K-designs

I developed this programs for my own design work for multihulls in the early eighties. The are written in GW-basic. The are .exe files, the programs work only under DOS. Above Windows 95 you need a DOS program to run them. If somebody is interested to re-write them in JAVA script I am willing to send the source code. The programs run very good in DOS BOX, also Windows 7 64 bit.

The programs enable you to predict the stability and speed of multihulls . Not a lot of technical dada are necessary to compare multihulls. How to collect data is described in the intro pages. Download the program(s) to your hard disk. Start them direct from there. The complete programs including an installation program, help programs and a comprehensive users manual can be obtained for $ 43,-.

This is are shareware programs. Free for private use.

1. QUICK PERFORMANCE CHECK (QUIKP.EXE)

The program shows the average speed of the boat, 24 hour distance sailed based on the average speed
and the wind pressure per square meter when a hull will lift (please reef before). The results for 5 boats can be shown on the same display time for easy comparison.

2. DYNAMIC STABILITY CALCULATION AND DIAGRAM (SPEED.EXE)

This program calculates the righting moment. The degrease of the righting moment is shown as a diagram. You can input different wind speeds .

3. SPEED PREDICTION (till 90 degree to the wind)   (DYSTAB.EXE)

This program predicts the speed of the boat at different wind forces and shows the wind force speed relation in the form of a diagram.

HOW TO USE THE PROGRAMS

Depending on the program you need the following boat data (see figure):

Water line length
Beam (center to center line)
Displacement
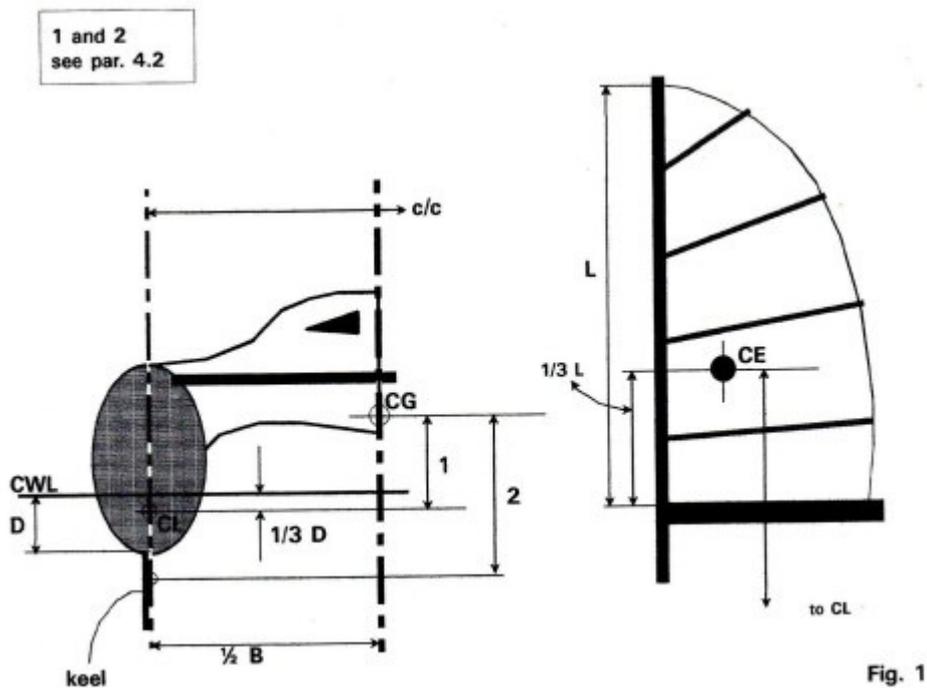Draft hull whit keel or dagger boards
Sail area
All inputs are metric. To calculate from feet divide by .305, sq/ft divide by .0929,
weight in pound by .454.

Fore some of the programs

Height of center of effort of the sails
Distance of center of gravity

DATA COLLECTION

Fig. 1

Use the specification of the boat of your interest to collect the above mentioned technical data. Basic data as length, beam, sail area and weight are easy are normally shown.

A. CE of the sail: Measure the luff of the mainsail and divide by 3 . Place the CE 1/3 upwards from the boom.
The jib lowers the sail area CE but the roach in the mainsail compensates for this.
The CE is the total sail pressure point we assume the whole wind force acts.

A.   The center of lateral resistance CL and CE
is shown on most side views. If not, find these by dividing the hull draft by 3. Place at 1/3 down of the CWL. To find the CL for a under water ship with keels or with the dagger boards down assume them at the max. draft of the hulls. For big keels or dagger boards in respect to the under water area use draft x factor 1.2. This is crude but besides for extreme underwater areas accurate by a about +/- 18 %.
The CE height is the sum of CE + distance boom to CWL + distance to CL.

B.   CG (center of gravity)

At the CG all boat mass is concentrated. On open beam multis assume at 80 % of the hulls height above CWL. On bridge deck at lower bridge deck level.

Besides the normal hydrodynamic forces the air drag of the sails, rigging, hulls + superstructures play an increasing role in fast boats. The power in the wind increases with the second power and the air drag of course also. The important fact is, that the air drag is inversely proportional to the air force i.e. forward speed. This means that if the sailarea is reduced (reefed down) , the effect of the air drag increases and the speed and pointing ability of the boat decreases very fast.
Multihulls with very high hulls in general have a high drag, superstructure and deck houses makes it worse. Streamlining the whole boat as far as is practical is very important.
To give you an idea. A flat plate has a drag coefficient (CD) of 4. A flat plate at an angle of 45°

one of 2. A cylinder (mast, rigging wire) one of ±1.2. In contrast an ellipse with an aspect ratio of 1 : 4 has an CD of only ± 0.3.

I hope this theoretical explanation helps to understand why some multihulls are not as fast as other and do not point well to windward.

The air drag (CW) for the speed prediction program:

Open beam cat = 0.9
Multi with superstructure low =1.
Multi superstructure normal =1.1
Multi with high superstructure = 1.2
Multi with deckhouse = 1.4

<u>Attention</u>

Don't forget to enter the scale factor (max. RMS) to 1 = 5 tons, 2 = 10 tons, 3 = 20 tons or 4 = 20 tons.

It is very informative to enter for the wind speed the following amounts: 00 (static stability) 10, 15, 20, 22, 24 and 26 kn . Study the righting moment curves.

The QUICK PERFORMANCE CHECK PROGRAM need the following up number otherwise the program will not work for the list results.

References used for the programs:

1. Aero and hydrodynamic of sailing,   C.A. Marchaj
2. Design for fast sailing,   E. Bruce & H. Morss
3. High speed sailing,   J. Norwood Jr.
4. Base speed: A simple measure
 for estimating multihulls (monohulls)
performance,   , MI No. 255   R. Boehmer

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