Flume Tank Testing of Six Otterboard Models

EEC Funded Otterboard Project TE 1-214 (Phase 3)

Consultancy Report No. 27

March 1991

SEA FISH INDUSTRY AUTHORITY
Seafish Technology

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J N Ward

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SUMMARY

This report describes the Flume Tank trials carried out by Seafish on six otterboard models for Phase 3 of EEC funded otterboard project TE 1-214. The project comprises 5 Phases, of which Phase 3 includes the final set of model tests.

Five of the otterboards were selected for Seafish to test from a list of fifteen chosen jointly by the three contractors. The five otterboards chosen for Seafish were:-

(i) Hinriksson Poly-ice
(ii) Nettec cambered vee
(iii) Bison 3 slot
(iv) Euronete "Portuguese type"
(v) Blooe Tech vee

Seafish also briefly tested a model of the Munkebo vee otterboard which had already been fully tested by DIFTA. The purpose of this extra test was to confirm the high values of CL found and also to check the consistency of results obtained by the different Flume Tanks.

The model tests were carried out using the same procedure as was used for the three models tested for Phase 1, apart from a three chain system being adopted for attaching the warp to all otterboard models.

No specific problems were encountered during the tests and all results are given in the standard form of CL and CL/CD, based on projected area, over a range of angles of attack and heel.

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FLUME TANK TESTING OF SIX OTTERBOARD MODELS EEC FUNDED OTTERBOARD PROJECT TE 1-214 (PHASE 3)

1 INTRODUCTION

Following the testing of the reference vee type otterboard by Seafish (Otterboard No. S.1), a further three otterboard models were tested to complete Phase 1 of the project. These three models were:-

(i) Standard flat otterboard (Otterboard No. S.2)
(ii) Bison 1 slot design (Otterboard No. S.3)
(iii) Hydrofin design (Otterboard No. S.4)

Seafish model tests for Phase 1 of the project are described in Refs. 1 and 2.

To complete the model testing programme for the project, a further five otterboard types were selected for Seafish to test, out of a list of fifteen chosen by the three contractors. The models for Seafish to test were:-

(i) Hinriksson Poly-Ice design (Otterboard No. S.5)
(ii) Nettec cambered vee design (Otterboard No. S.6)
(iii) Bison 3 slot design (Otterboard No. S.8)
(iv) Euronete "Portuguese type" design (Otterboard No. 9)
(v) Blooe Tech vee design (Otterboard No. S.10)

It had been agreed that from time to time otterboard models should be exchanged between contractors to confirm unusual results. In view of the unexpectedly high CL values obtained by DIFTA for the Munkebo vee type otterboard, a request was made to Seafish to carry out additional tests on the Munkebo model (Seafish Otterboard No. S.7).

During the testing of the Bison 1 slot otterboard (Ref. 2) two chains were used to adjust the height of the warp attachment point. This height had to be adjusted to obtain the correct otterboard heel whilst at the same time maintaining the warp at the agreed vertical angle of 6^{o}.

It was decided for the next five otterboard tests, that a three chain system for the warp attachment point would be used, as shown in Fig 1.

Apart from the Nettec cambered vee otterboard, all models tested in Phase 3 of the project have straight shoes, so the face of the shoe was taken as the reference line for the angle of attack. For the Nettec model the reference line was taken as a line joining the two eyes for the warp chain attachment (i.e. parallel to a line joining the nose to the tail of the otterboard).

Angles of heel for all vee otterboards were chosen firstly as 0^{o}, defined as when the top half of the board was vertical and secondly heeling outwards until the top edge of the board was vertically above the shoe. All other otterboard models were tested at 0^{o} heel, or upright, and also heeling in at -10^{o}.

Otterboard models were chosen at scales ranging from 1:2.5 to 1:3.0. This gives models representing the size of otterboard used in the full scale sea trials with a 300 h.p. net.

The performance results for each model tested are given in the standard forms of CL, CL/CD and CP which are defined in Section 4 together with other formulae and definitions. In practice, a higher value of CL means that a smaller otterboard is required to supply a given spreading force. A higher value of CL/CD means that less drag is produced by the otterboard for a given spreading force.

All results given in this report refer to models tested in a Flume Tank. They should not be interpreted as meaning the same results would be produced in full scale tests at sea. Correlation of these model results to those obtained in full scale tests at sea will be conducted for some of the models described here.

2 METHOD OF TESTING

No changes were made to the basic testing technique, which is described in Refs. 1 and 2, apart from a standardisation of the method of attaching the warp to the otterboard.

For each otterboard model tested in Phase 1 of the project a special arrangement was made to adjust the warp attachment point. This was necessary in order to achieve the full range of angles of atack (25^{o}-45^{o}) whilst maintaining the desired angle of heel and the vertical angle of the warp (6^{o}). The relative lengths of the two backstrops were adjusted where warp adjustments only were found to give inadequate control of the required angles.

For the otterboard tests described in this report all models (except the Munkebo vee) were tested with a three chain warp attachment rig as shown in Fig 1. By adjusting the length of one, two or three chains the otterboard model can be set to the required angles of attack, heel and warp vertical angle. Using this rig the backstrop lengths can be left equal and so there is less effect from them on the pitch attitude of the model.

3 FLUME TANK TESTS AND RESULTS

3.1 Hinriksson Poly-Ice Otterboard

This model was supplied by the manufacturer and is shown in Fig 2. Throughout the tests the model had a positive (nose up) pitch of about $2\text{-}3^{\circ}$.

The model was tested at 0° heel (upright) and at -10° heel (inward). The results are given in Appendix I and Figs 3 and 4. The maximum value of CL is about 1.18 at 33° angle of attack for both 0° and -10° heel. However, CL/CD values at -10° heel rise to 2.00 at 25° angle of attack but only 1.78 at 0° heel.

3.2 Nettec Cambered Vee Otterboard

This model was made by Seafish, scaled from a full-scale otterboard and is shown in Fig 5.

The model was tested at 0° heel (top plate upright) and $+15^{\circ}$ heel (top plate heeling out 15°). The results are given in Appendix II and Figs 6 and 7.

The maximum value of CL is 1.50 at 35° angle of attack for both 0° and $+15^{\circ}$ heel. CL/CD values are approximately the same for both heel angles rising to about 1.63 at 25° angle of attack.

3.3 Munkebo Vee Otterboard

Only three angles of attack were tested for this otterboard model as it had already been fully tested by DIFTA. The model was supplied by the manufacturer to DIFTA and is shown in Fig 8.

The data obtained for these three angles of attack is given in Appendix III and plotted with the DIFTA data and curves in Fig 9.

It can be seen that the Seafish data points fall within the data points obtained by DIFTA. This confirms that the maximum CL value is approximately 1.27 at 33°.

3.4 Bison 3 Slot Otterboard

Bison otterboards are supplied with a range of weights which fit into the lower face just above the shoe. At sea these weights are adjusted to obtain the correct ground contact.

The model was supplied by the manufacturer and is shown in Fig 10. All the weights supplied with the otterboard were added as this made the weight compatible with other models tested.

The model was tested at 0° heel and -10° heel (inward) as these otterboards are intended to be used heeling in slightly. The results are given in Appendix IV and Figs 11 and 12.

At 0° heel the maximum value of CL is 1.30 at 43° angle of attack. At -10° heel the line of CL is similar but gives a maximum above 45° angle of attack.

CL/CD values at -10° heel rise to 2.03 at 25° angle of attack but only 1.83 at 0° heel.

3.5 Euronete "Portuguese Type" Otterboard

This model was supplied by the manufacturer and is shown in Fig 13. The warp is normally attached to two triangles as is usual on flat wooden otterboards. However, as in the other model tests, the three chain system of warp attachment was used as shown in Fig 1. The towing triangles were left in their normal positions during the model tests so their hydrodynamic effect was taken into account. The model was tested at 0° heel (upright) and -10° heel (inward). The results are given in Appendix V and Figs 14 and 15.

The maximum value of CL is about 1.02 at 31°-32° angle of attack for both 0° and -10° heel. CL/CD values are also very similar for both angles of heel rising to 1.72 at 25° angle of attack.

3.6 Blooe Tech Vee Otterboard

This otterboard type is unusual in that it is a standard vee shape, but is constructed of plastic panels in a steel framework rather than sheet steel. The model was made by Seafish from plans supplied by the manufacturer and is shown in Fig 16.

The model was tested at 0^{o} heel (top plate upright) and $+10^{o}$ heel (top plate heeling out at 10^{o}). The results are given in Appendix VI and Figs 17 and 18.

The maximum value of CL is 1.00 at 28^{o}-29^{o} angle of attack for both 0^{o} and $+10^{o}$ heel. CL/CD values are also very similar for both angle of heel rising to 1.80 at 25^{o} angle of attack.

4 DEFINITIONS

		Units
C_L	Spreading force (lift) coefficient	
C_D	Drag coefficient	
Cp	Longitudinal centre of force acting on otterboard	
L	Spreading force	kg
D	Drag force	kg
p	Density of water (102)	$kg.sec^2/m^4$
l	Otterboard length	m
h	Otterboard height	m
Sp	Otterboard Projected Area	m^2
S	Otterboard area (l x h)	m^2
AR	Otterboard aspect ratio h/l	
V	Water speed	m/sec
C_L	= $L/(\frac{1}{2}\ p\ V^2\ Sp)$	
C_D	= $D/(\frac{1}{2}\ p\ V^2\ Sp)$	
Cp	= Longitudinal centre of force/l	
C_L/C_D	= Otterboard efficiency	
W	Warp load	kg
B	Bridle load	kg
a	Warp angle (projected onto horizontal plane)	degrees
b	Bridle angle (projected onto horizontal plane)	degrees
d	Warp declination (in plane of warp)	degrees

5 SPREADSHEET CALCULATION FORMULAE FOR CL AND CD

Area (p)	Projected Area of Otterboard =	Sp
A of A	Angle of attack	
W. Load	Warp load =	W
B. Load	Bridle load =	B
W. Angle	Warp angle =	a
B. Angle	Bridle angle =	b
Decl.n	Warp delination =	d
W. Lift	Warp lift =	W x cos d x sin a
W. Drag	Warp drag =	W x cos d x cos a
B. Lift	Bridle lift =	B sin b
B. Drag	Bridle drag =	B cos b
S. Lift	Sum of lifts =	W x cos d x sin a + B sin b
S. Drag	Sum of drags =	W x cos d x cos a - B cos b
CL	S. Lift/(0.5 x (1000/9.81) x Sp x V^2)	
CD	S. Drag/(0.5 x (1000/9.81) x Sp x V^2)	

