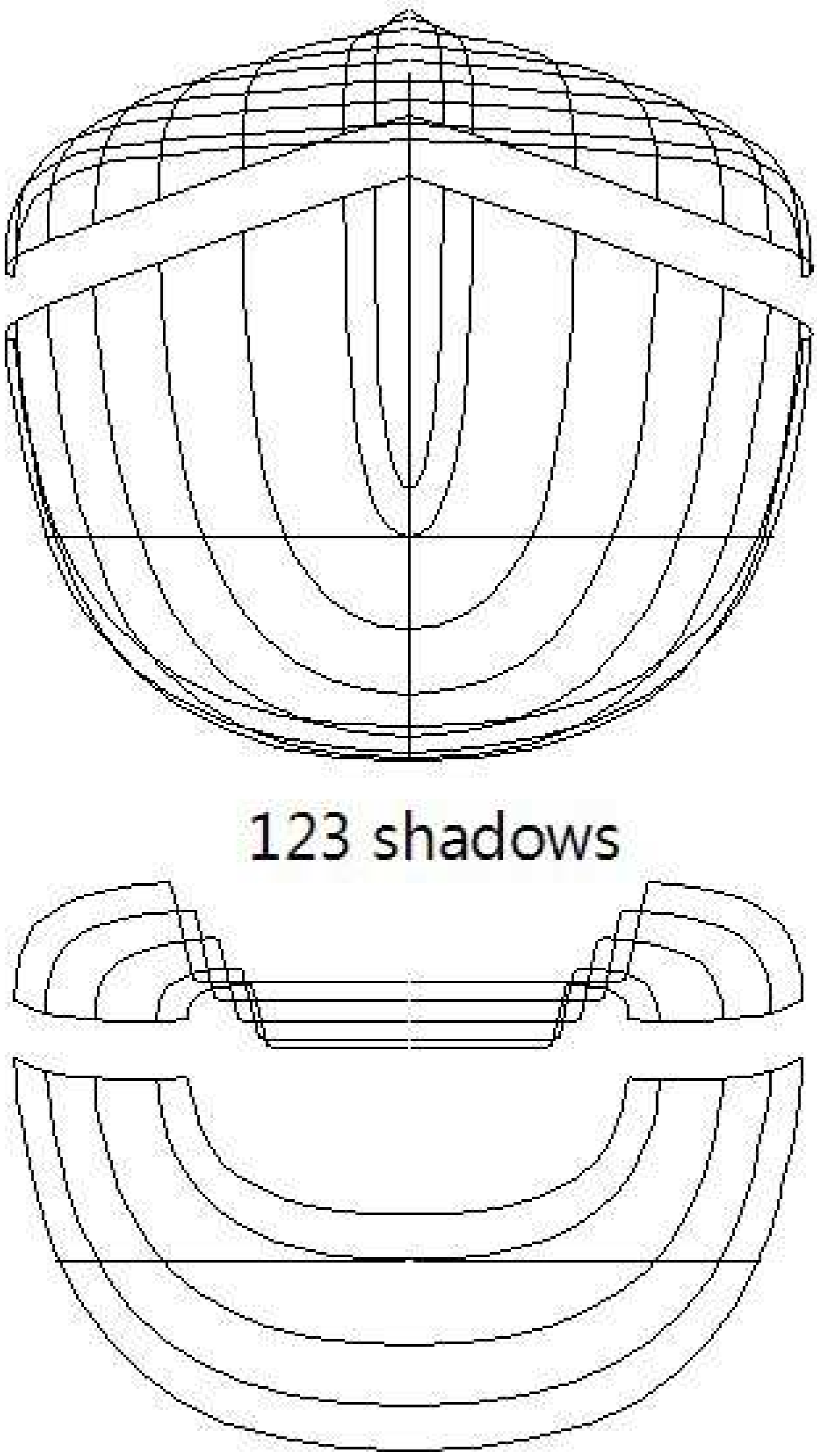
Next page shows the dual winch set-up, one for the Main and one for the Jib

