

Netherlands Ship Model Basin

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Mr. Warren L. Jones
America's Cup Challenge 1980 Ltd.
G.P.O. Box P1236
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Australia

1981-08-13

Subject: Model test programme to arrive at new 12 Metre
hull design

Our reference: PR44359 - model 5854B-----

AS
Arch
2 RD
2 RC
2 TU
3 DP
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Dear Warren,

I have just finished writing a short report to Ben containing all the required information for the construction of the yachts and the remaining calculations (drawings, calculations and test results), etc. The tests with the modified bustle configuration gave very satisfactory results. I have enclosed a table (Table 1), giving the comparison of the performance of the final design with the "Australia 1980" base configuration.

As you can see, there is a significant improvement in all areas of performance except in the running and reaching speed between 8 and 9.50 knots, in which region the existence of the bustle results in a small improvement in the overall resistance due to the improved wave resistance.

These performance figures have not been corrected for the larger sail area for the final configuration. If Ben can come up with another 50 to 70 ft², instead of 20 ft², this small drop in performance can be compensated for.

The most important fact to notice is that a very significant improvement in windward performance has been obtained without sacrificing running or reaching ability, something which has been impossible in 12 Metre design since the conception of "Intrepid" many years ago.

I have also enclosed a copy of a table (Table 2) containing the most important lengths, areas and volumes, etc, of the final configuration, since some of these figures differ slightly from the figures I provided when you were in Wageningen on July 27, 1981.

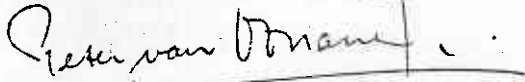
Mr. Warren L. Jones
Perth

1981-08-12
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Since all of the testing and computer calculations have now been finished, and only the writing of the final report remains, I have enclosed in triplicate our invoice, No. 10600, for Hfl. 64,050.--, leaving only Hfl. 5,000.-- to be invoiced when the final report is finalized, after I come back from holidays in September 1981.

I have just received your telex relative to initiation of registering patent on the keel. I will be happy to help in any way I can. Please confirm your instructions relative to the strength calculations and the full-scale performance evaluation (see my letter dated August 5, 1981).

Yours sincerely,
NETHERLANDS SHIP MODEL BASIN



Dr. Peter van Oossanen
Head of Design Research
Research and Development Division

Encl.: Invoice no. 10600 (3x)

PvO/tg

Table 1

Comparison of performance of final configuration (5854B-VA-IIA) with the "Australia 1980" configuration as determined from model tests.

Running and reaching

<u>"Australia 1980"</u>	<u>Final configuration</u> (M5854B, keel VA, finlets IIA)	
5.25 knots	5.36 knots	(+0.11 knot)
5.86 "	6.01 "	(+0.15 ")
6.37 "	6.54 "	(+0.17 ")
6.84 "	7.00 "	(+0.16 ")
7.31 "	7.42 "	(+0.11 ")
7.70 "	7.71 "	(+0.01 ")
7.94 "	7.94 "	(0 ")
8.14 "	8.12 "	(-0.02 ")
8.40 "	8.37 "	(-0.03 ")
8.60 "	8.55 "	(-0.05 ")
8.77 "	8.71 "	(-0.06 ")
9.06 "	9.02 "	(-0.04 ")
9.40 "	9.38 "	(-0.02 ")
9.60 "	9.60 "	(0 ")

Speed made good (beating)

<u>Masthead true wind speed</u>	<u>"Australia 1980"</u>	<u>Final configuration</u>
(knots)	(knots)	(knots)
5	3.26	3.31 (+0.05)
6	3.88	3.98 (+0.10)
7	4.46	4.59 (+0.13)
8	4.92	5.09 (+0.17)
9	5.32	5.53 (+0.21)
10	5.66	5.87 (+0.21)
11	5.96	6.15 (+0.19)
12	6.20	6.36 (+0.16)
13	6.41	6.55 (+0.13)
14	6.58	6.71 (+0.13)
15	6.72	6.85 (+0.13)
16	6.83	6.97 (+0.14)

Table 2

Particulars of "Australia 1980" and final configuration
(M5854B, keel V A, finlets II A)

	<u>"Australia 1980"</u>	<u>Final configuration</u>
- length of waterline in racing trim condition	14.173 m (46.5 ft)	14.173 m (46.5 ft)
- rated waterline length	13.720 m (45.0 ft)	13.400 * (43.96 ft)
- displacement to racing trim waterline in salt water	26.190 m ³ (59060 lbs)	24.870 m ³ (56080 lbs)
- displacement to rated waterline in salt water	24.640 m ³ (55560 lbs)	23.00 m ³ (51870 lbs)
- weight of crew and sails	3500 lbs	4210 lbs ***
- total wetted surface to racing trim waterline	60.63 m ² (652.6 ft ²)	61.12 m ² (657.9 ft ²)
- maximum draught relative to rated waterline length	2.695 m (8.842 ft)	2.644 m ** (8.675 ft)
- rated sail area	166.85 m ² (1796 ft ²)	168.79 m ² (1817 ft ²)

* This value has to be increased to 13.470 m (44.193 ft) for the actual yacht, to be compatible with the displacement of 23.0 m³.

** Can be increased to 2.655 m (8.711 ft).

*** Yet to be checked.

Table 3

Volume and centre of buoyancy location of canoe body, keel, finlets and rudder for racing trim draught -----

<u>description</u>	<u>volume</u>	<u>longitudinal centre of buoyancy</u>
canoe body	23.485 m ³	0.458 m behind station 5
keel	1.1159 m ³	0.4486 m " "
2 finlets	0.2324 m ³	1.5747 m " "
1 rudder	0.0360 m ³	6.728 m " "
total configuration	24.869 m ³	0.4772 m " "

note: volume of keel is calculated as an appendage (not to a horizontal waterline, but to the V-form of the canoe-body). If all of the keel and finlets were to be filled with lead with a density of 11300 kg/m³, the weight of the keel configuration would be:

$$(1.1159 + 0.2324) \times 11300 = 15236 \text{ kg} \quad (33519 \text{ lbs})$$

Since about 18000 kg (about 40000 lbs) is required (leaving only about 12000 lbs for the weight of hull, mast, etc.) it will probably be necessary to extend the lead line to approximately the 5.0 ft waterline or slightly above. Also note that for the centre of gravity of the keel plus finlets to be in the same vertical line as the longitudinal centre of buoyancy of the canoe body (plus rudder) the keel configuration must move forward about 17.5 cm. This value is only valid off-course if the 2700 kg of extra required lead is positioned such that its centre of gravity correspondence with the longitudinal centre of buoyancy of the canoe body (plus rudder) situated at 0.468 m behind station 5.