6 CONCLUSIONS

1. The three chain adjustment for the warp attachment point works well with all models.

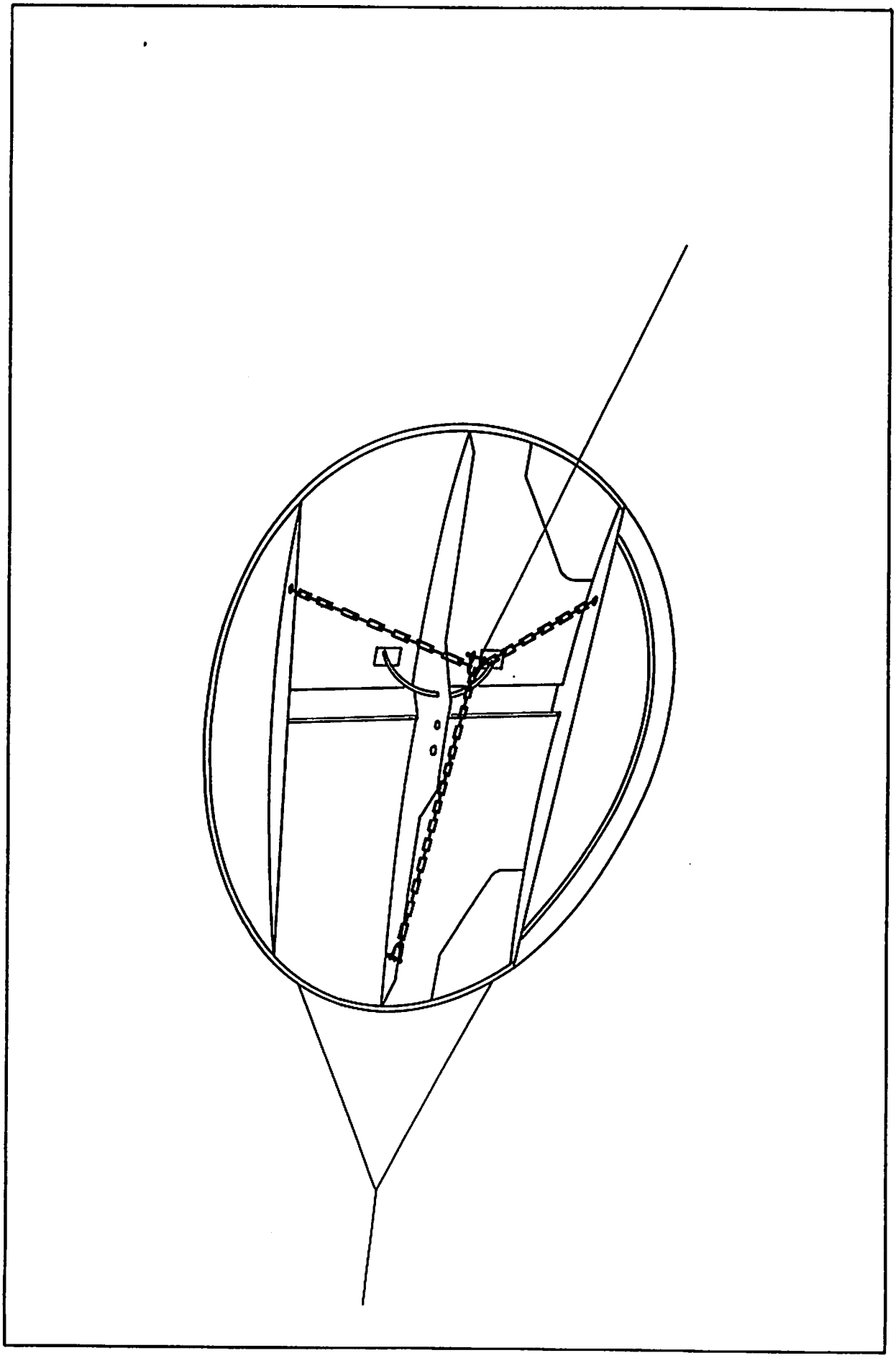
2. Tests on the Munkebo vee otterboard showed good consistency between the results of Seafish and DIFTA.

7 REFERENCES

1. WARD J.N., 1989. Flume Tank Testing of a Vee Type Otterboard (Harmonisation Trials) - EEC Funded Otterboard Project TE 1-214. Seafish Consultancy Report No. 14.

2. WARD J.N., 1990. Flume Tank Testing of Three Otterboard Models - EEC Funded Otterbord Project TE 1-214 (Phase 1). Seafish Consultancy Report No. 17.

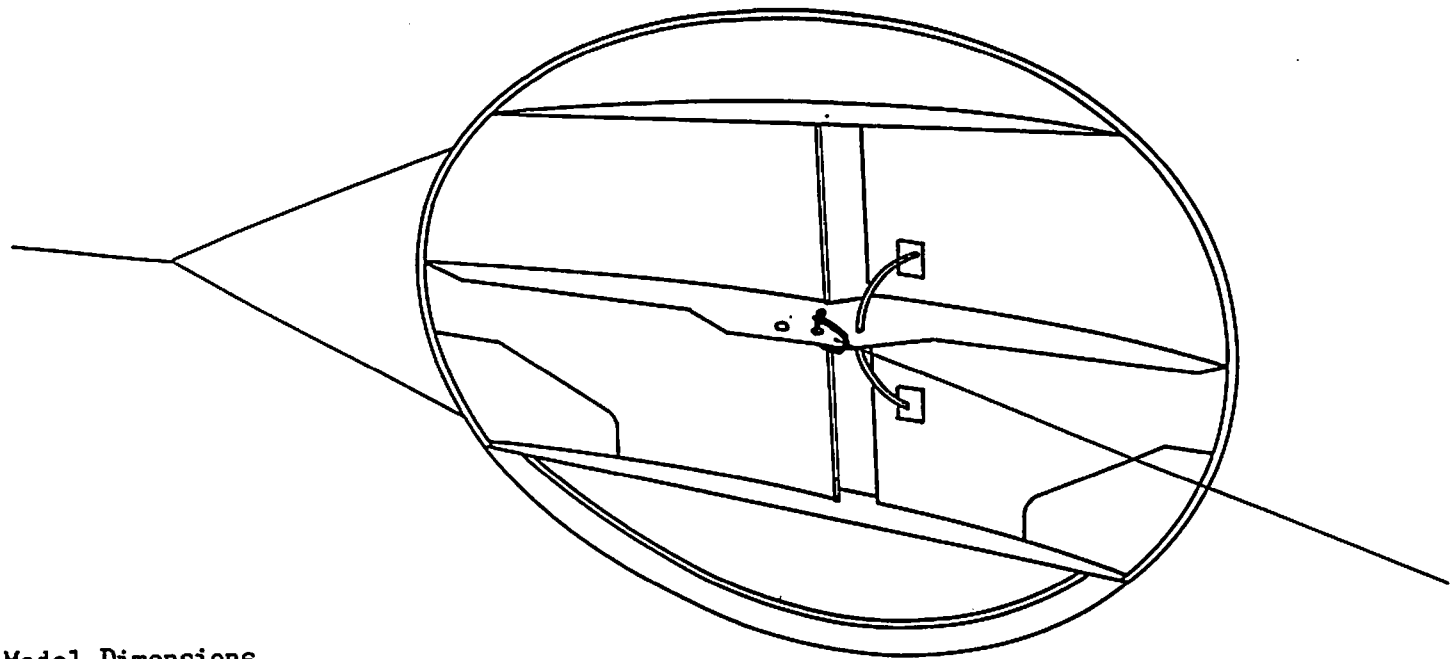
FIGURES



3 CHAIN WARP ATTACHMENT SYSTEM

Fig 1

Fig 2



Model Dimensions

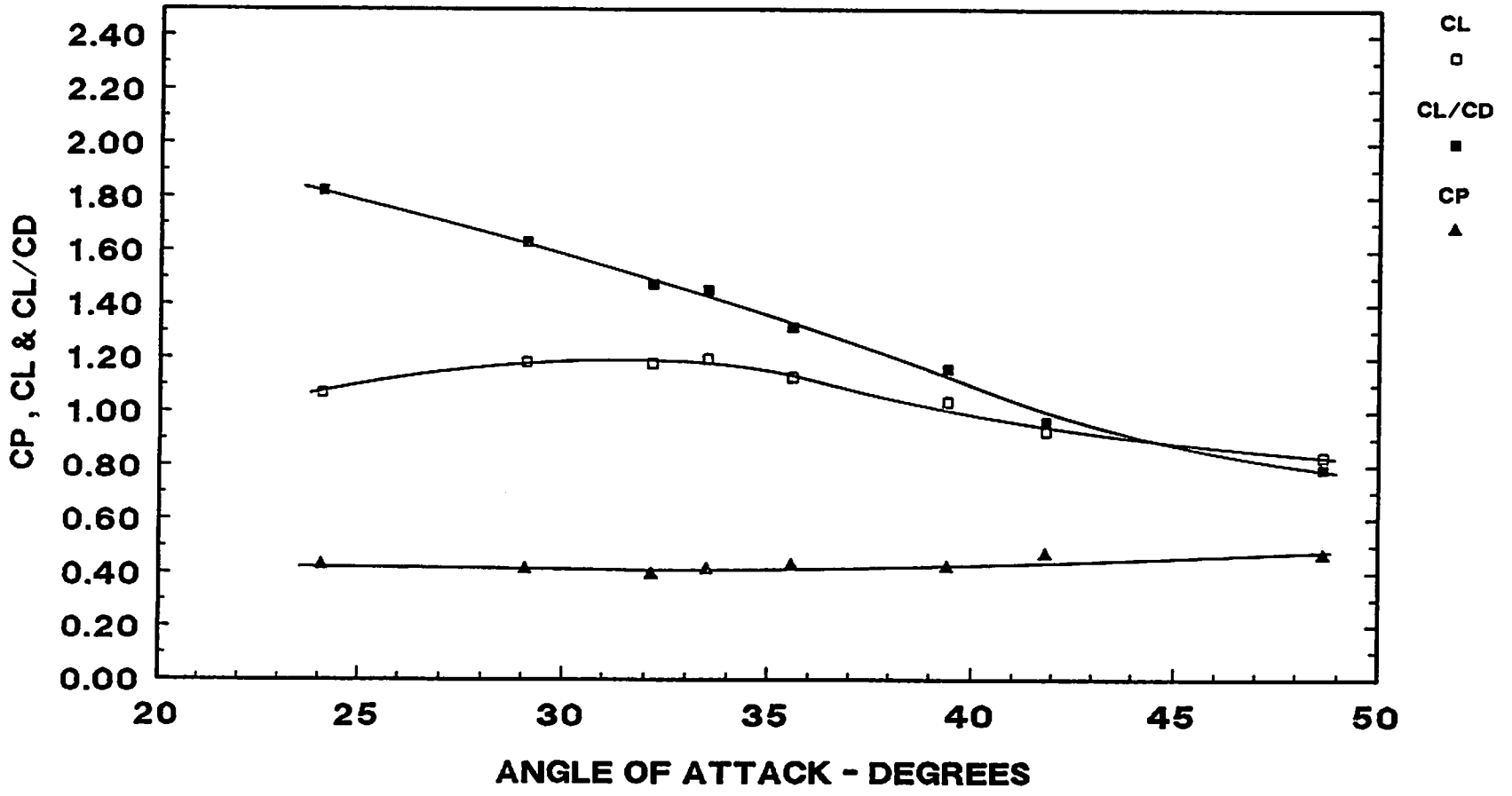
Length	0.748m
Height	0.510m
Projected Area	0.304m
Weight	12.8kgs