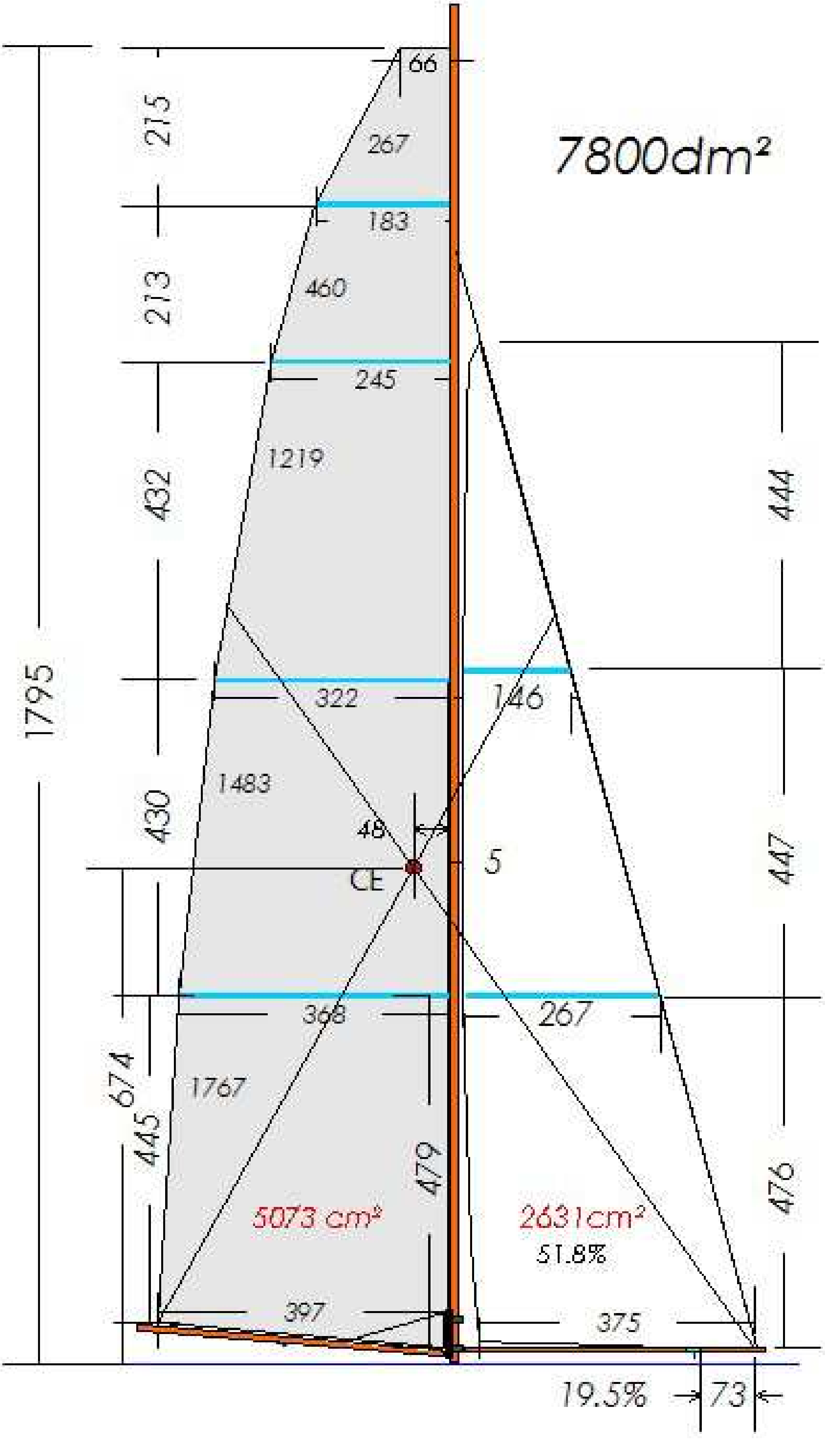


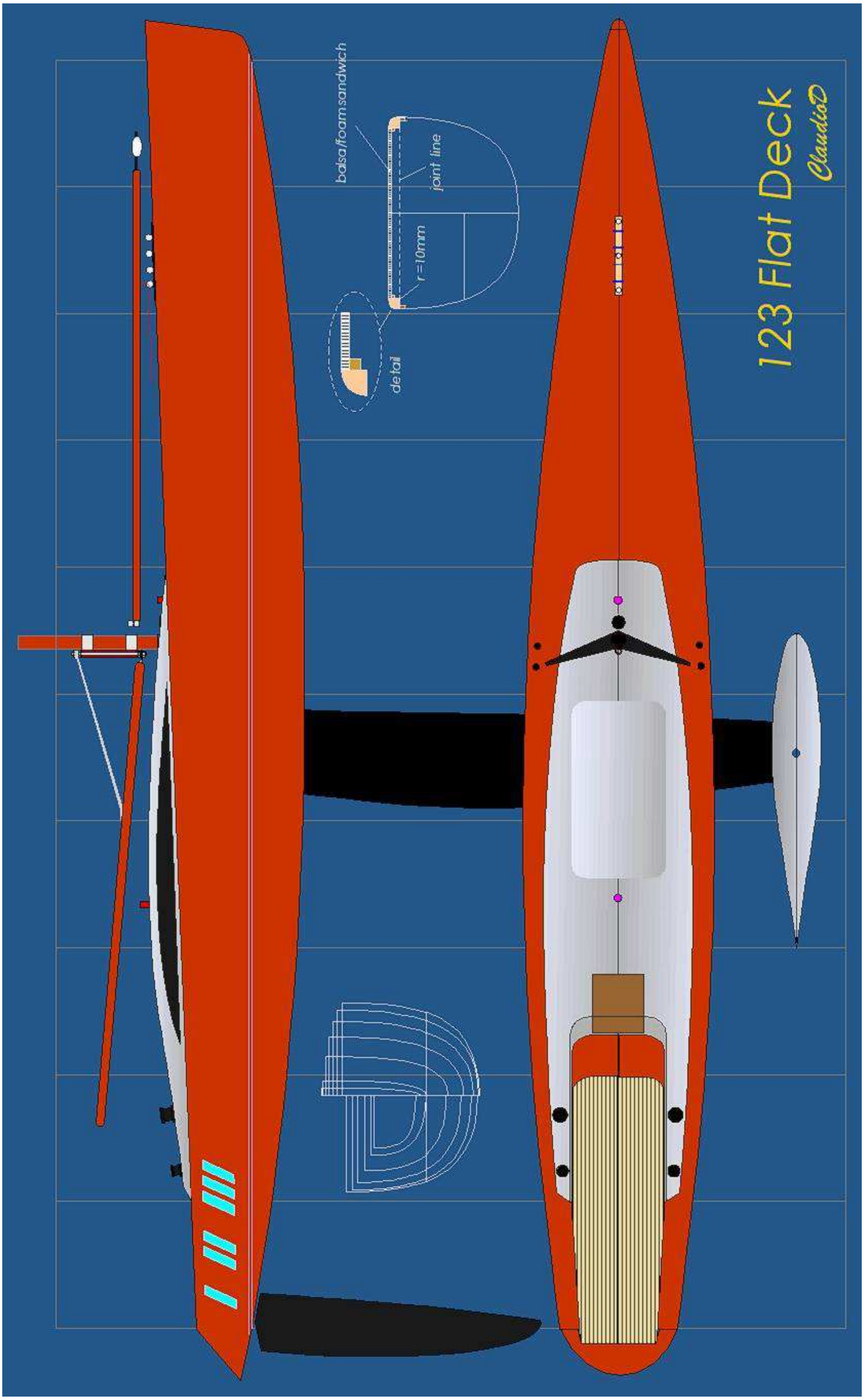
In order to operate the two winches separately, has been necessary to modify the Transmitter Joysticks functions.
This resulted in a difficult appraisal of the servo's control.

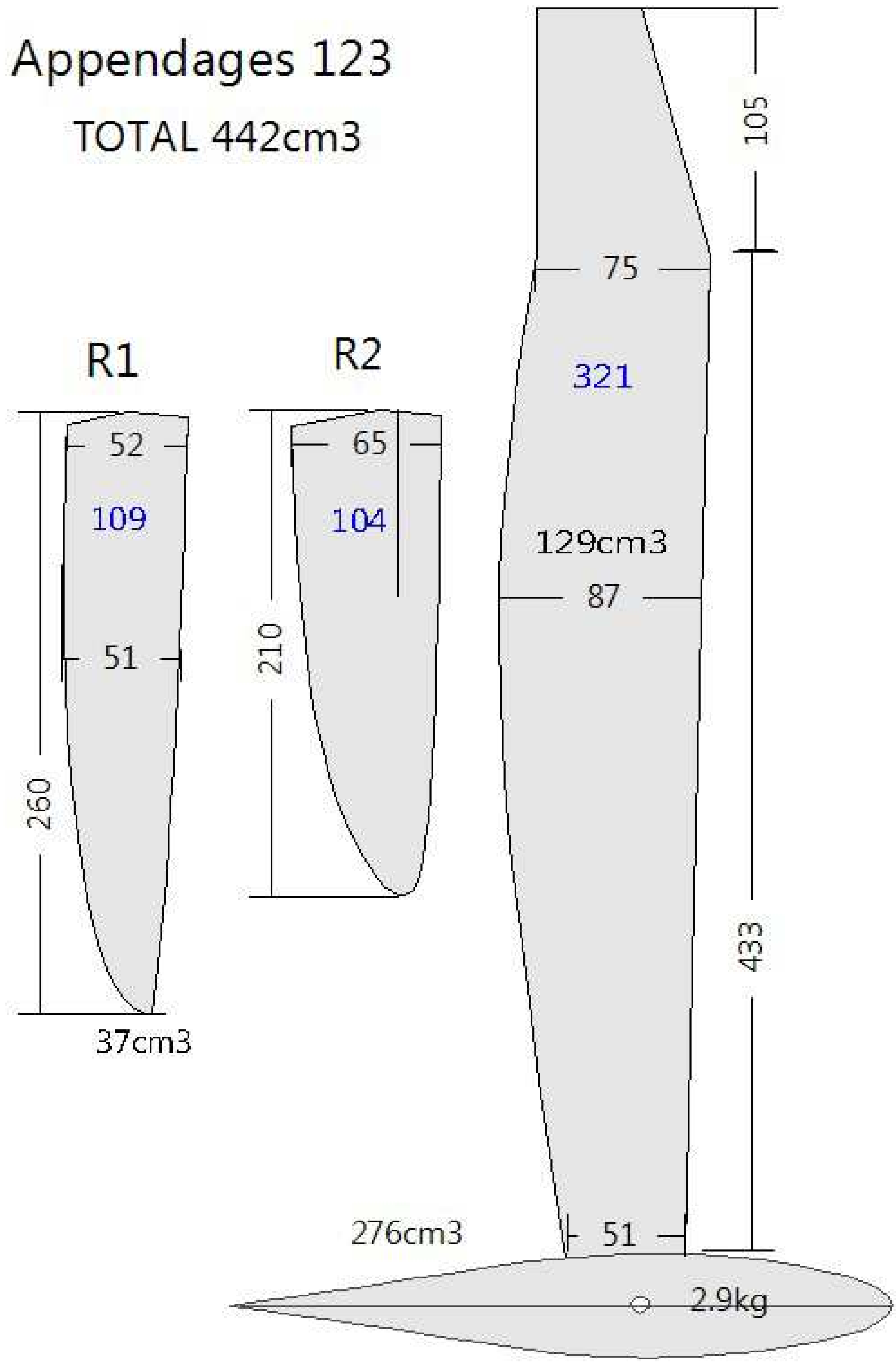

1230
1150
35
45
74°
78.5°
272
214
12°
52
165
LCB
Jib
Main
Bat.
Rx
225
125
95
3.5°
170
272
275
38
43
67
0
1
2
3
4
5
6
7
8
9
10