HINRIKSSON POLY-ICE OTTERBOARD

HINRIKSSON POLY-ICE OTTERBOARD

AT 0° (UPRIGHT) HEEL

OTTERBOARD NO. S.5



CL AND CD BASED ON PROJECTED AREA

TEST NO. S.5.1

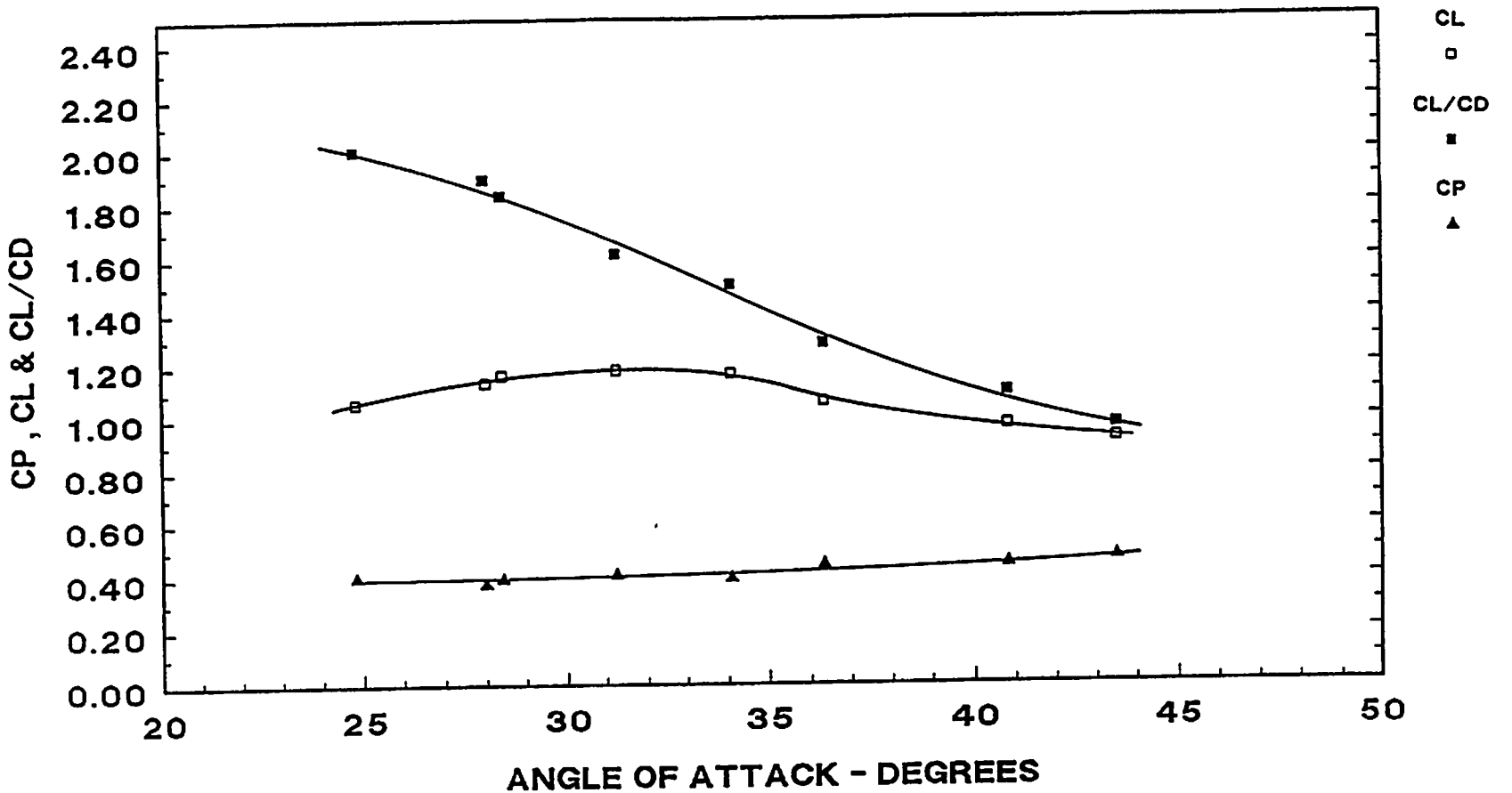
Fig 3

Fig 4

HINRIKSSON POLY-ICE OTTERBOARD

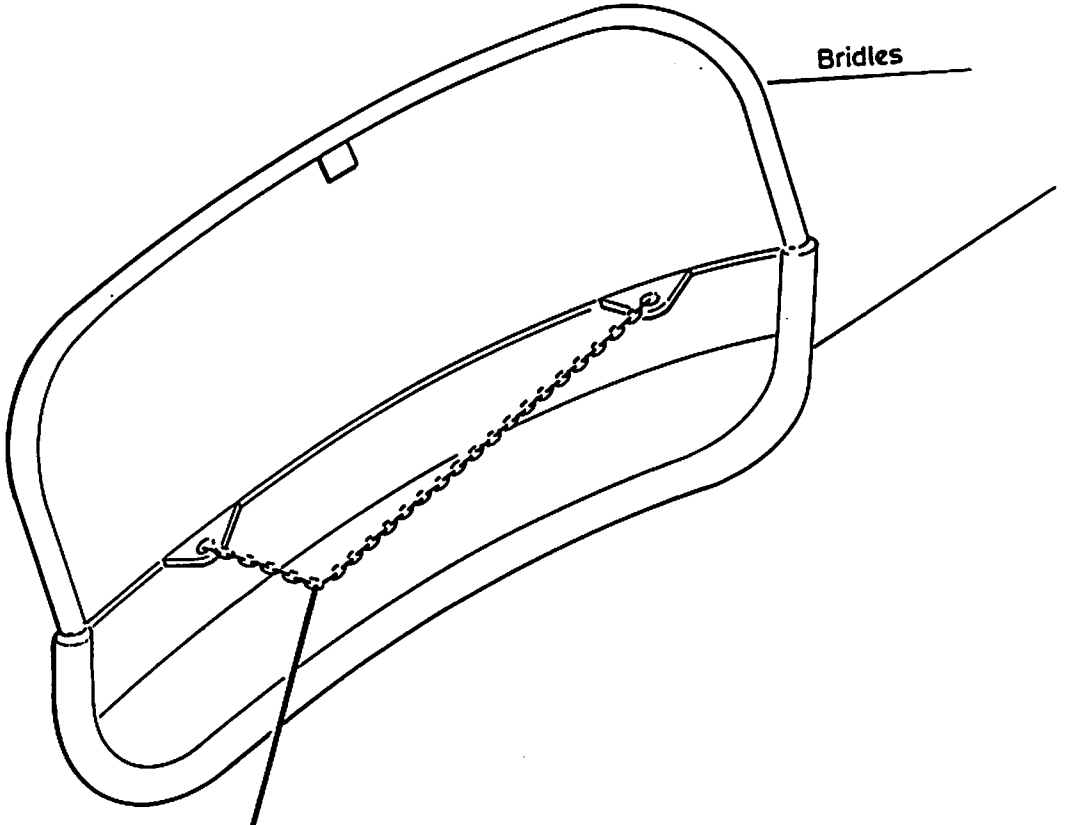
AT -10° (INWARD) HEEL

OTTERBOARD NO. S.5



CL AND CD BASED ON PROJECTED AREA

TEST NO. S.5.2



Model Dimensions

Length	0.686m
Height	0.427m
Projected Area	0.288m^2
Weight	22.0kgs

NETTEC CAMBERED VEE OTTERBOARD