The shadows have been modified by splitting hull from deck:




7800dm²
66
215
267
183
213
460
245
432
1219
444
1795
322
146
1483
430
48
5
CE
447
368
267
674
1767
445
479
476
5073 cm²
2631cm²
51.8%
397
375
19.5%
73

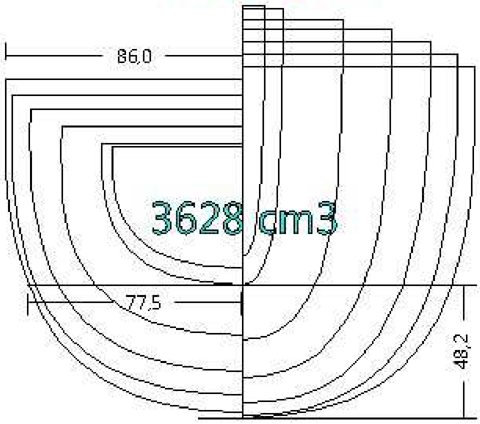

123 Flat Deck
ClaudioD
balsa/foamsandwich
joint line
r=10mm
detail


Appendages 123
TOTAL 442cm3
R1
R2
52
109
51
260
37cm3
65
104
210
75
321
129cm3
87
105
433
51
276cm3
2.9kg

During the model design one of the first activity consisted in the shadow drawing and calculations.
Here below the evolution from '121' to the final '123'.
The chosen form being the one offering less Wet Area in spite of '121' having less draft!

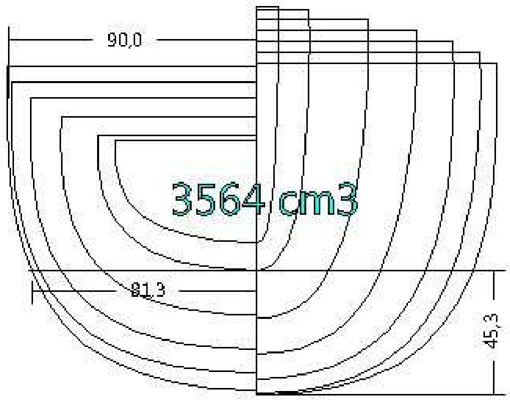
'123' was retained

123 cm



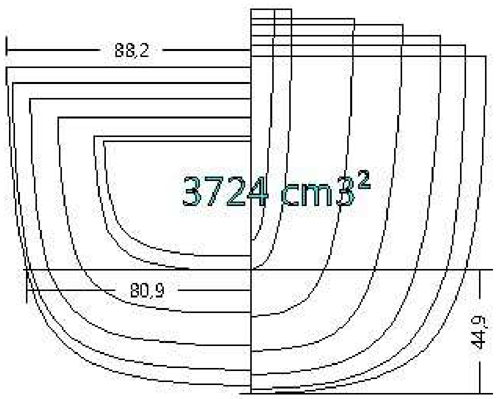
WET AREA 1558cm²

121 cm



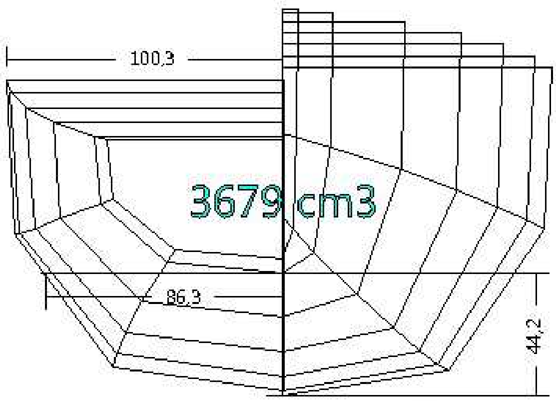
WET AREA 1589cm²
+1.9%

122 cm



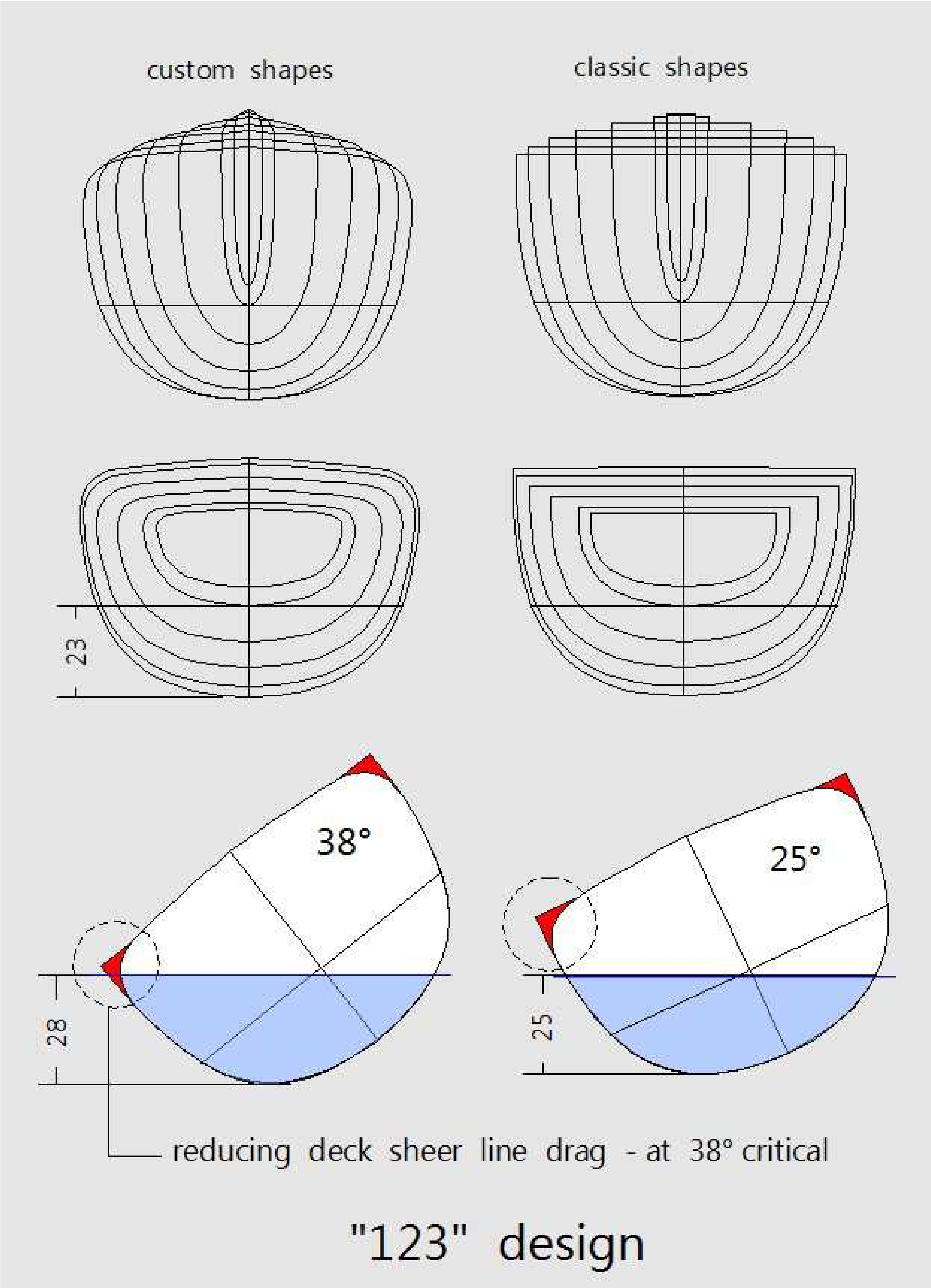
WET AREA 1616cm²
+3.7%

122 chine



WET AREA 1687cm²
+8.2%

One of the concerns was the tilting angle versus deck sheer line drag. Rounded corners helped over 28° of tilt.