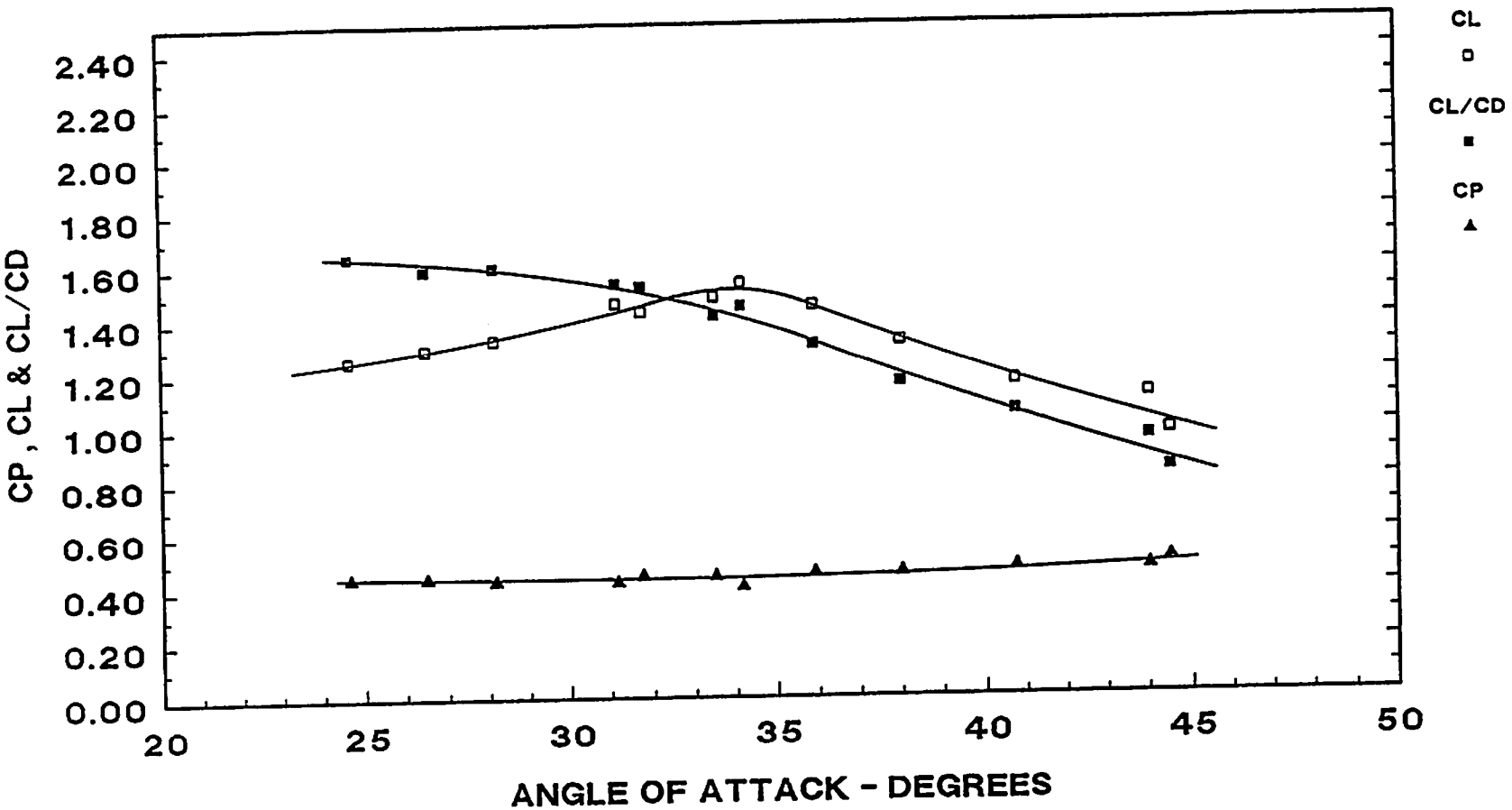
Fig 5

Fig 6

NETTEC CAMBERED VEE OTTERBOARD

AT 0° (UPRIGHT) HEEL

OTTERBOARD NO. S.6



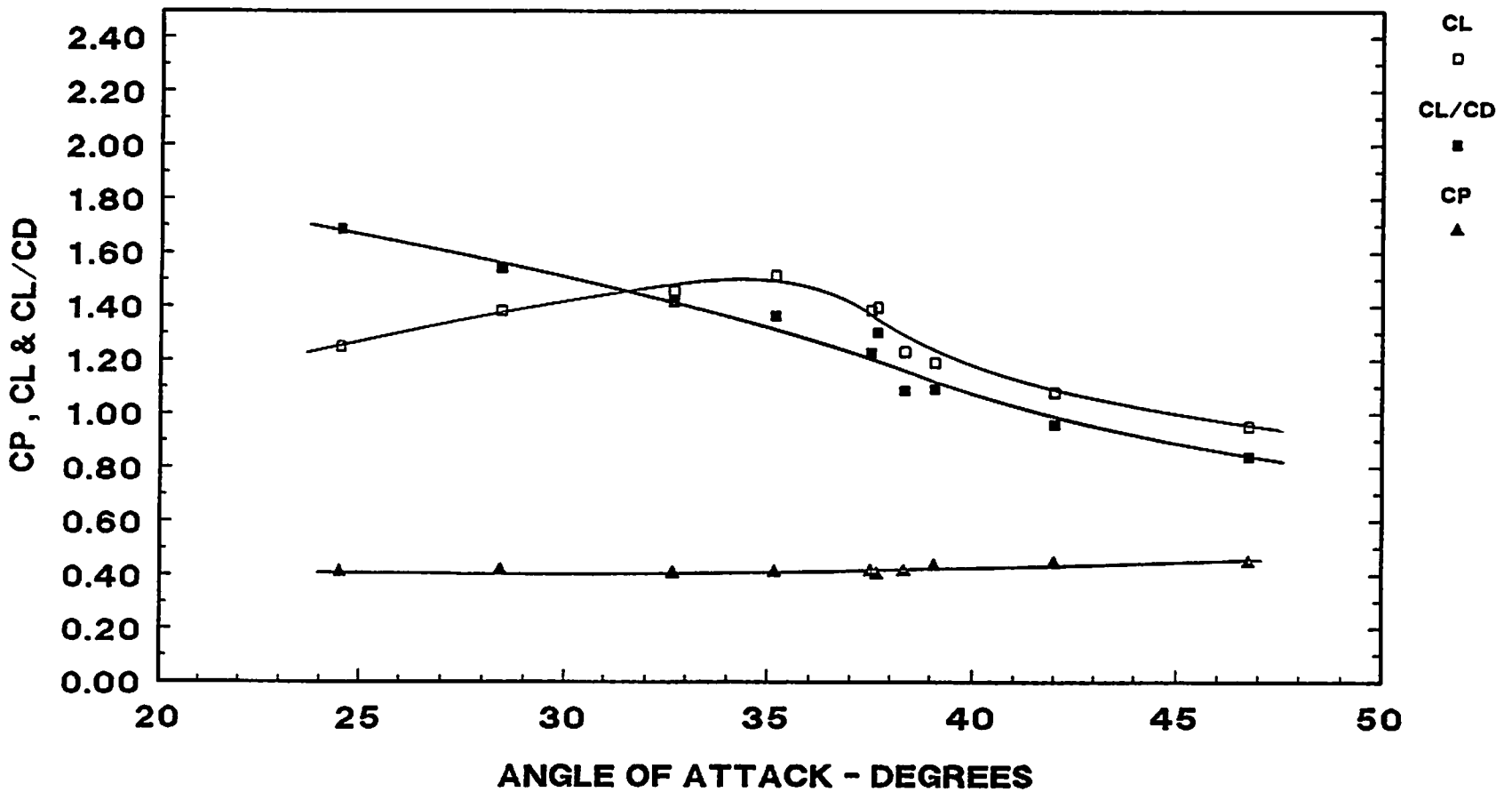
CL AND CD BASED ON PROJECTED AREA

TEST NO. S.6.1

NETTEC CAMBERED VEE OTTERBOARD

AT +15° (OUTWARD) HEEL

OTTERBOARD NO. S.6

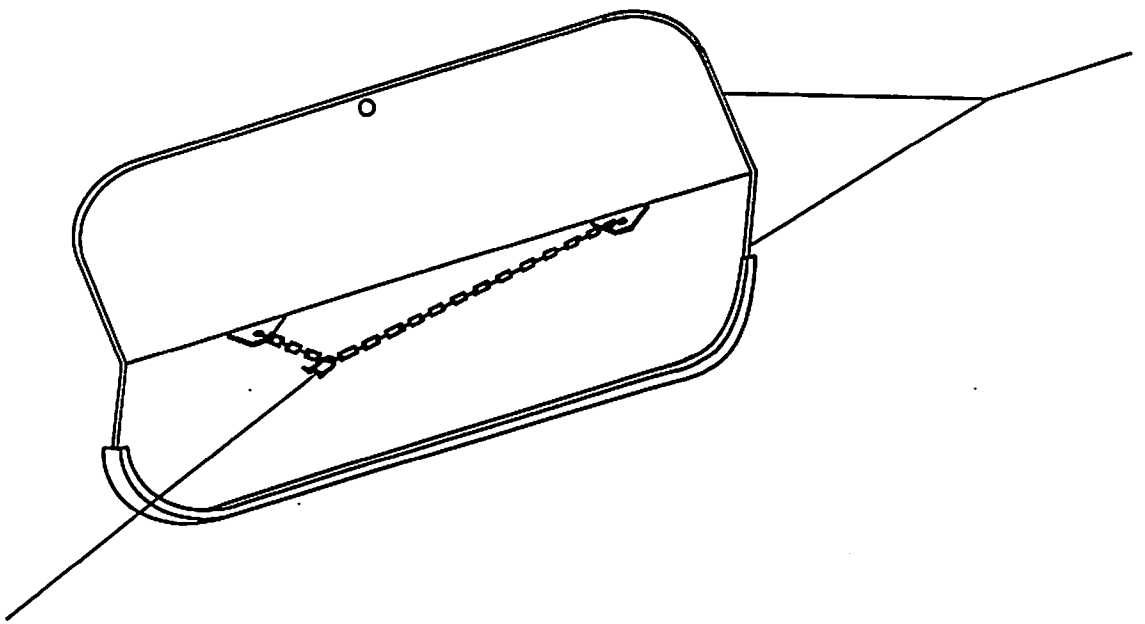


CL AND CD BASED ON PROJECTED AREA

TEST NO. S.6.2

Fig 7

Fig 8



Model Dimensions

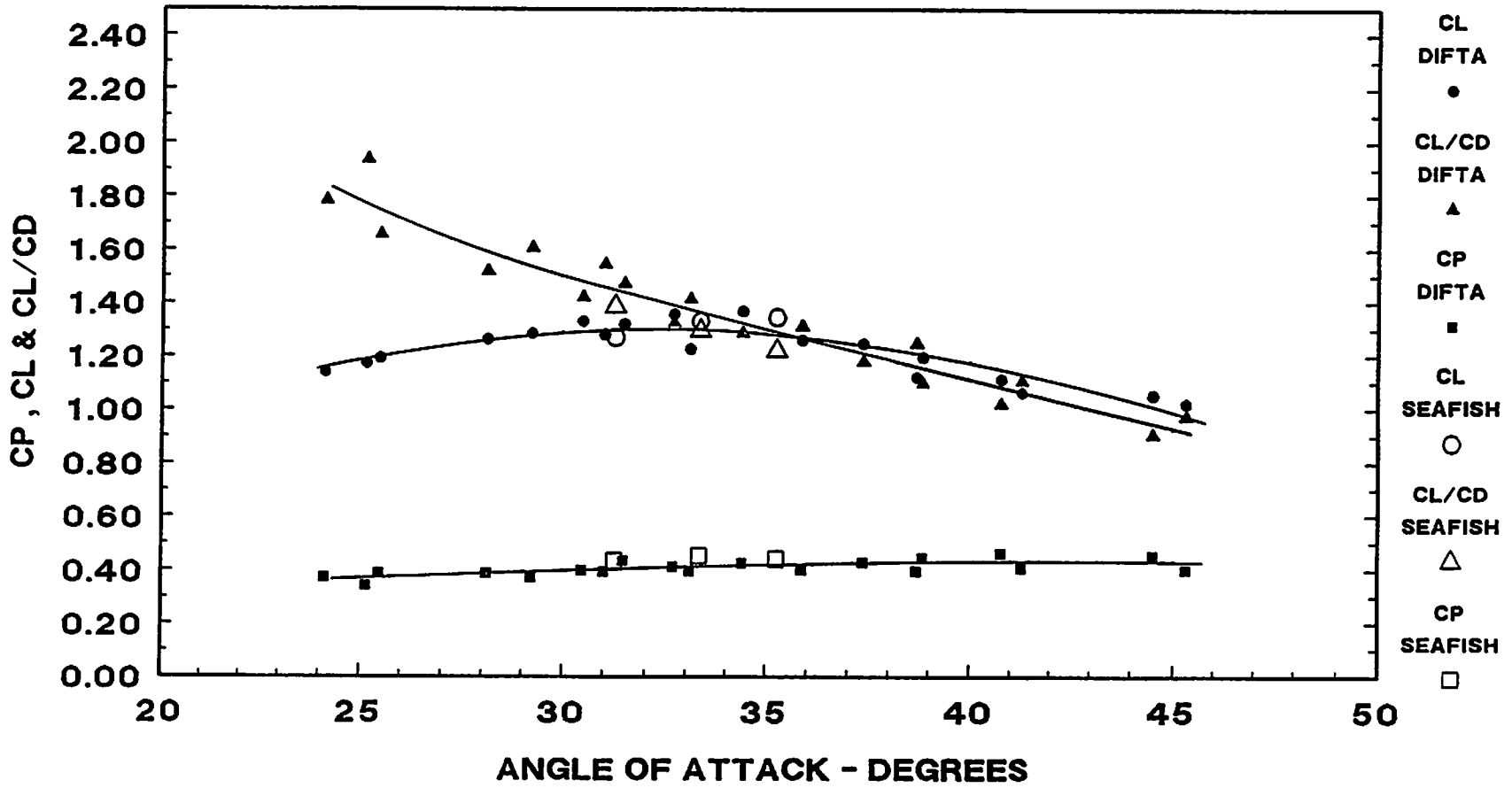
Length	0.816m
Height	0.420m
Projected Area	0.315m^2
Weight	10.7kgs