Weight follow-on July 30 - 2012 New Hull and Flat deck

Hull 3x80g/m² glass	152g	
Deck full laminate 2x105g/m²	82g > 105g	(measured complete)
Hull + Bow + balsa stern + stripes	176g	(+24g)
Glass reinforcements	33g	(20.0 dm² of 165g/m²)
resin for reinforcements	33g	

Hull weight update	242g +
Deck as is	105g =
sub total	347g

Today 14th of august 2012 : projected weight

Hull + Deck (before supports)	347g	(measured)
2 winches (65g)	130g	(measured)
Rudder servo	33g	(measured)
Battery (5 x AAA) - 6V.-1000mA/h	64g	(measured)
Receiver	12g	
Fin	151g	(measured)
Rudder	35g	(measured)
Rig	222g	(measured
Jib servo Trim	Hitec HS-5245MG	32g
sub total	994g	

Supports :

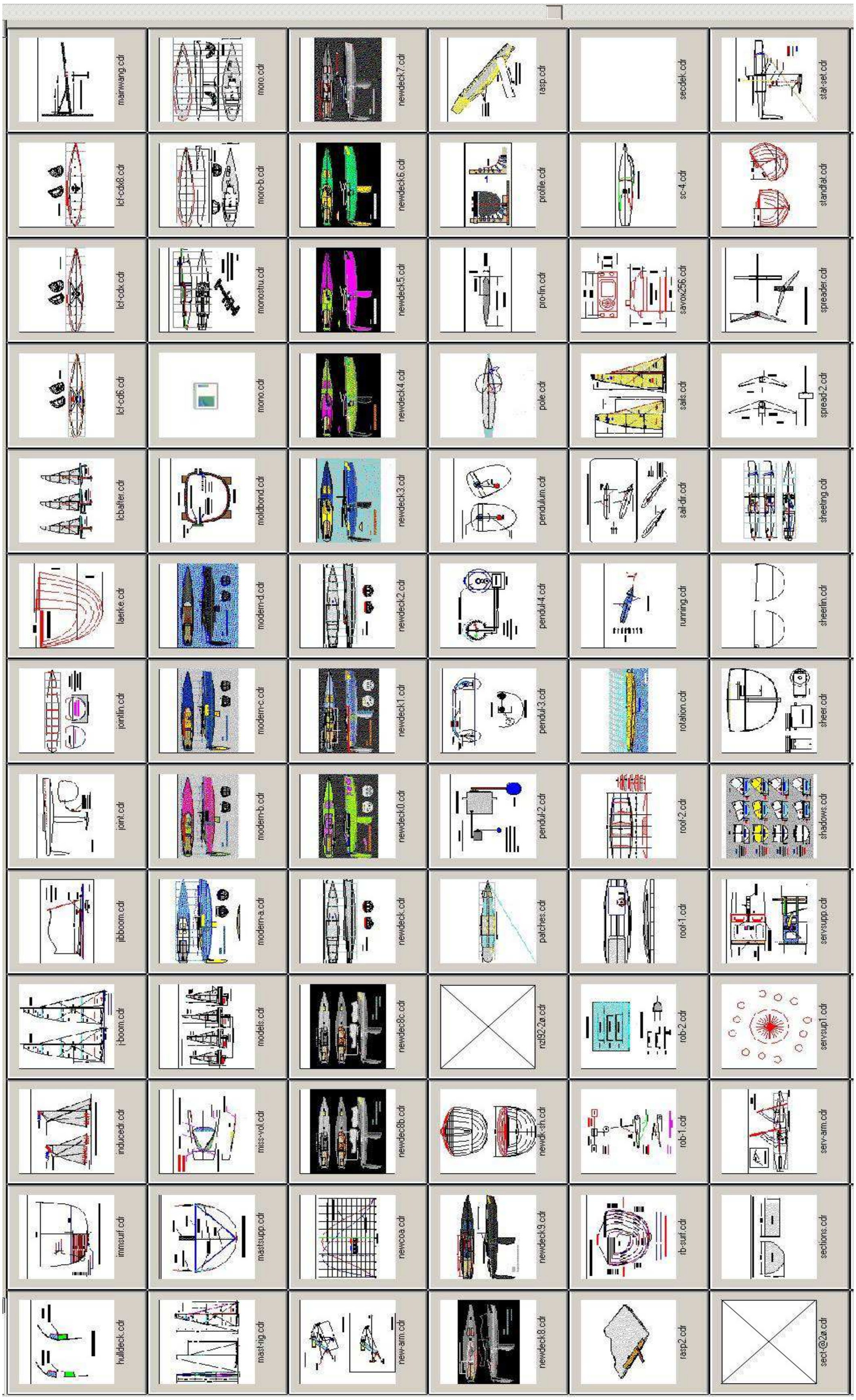
mast	32g	(measured)
eye bolts	5.9g	(measured)
fin box	22g	(measured)
Fin box bar	5g	(measured)
dual winch support bars	9g	(measured)
servo rudder supports bars	7g	(measured)
rudder trunk support	6.9g	(measured)
Jib anchor support	13g	(measured)
fairlead support	3g	(measured)
Paint/primer	35g	(expected)
sub total	138.8g	