MUNKEBO VEE OTTERBOARD

MUNKEBO VEE OTTERBOARD

AT +15° (OUTWARD) HEEL

OTTERBOARD NO. S.7

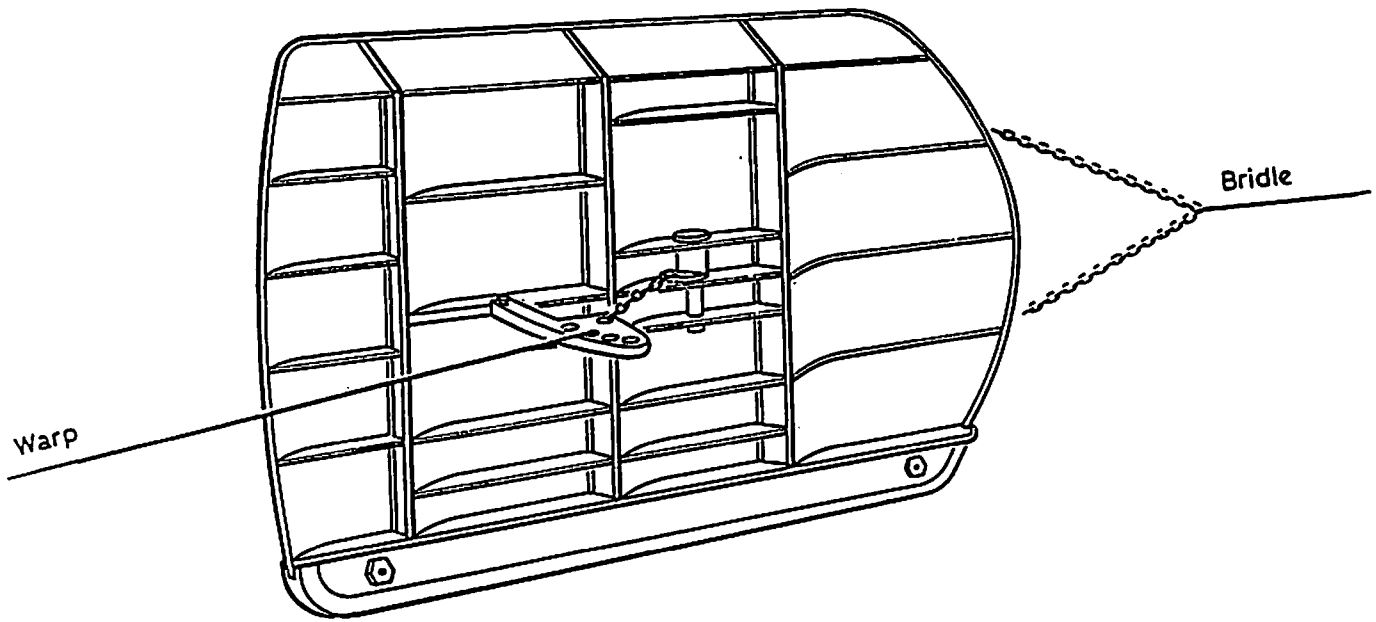


CL AND CD BASED ON PROJECTED AREA

TEST NO. S.7.1

Fig 9

Fig 10



Model Dimensions

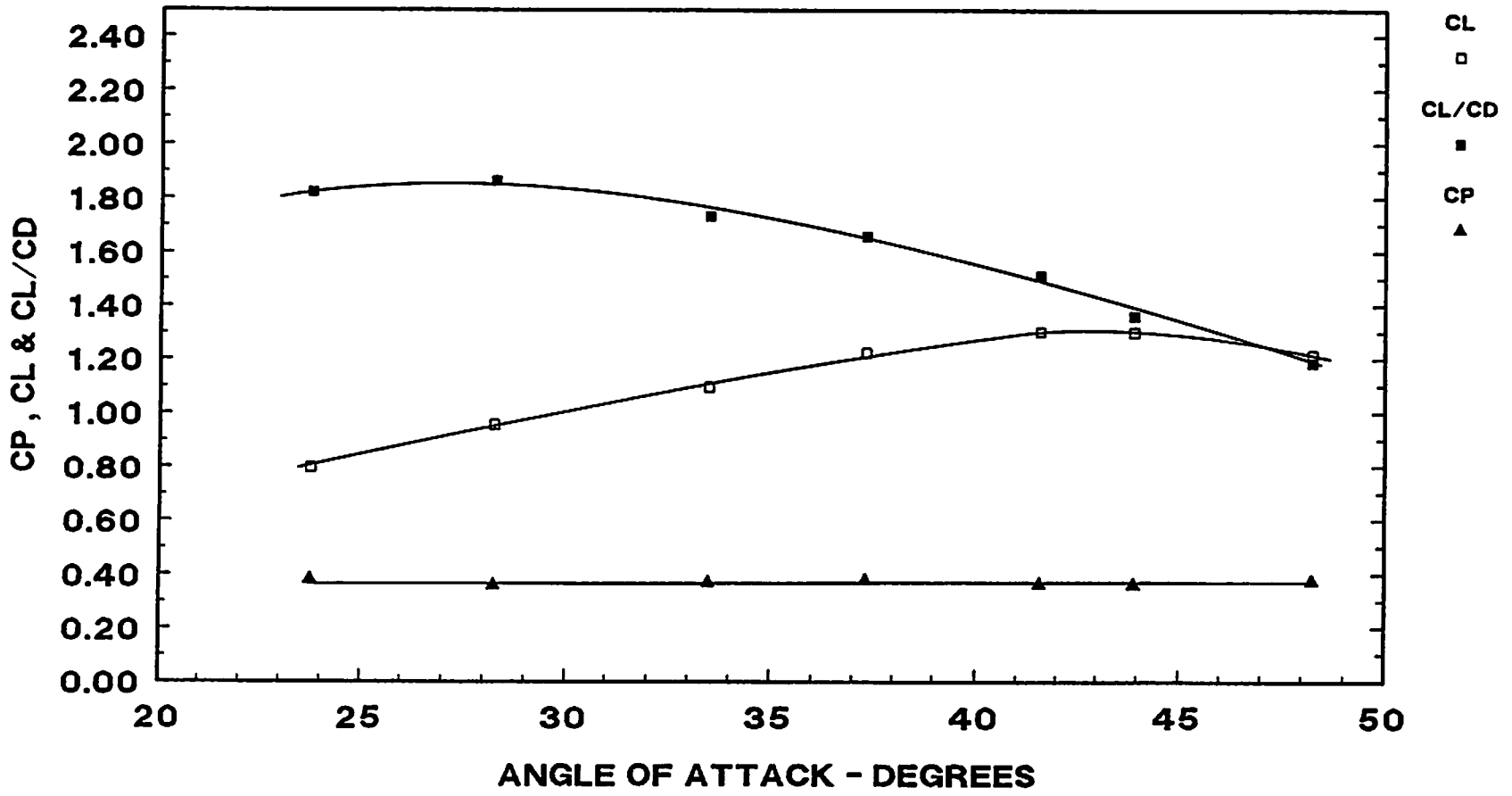
Length	0.673m
Height	0.423m
Projected Area	0.263m^2
Weight	11.4kgs

BISON 3 SLOT OTTERBOARD

BISON 3 SLOT OTTERBOARD

AT 0° (UPRIGHT) HEEL

OTTERBOARD NO. S.8



CL AND CD BASED ON PROJECTED AREA

TEST NO. S.8.1

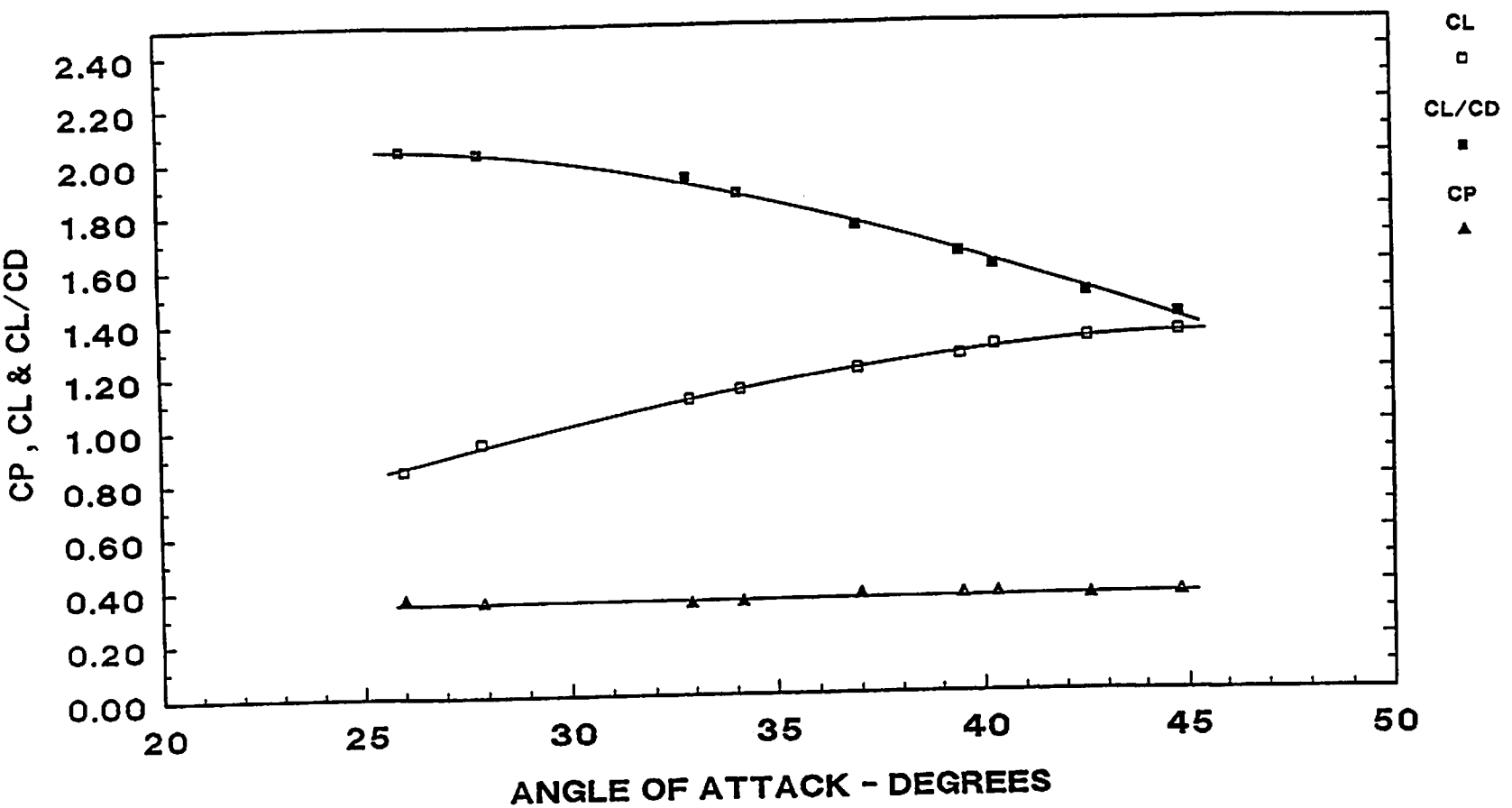
Fig 11

Fig 12

BISON 3 SLOT OTTERBOARD

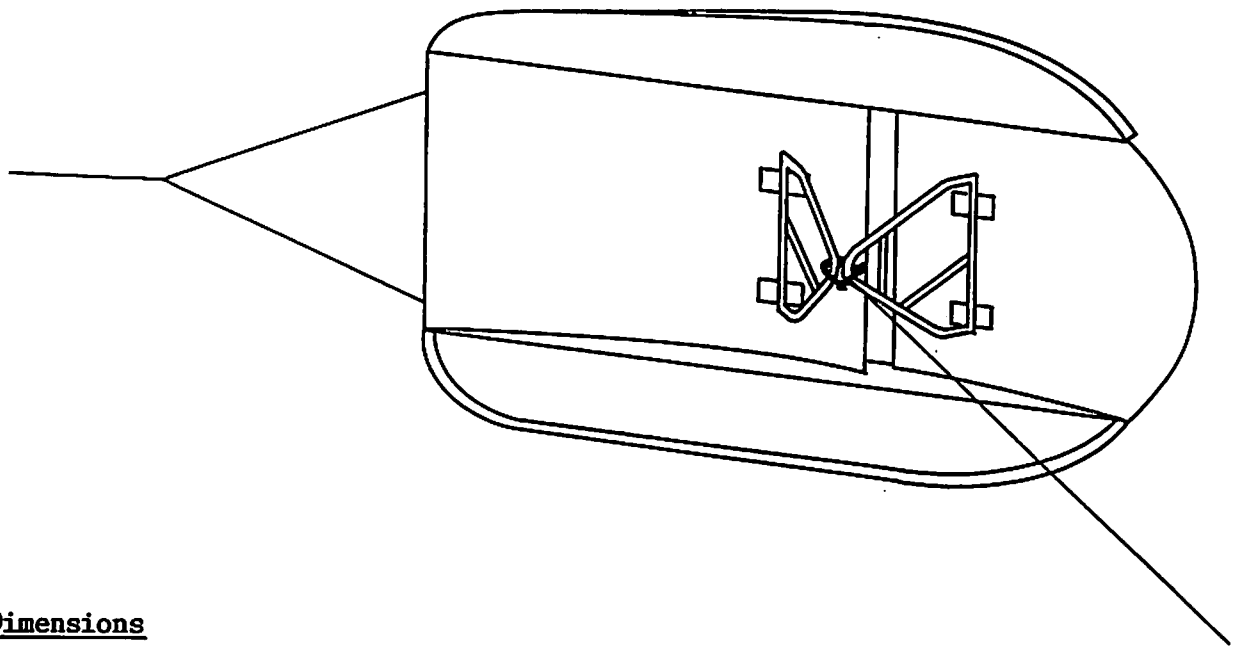
AT -10° (INWARD) HEEL

OTTERBOARD NO. S.8



CL AND CD BASED ON PROJECTED AREA

TEST NO. S.8.2



Model Dimensions

Length	0.750m
Height	0.417m
Projected Area	0.275m^2
Weight	11.4kgs

EURONETE "PORTUGUESE TYPE" OTTERBOARD

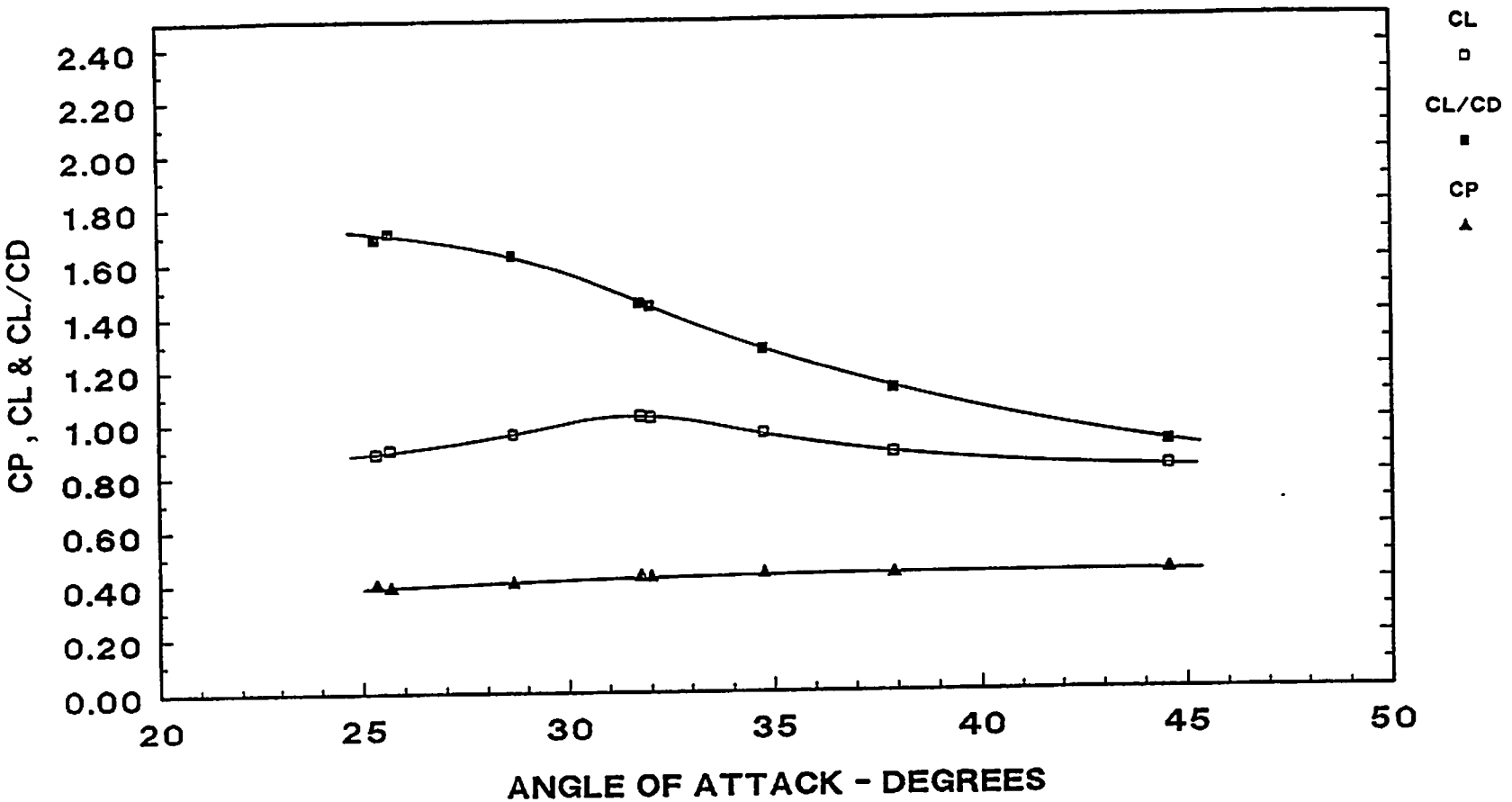
Fig 13

Fig 14

EURONETE "PORTUGUESE TYPE" OTTERBOARD

AT 0° (UPRIGHT) HEEL

OTTERBOARD NO. S.9



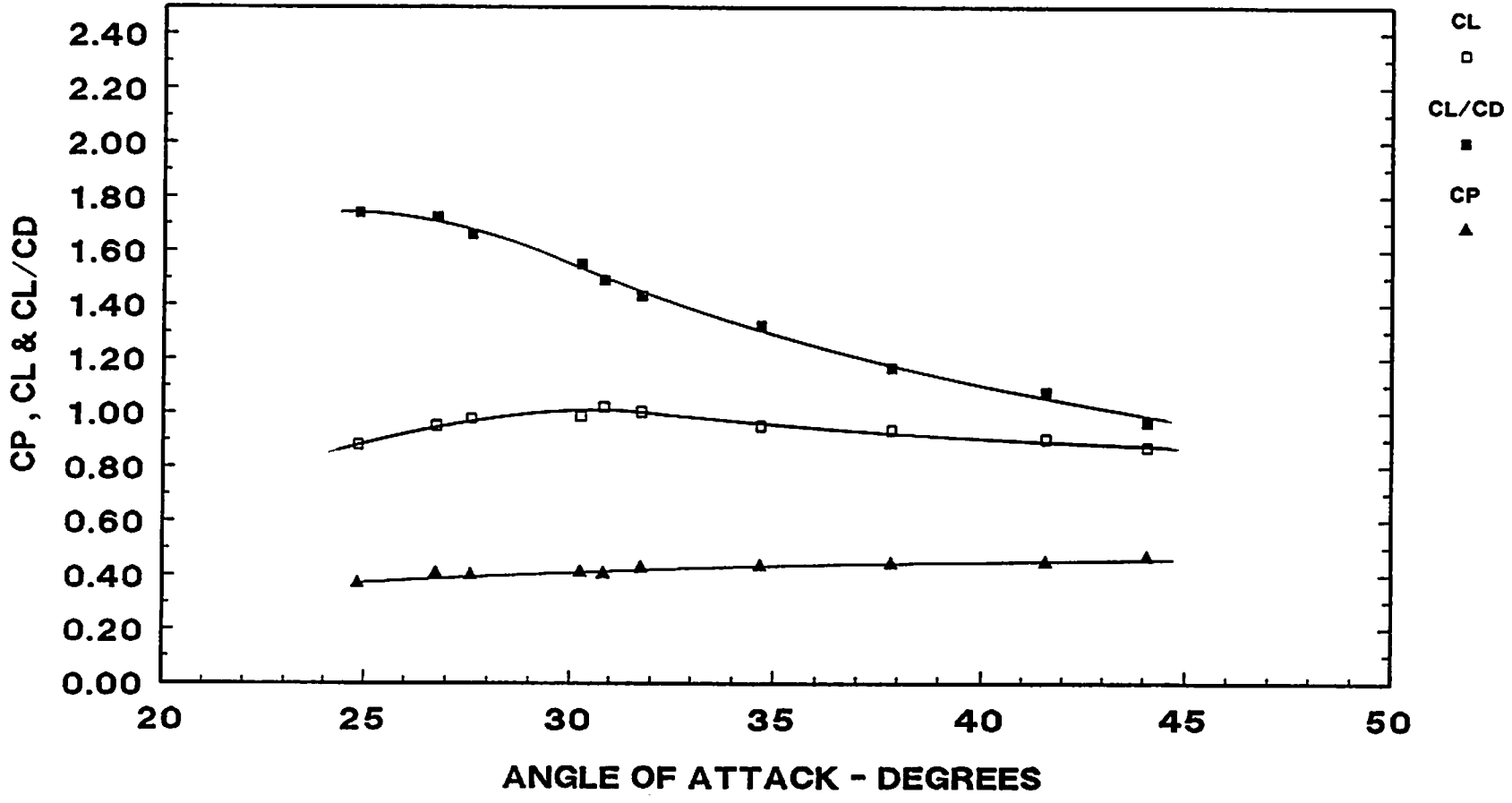
CL AND CD BASED ON PROJECTED AREA

TEST NO. S.9.1

EURONETE "PORTUGUESE TYPE" OTTERBOARD

AT -10° (INWARD) HEEL

OTTERBOARD NO. S.9



CL AND CD BASED ON PROJECTED AREA

TEST NO. S.9.2

Fig 15

Model Dimensions

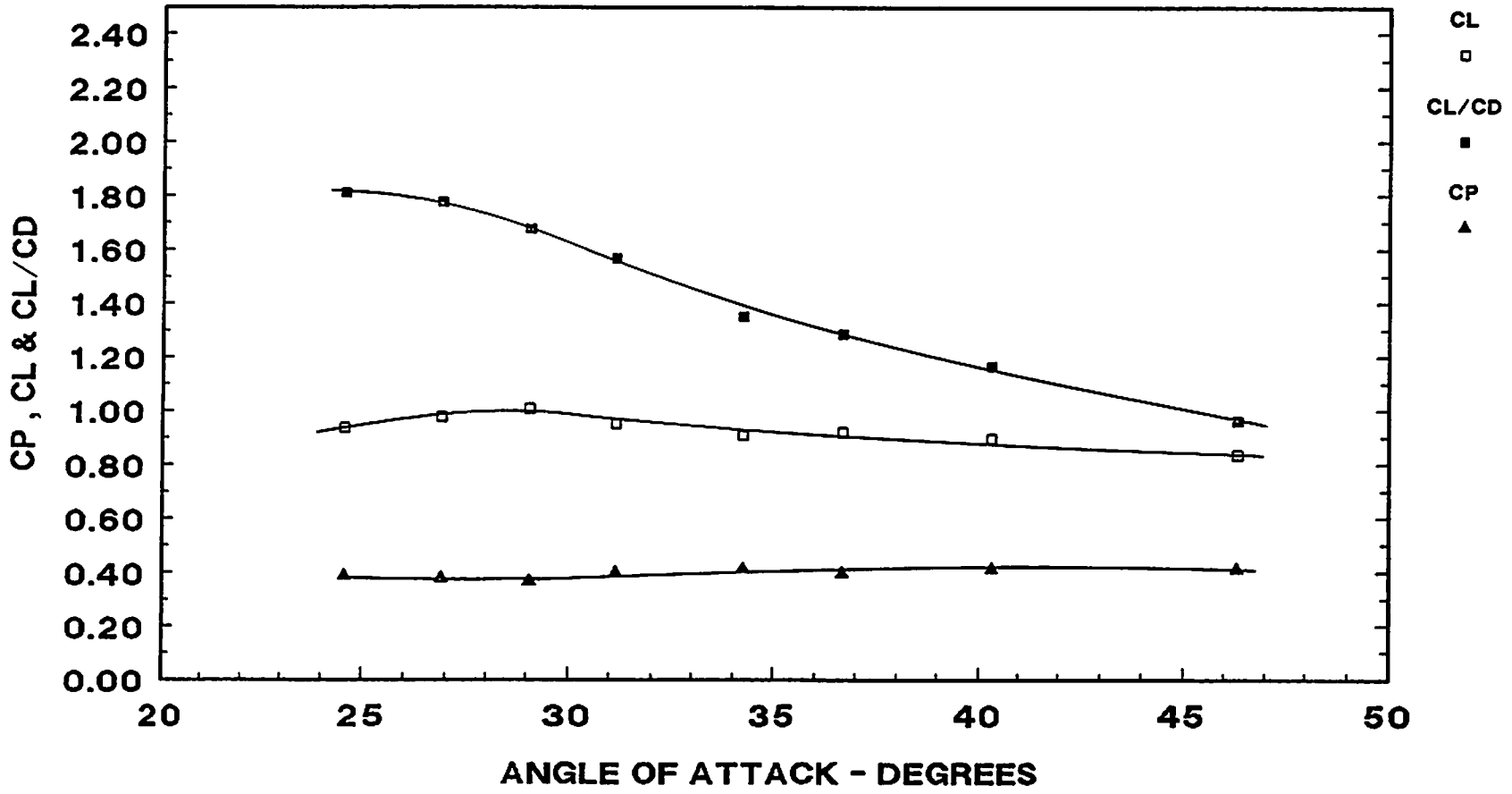
Length	0.730m
Height	0.469m
Projected Area	0.340m^2
Weight	11.8kgs

BLOOETECH VEE OTTERBOARD

BLOOE TECH VEE OTTERBOARD

AT 0° (UPRIGHT) HEEL