Bulb	2920g	(measured)
Total	4052g	

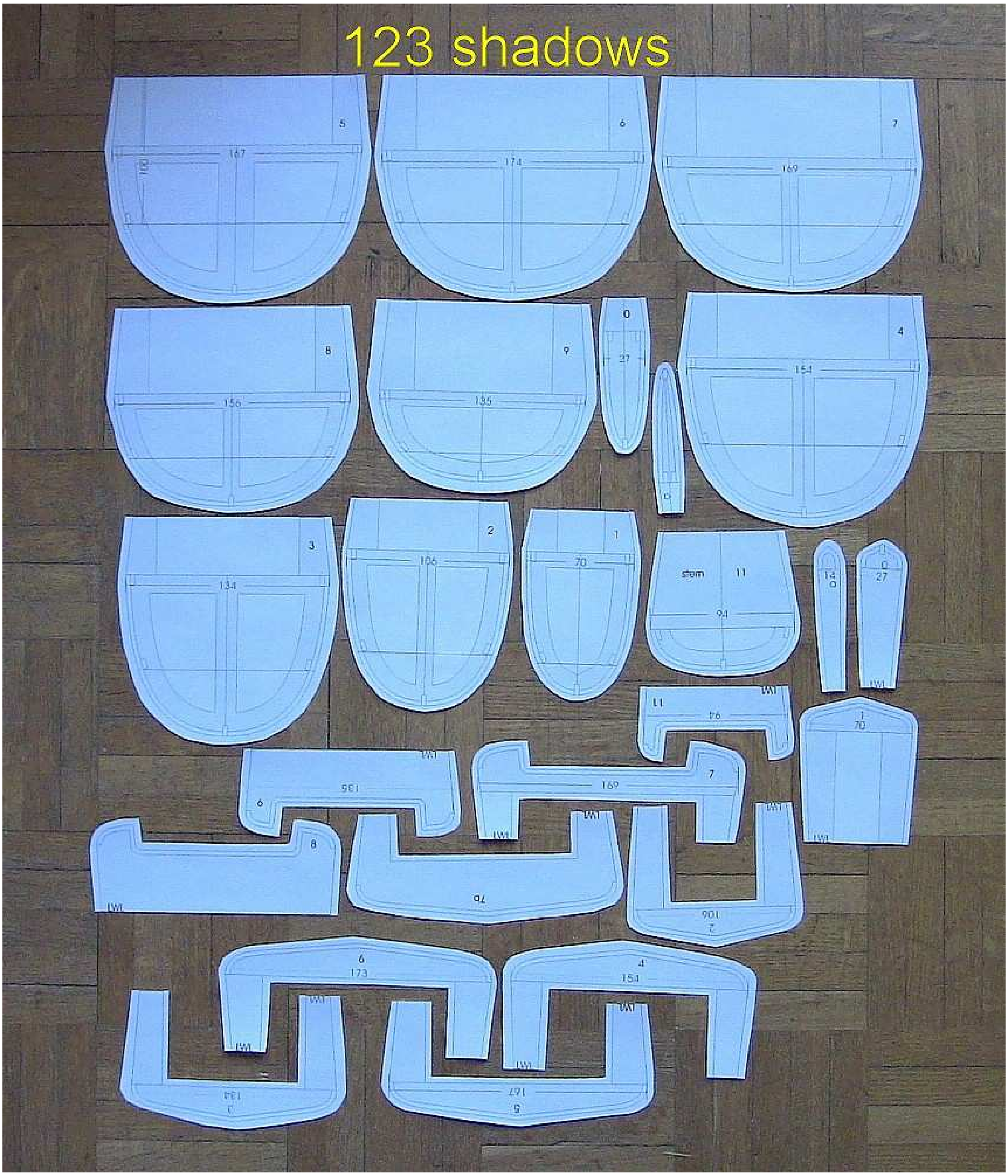
Missing deck bonding

Design aimling goal !! < 4000g

Example of one of the many pages of CorelDraw Mosaic Roll-Up



The images that follows are the ones referring to the '123' Construction Phase



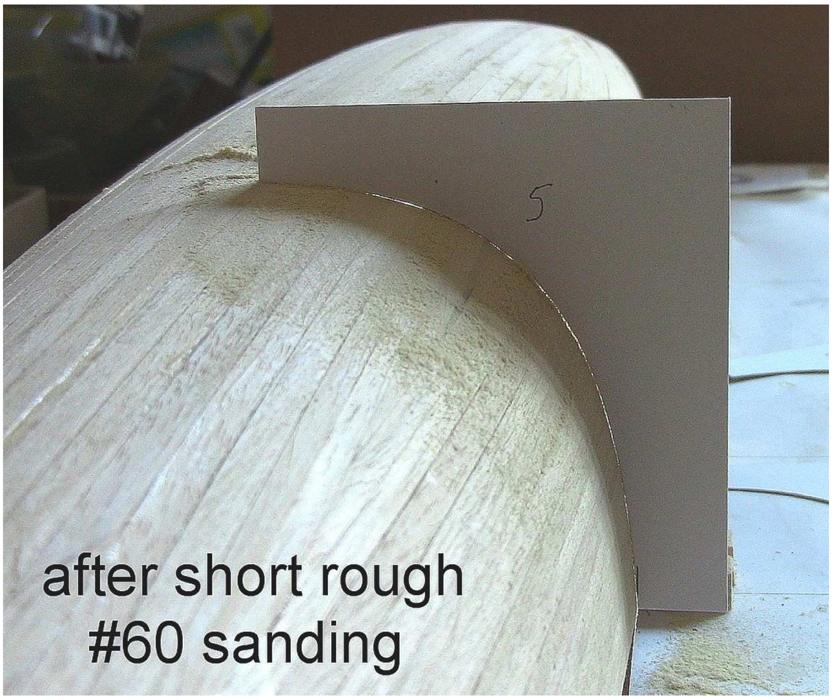

frames ready
for final cut


ONE TWO THREE
ONE TWO THREE

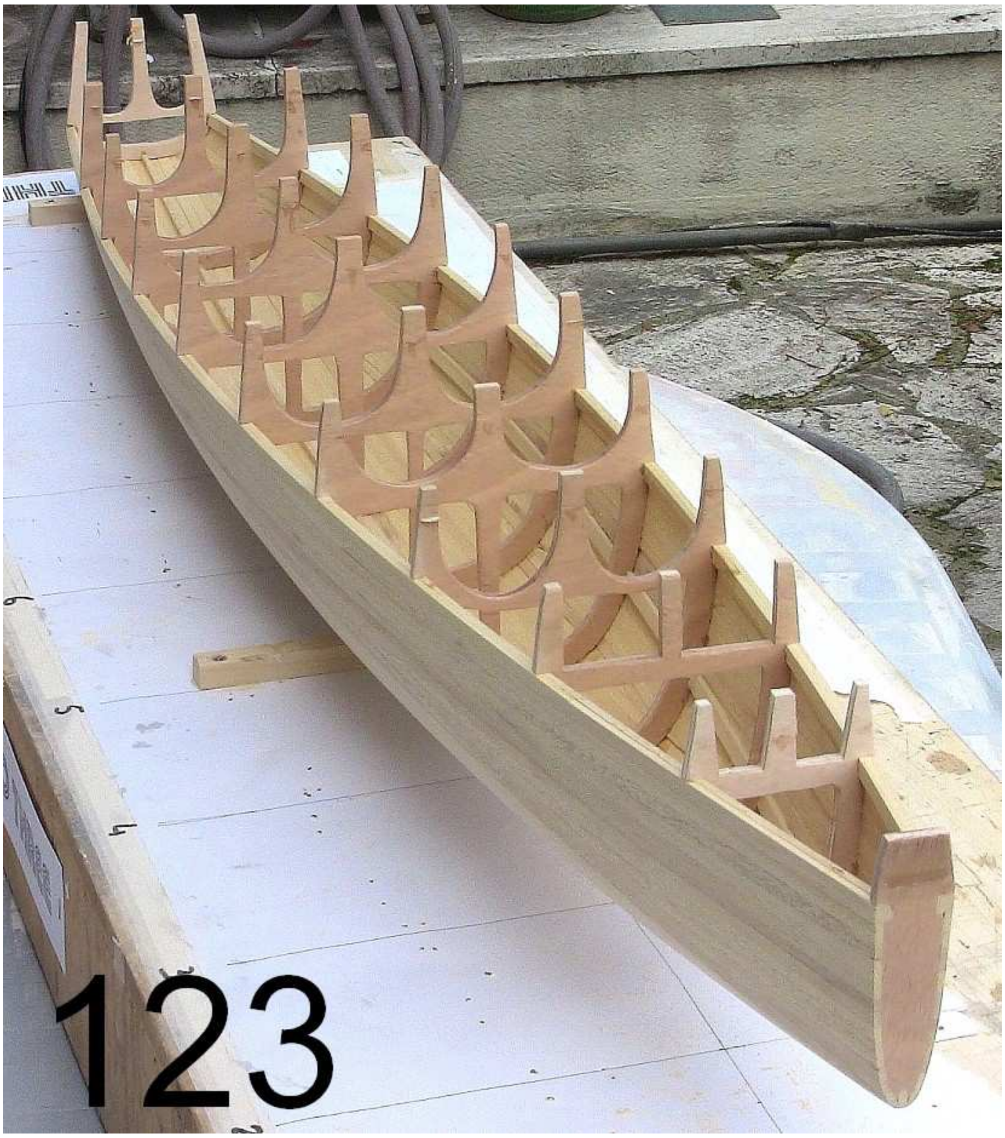

123

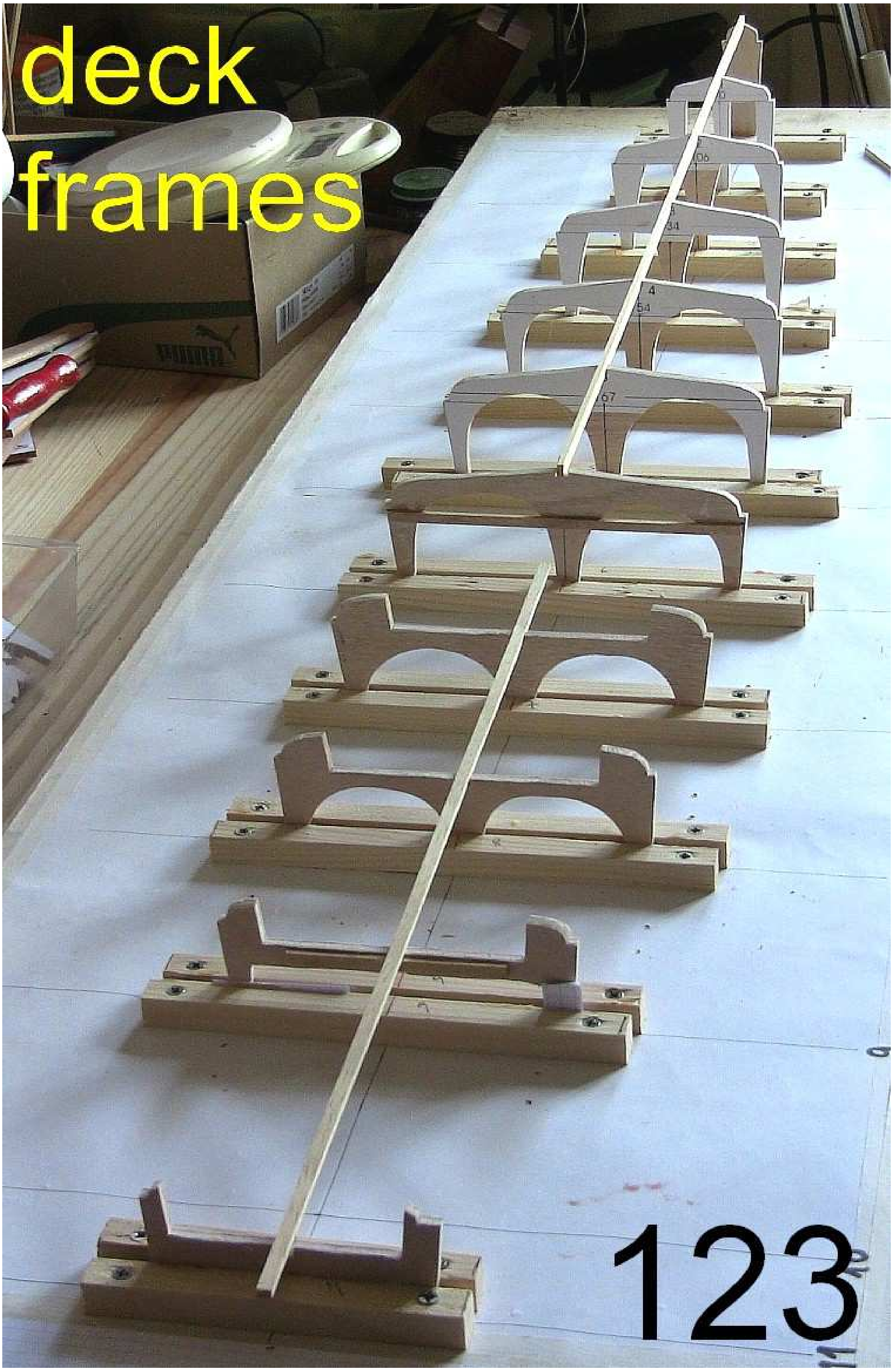

ONE TWO THREE