OTTERBOARD NO. S.10



CL AND CD BASED ON PROJECTED AREA

TEST NO. S.10.1

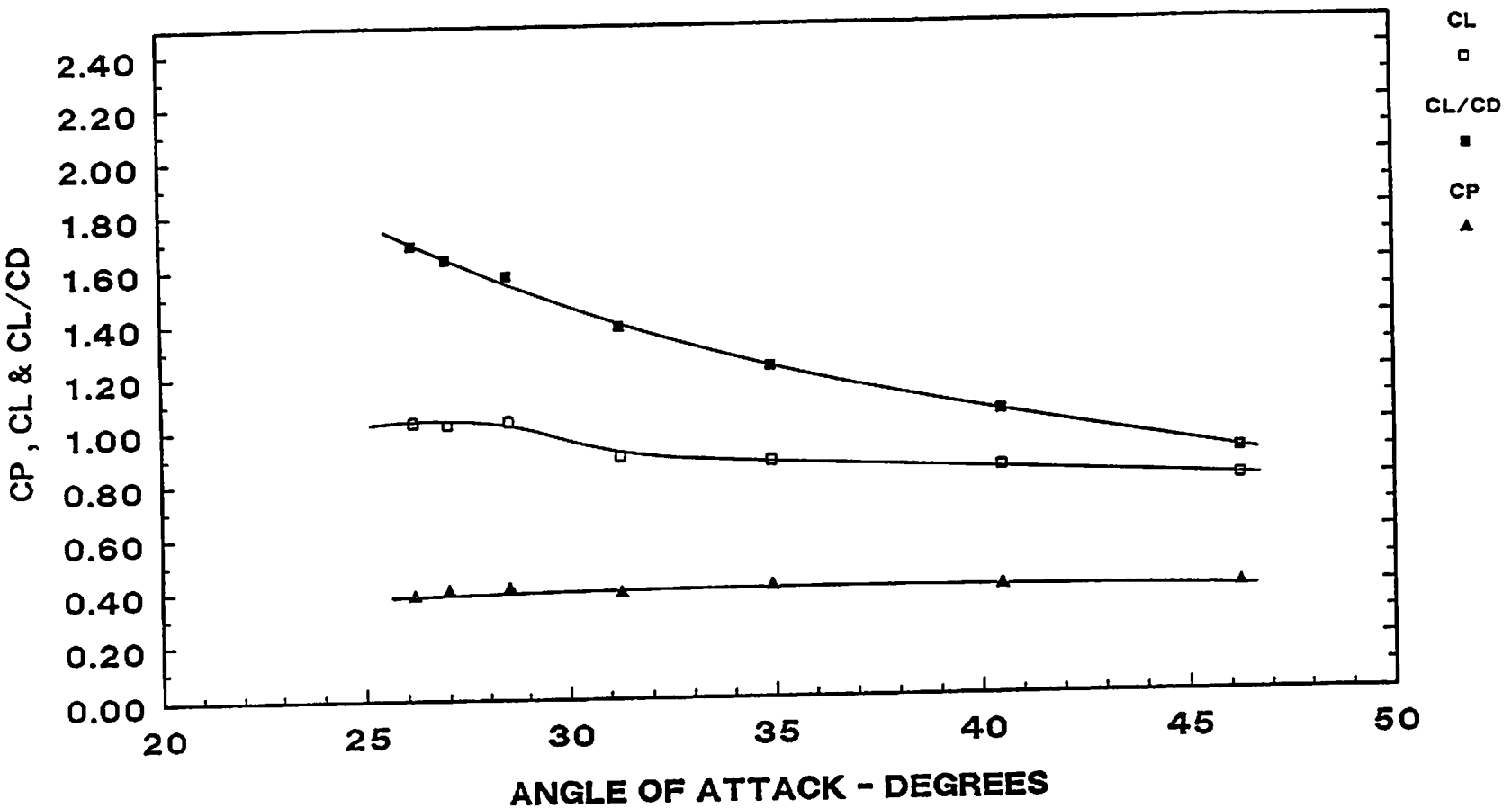
Fig 17

Fig 18

BLOOE TECH VEE OTTERBOARD

AT +10° (OUTWARD) HEEL

OTTERBOARD NO. S.10



CL AND CD BASED ON PROJECTED AREA

TEST NO. S.10.2

APPENDICES

APPENDIX I

RESULTS FOR HINRIKSSON POLY-ICE OTTERBOARD

HINRIKSSON POLY-ICE OTTERBOARD AT 0° HEEL

OTTERBOARD NO. S.5
TEST NO. S.5.1

LENGTH	-M	0.748	
HEIGHT	-M	0.510	
AREA (P)	-M²	0.304	(PROJECTED)
ASPECT RATIO		0.682	
WEIGHT	-Kgs	12.800	

Area M²	Speed M/Sec	Heel deg	A of A deg	W.Load Kgs	B.Load Kgs	W.Angle deg	B.Angle deg	Decl.n deg
0.304	0.901	0.000	24.070	25.233	17.972	15.920	21.500	6.980
0.304	0.898	0.000	29.070	27.902	18.945	16.140	21.920	6.508
0.304	0.902	0.000	32.160	29.098	18.959	16.160	21.070	6.508
0.304	0.904	0.000	33.500	29.454	18.998	16.250	21.420	6.450
0.304	0.894	0.000	35.580	27.920	17.210	16.160	21.250	6.450
0.304	0.894	0.000	39.416	26.353	15.116	16.160	21.580	6.892
0.304	0.903	0.000	41.830	25.375	13.045	15.910	21.500	5.279
0.304	0.903	0.000	48.660	24.550	10.893	15.830	20.830	5.547