Surface
Hull Form
Control



Removed
from assy
table




deck
frames
123

Deck strip planking seen from above


123
before
epoxy
resin


Deck with epoxy filler
123

Hull and Deck Masters almost ready for mold making


packing tape
+ wax ?!
Deck
123


all about 123

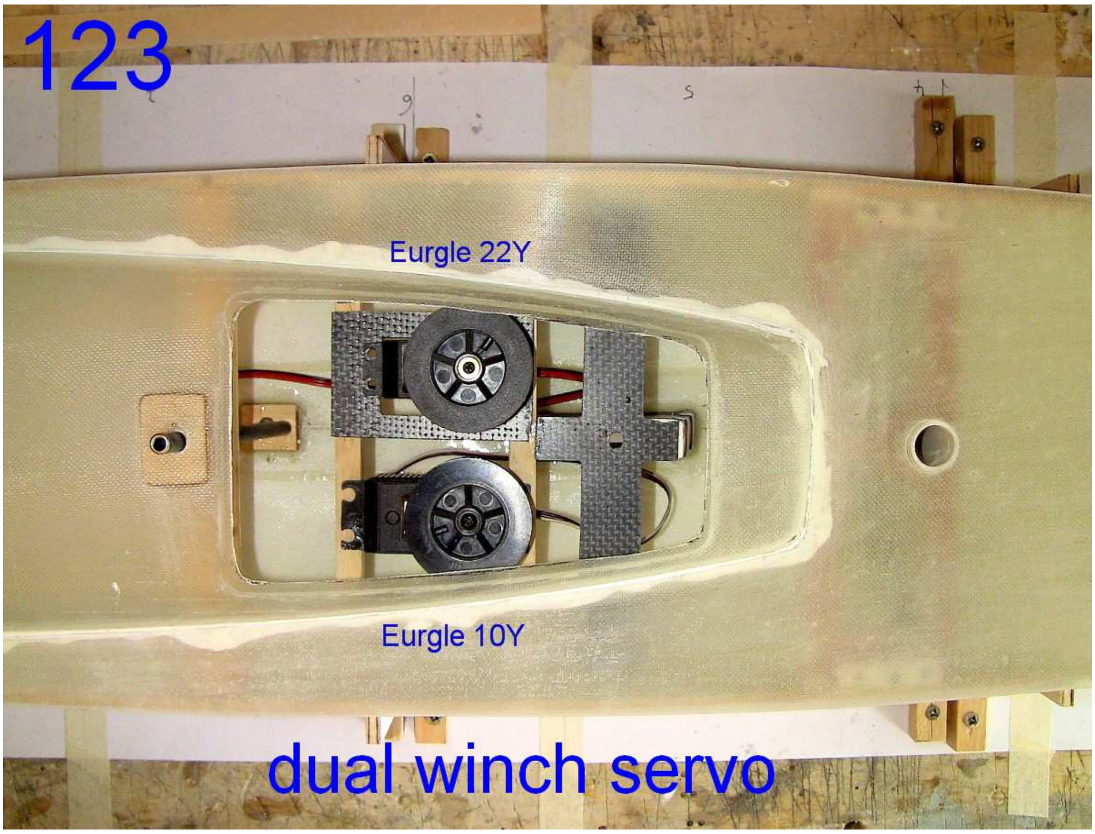

123
ONE TWO THREE
counter-shadows


Deck demolded
123

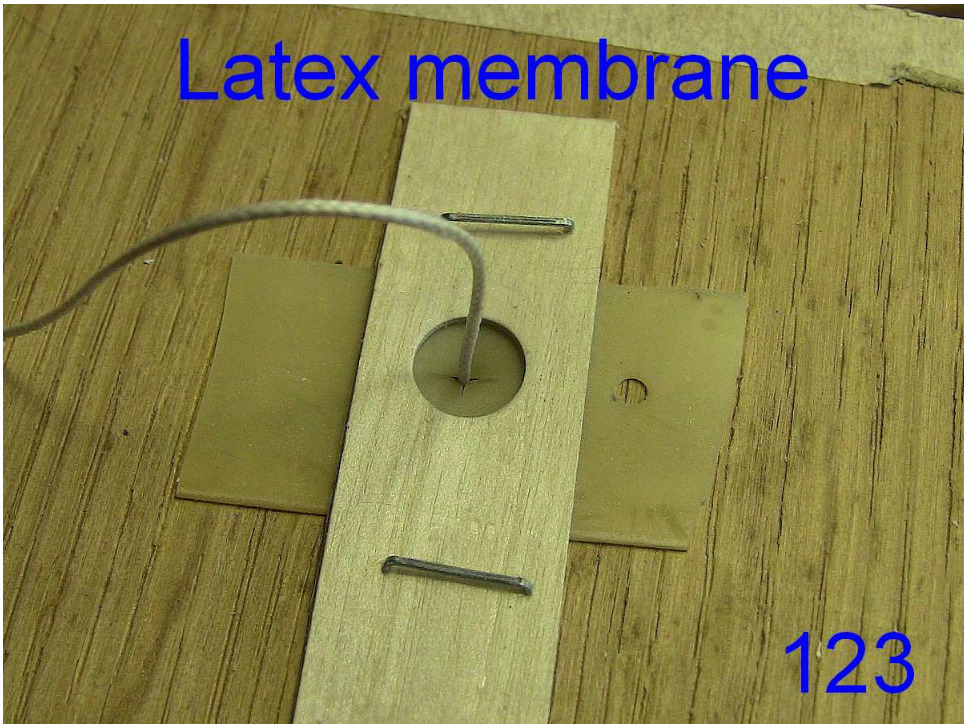

123

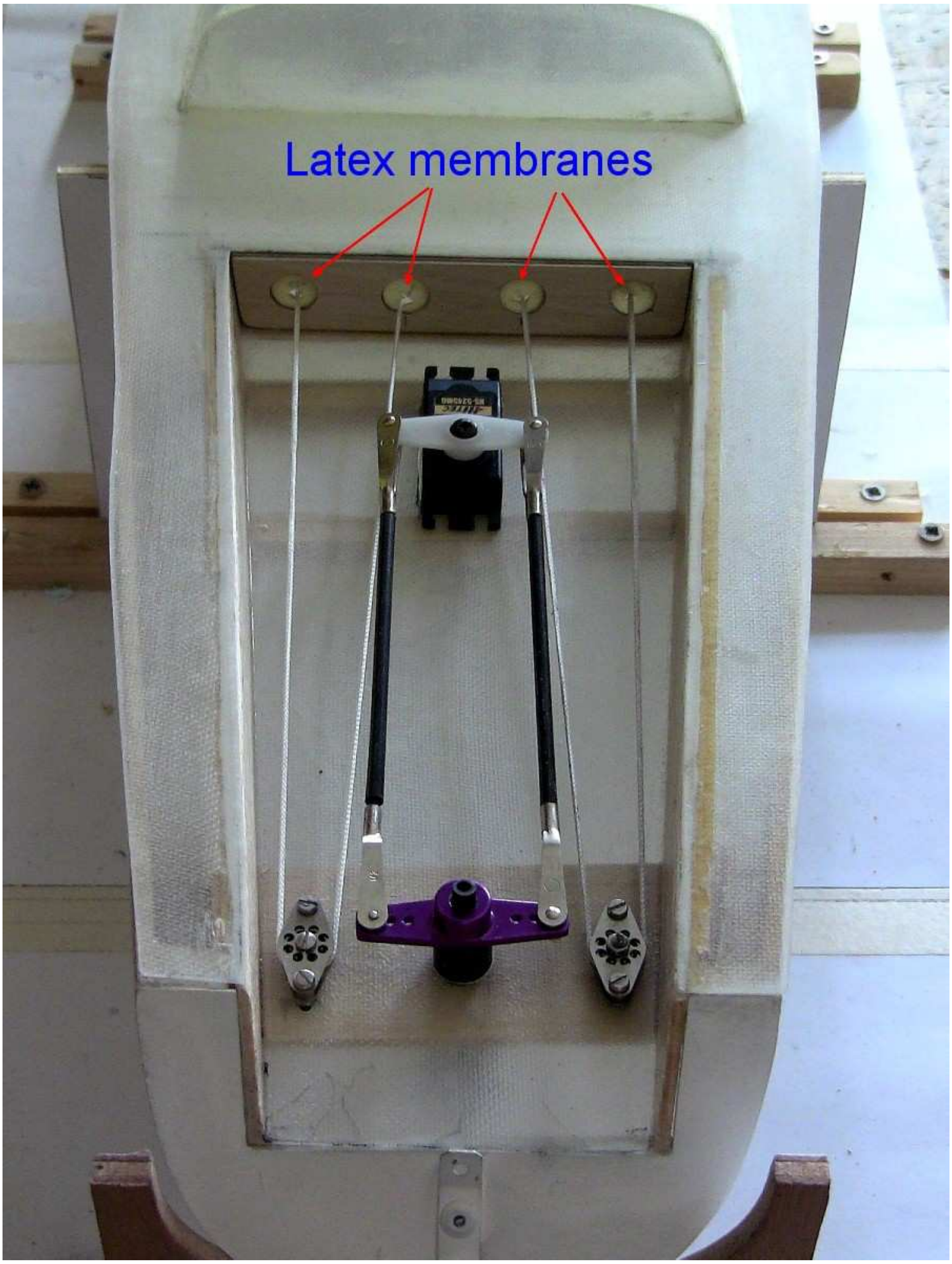
Deck and Hull assembled


123
ONE TWO THREE



Latex membrane





Details for dual servo's strings and return pulleys

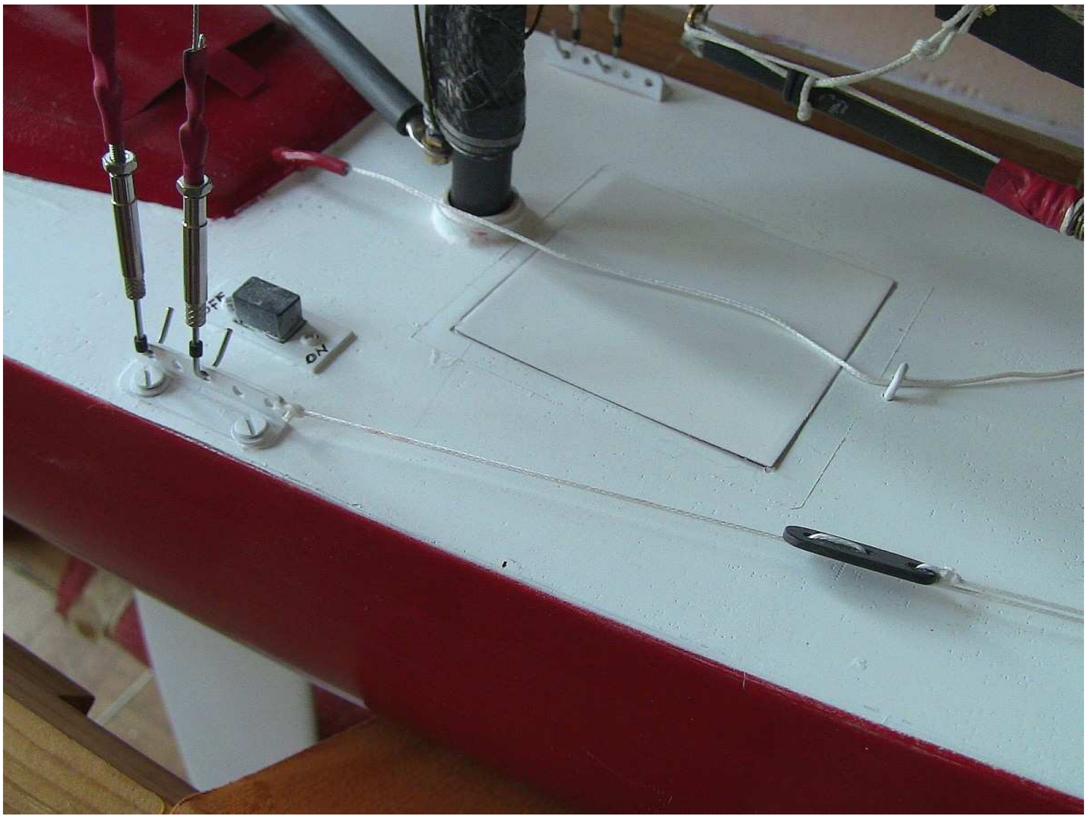
Servo's sheeting path

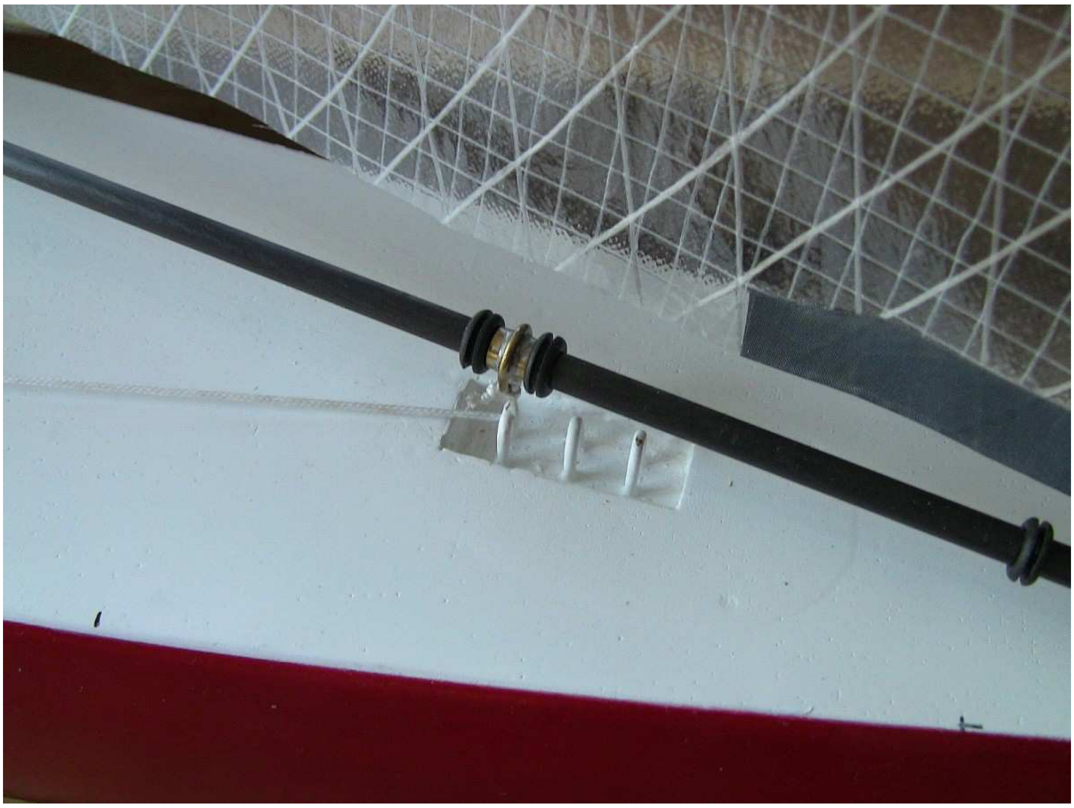
Missing Sails and Bulb


123


locked / bonded with
3mm carbon pin

First water contact !





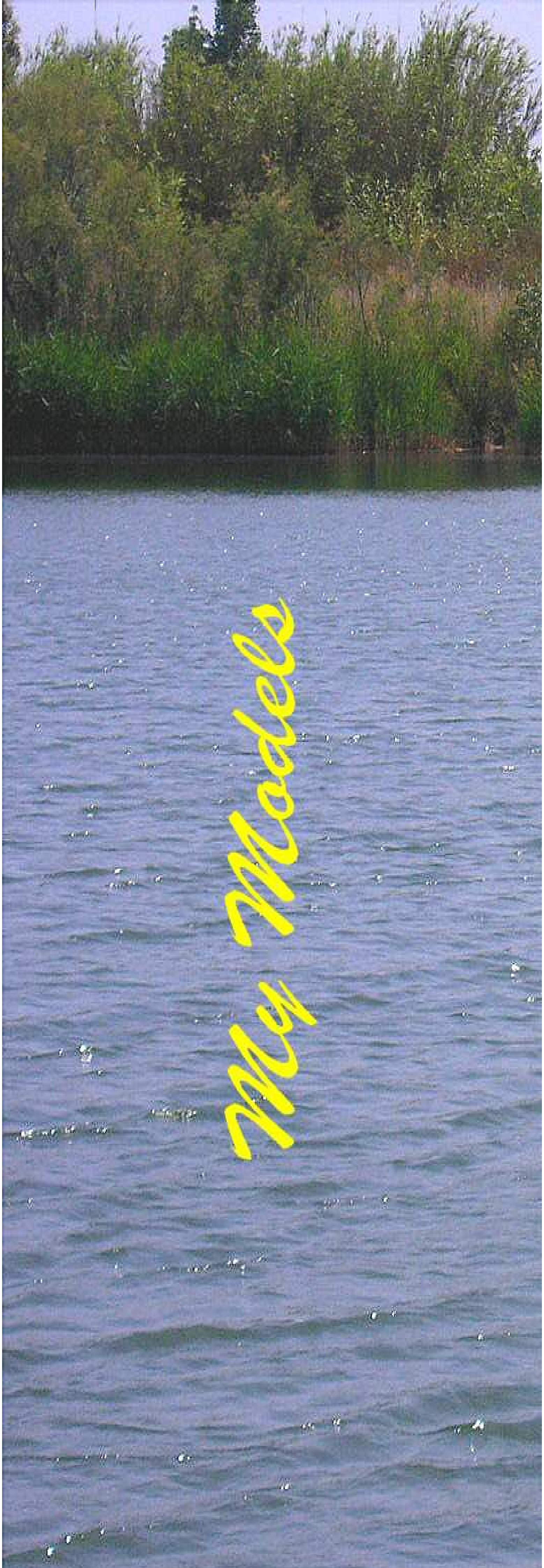
Main sail could be better adjusted !

Main not well set !

In spite of the Main Sail poor adjustment, the performances observed were very good.
Reduction of weight will improve dramatically the speed performances.
The wind was blowing that day at 18kt.
Personally, I miss some maneuvers since mixing up my fingers and the Joysticks.
Need some training or modify the Radio system control in another way.
I was surprised to see the "Nose Up" instead of "Nose Down".
Probably the results are due the centering of the boat and to the position of the Center of Flotation.

Video

https://youtu.be/fnpIoA72jGk


My Models