W.Drag Kgs	B.Drag Kgs	W.Lift Kgs	B.Lift Kgs	S.Drag Kgs	S.Lift Kgs	CL	CD	CL/CD
24.085	16.721	6.870	6.587	7.364	13.457	1.070	0.585	1.827
26.630	17.575	7.706	7.072	9.054	14.779	1.183	0.725	1.632
27.768	17.691	8.046	6.816	10.077	14.862	1.179	0.799	1.475
28.098	17.686	8.190	6.938	10.413	15.128	1.195	0.822	1.453
26.647	16.040	7.722	6.238	10.607	13.959	1.127	0.857	1.316
25.129	14.056	7.282	5.560	11.072	12.841	1.037	0.894	1.160
24.299	12.137	6.926	4.781	12.162	11.707	0.927	0.963	0.963
23.508	10.181	6.665	3.874	13.327	10.539	0.834	1.055	0.791

V2 HINRIKSSON POLY-ICE OTTERBOARD AT 0° HEEL

OTTERBOARD NO. S.5
TEST NO. S.5.1

CENTRE OF PRESSURE CALCULATION

IS TOW ARM/CHAIN HINGED? Yes=1,No=0 0

WARP POS.N x1	y1	BRIDLE POS.N x2	y2	A of A rads	W.Angle rads	B.Angle rads	Decl.n rads
0.105	0.136	0.578	-0.060	0.420	0.278	0.375	0.122
0.165	0.120	0.578	-0.060	0.507	0.282	0.383	0.114
0.185	0.120	0.578	-0.060	0.561	0.282	0.368	0.114
0.205	0.122	0.578	-0.060	0.585	0.284	0.374	0.113
0.210	0.145	0.578	-0.060	0.621	0.282	0.371	0.113
0.210	0.177	0.578	-0.060	0.688	0.282	0.377	0.120
0.235	0.207	0.578	-0.060	0.730	0.278	0.375	0.092
0.283	0.195	0.578	-0.060	0.849	0.276	0.364	0.097

Drag A rads	Arm Ang rads	y1'	X	Y	Centre of Pressure x/L
0.501	0.000	0.136	0.325	-0.049	0.429
0.550	0.000	0.120	0.310	-0.026	0.413
0.596	0.000	0.120	0.296	-0.005	0.396
0.603	0.000	0.122	0.311	-0.003	0.415
0.650	0.000	0.145	0.320	0.006	0.428
0.712	0.000	0.177	0.314	0.025	0.421
0.804	0.000	0.207	0.350	0.024	0.471
0.902	0.000	0.195	0.346	0.062	0.467

HINRIKSSON POLY-ICE OTTERBOARD AT -10° HEEL

OTTERBOARD NO. S.5
TEST NO. S.5.2

LENGTH	-M	0.748
HEIGHT	-M	0.510
AREA (P)	-M²	0.304 (PROJECTED)
ASPECT RATIO		0.682
WEIGHT	-Kgs	12.800

Area M²	Speed M/Sec	Heel deg	A of A deg	W.Load Kgs	B.Load Kgs	W.Angle deg	B.Angle deg	Decl.n deg
0.304	0.900	-10.000	24.830	24.199	17.739	16.160	21.910	6.584
0.304	0.905	-10.000	28.000	26.288	18.886	16.250	22.080	6.219
0.304	0.905	-10.000	28.416	26.981	19.097	16.416	22.080	6.219
0.304	0.891	-10.000	31.250	27.526	18.681	16.080	21.830	5.739
0.304	0.904	-10.000	34.080	28.444	18.712	16.080	21.750	5.202
0.304	0.903	-10.000	36.330	26.726	16.297	16.000	21.910	5.068
0.304	0.908	-10.000	40.830	25.973	14.570	15.910	21.416	5.547
0.304	0.899	-10.000	43.500	24.842	12.780	16.250	21.160	5.259

W.Drag Kgs	B.Drag Kgs	W.Lift Kgs	B.Lift Kgs	S.Drag Kgs	S.Lift Kgs	CL	CD	CL/CD
23.090	16.458	6.691	6.619	6.632	13.310	1.061	0.528	2.007
25.089	17.501	7.313	7.099	7.588	14.412	1.136	0.598	1.899
25.729	17.696	7.580	7.179	8.032	14.759	1.163	0.633	1.837
26.317	17.341	7.586	6.947	8.975	14.533	1.181	0.730	1.619
27.219	17.380	7.846	6.934	9.839	14.780	1.167	0.777	1.502
25.590	15.120	7.338	6.081	10.470	13.419	1.062	0.829	1.282
24.861	13.564	7.087	5.320	11.297	12.407	0.971	0.884	1.098
23.749	11.918	6.922	4.613	11.831	11.535	0.921	0.945	0.975

V2 HINRIKSSON POLY-ICE OTTERBOARD AT -10° HEEL

OTTERBOARD NO. S.5
TEST NO. S.5.2

CENTRE OF PRESSURE CALCULATION

IS TOW ARM/CHAIN HINGED? Yes=1,No=0 0

WARP POS.N x1	y1	BRIDLE POS.N x2	y2	A of A rads	W.Angle rads	B.Angle rads	Decl.n rads
0.142	0.097	0.578	-0.060	0.433	0.282	0.382	0.115
0.140	0.110	0.578	-0.060	0.489	0.284	0.385	0.109
0.154	0.114	0.578	-0.060	0.496	0.287	0.385	0.109
0.182	0.123	0.578	-0.060	0.545	0.281	0.381	0.100
0.181	0.141	0.578	-0.060	0.595	0.281	0.380	0.091
0.198	0.180	0.578	-0.060	0.634	0.279	0.382	0.088
0.229	0.188	0.578	-0.060	0.713	0.278	0.374	0.097
0.265	0.180	0.578	-0.060	0.759	0.284	0.369	0.092

Drag A rads	Arm Ang rads	y1'	X	Y	Centre of Pressure x/L
0.462	0.175	0.096	0.304	-0.045	0.404
0.485	0.175	0.108	0.280	-0.028	0.375
0.498	0.175	0.112	0.295	-0.028	0.394
0.553	0.175	0.121	0.307	-0.014	0.410
0.587	0.175	0.139	0.294	0.003	0.394
0.663	0.175	0.177	0.332	0.004	0.443
0.739	0.175	0.185	0.332	0.027	0.445
0.798	0.175	0.177	0.348	0.036	0.467

APPENDIX II

RESULTS FOR NETTEC CAMBERED VEE OTTERBOARD

NETTEC CAMBERED VEE OTTERBOARD AT 0° HEEL

OTTERBOARD NO. S.6
TEST NO. S.6.1

LENGTH	-M	0.686	
HEIGHT	-M	0.427	
AREA (P)	-M²	0.288	(PROJECTED)
ASPECT RATIO		0.622	
WEIGHT	-Kgs	22.000	

Area M²	Speed M/Sec	Heel deg	A of A deg	W.Load Kgs	B.Load Kgs	W.Angle deg	B.Angle deg	Decl.n deg
0.288	0.886	0.000	24.660	27.853	19.123	15.750	21.330	6.892
0.288	0.907	0.000	26.500	30.048	20.364	15.830	21.580	5.931
0.288	0.886	0.000	28.160	29.600	20.148	15.750	21.330	5.931
0.288	0.903	0.000	31.160	33.113	21.912	16.250	22.160	5.164
0.288	0.898	0.000	31.750	33.052	21.991	15.750	21.500	6.892
0.288	0.897	0.000	33.500	34.470	22.072	15.910	21.660	6.988
0.288	0.895	0.000	34.160	34.964	22.634	16.000	22.000	6.037
0.288	0.908	0.000	35.910	35.282	21.834	15.830	21.500	6.123
0.288	0.903	0.000	38.000	32.945	19.239	15.670	21.160	6.988
0.288	0.899	0.000	40.750	30.223	17.060	14.910	20.910	5.739
0.288	0.893	0.000	44.000	28.940	15.111	15.330	21.000	5.739
0.288	0.904	0.000	44.500	27.076	12.799	15.416	20.750	5.931

W.Drag Kgs	B.Drag Kgs	W.Lift Kgs	B.Lift Kgs	S.Drag Kgs	S.Lift Kgs	CL	CD	CL/CD
26.614	17.813	7.506	6.956	8.800	14.462	1.255	0.764	1.643
28.754	18.937	8.153	7.490	9.817	15.643	1.295	0.813	1.593
28.336	18.768	7.992	7.329	9.568	15.320	1.330	0.830	1.601
31.661	20.293	9.228	8.265	11.368	17.493	1.462	0.950	1.539
31.581	20.461	8.907	8.060	11.120	16.967	1.433	0.939	1.526
32.903	20.514	9.379	8.147	12.390	17.526	1.484	1.049	1.415
33.423	20.986	9.584	8.479	12.437	18.063	1.536	1.058	1.452
33.750	20.315	9.569	8.002	13.436	17.572	1.452	1.110	1.308
31.485	17.942	8.832	6.945	13.543	15.777	1.318	1.131	1.165
29.059	15.936	7.737	6.089	13.123	13.826	1.165	1.106	1.054
27.770	14.107	7.613	5.415	13.663	13.028	1.113	1.167	0.954
25.962	11.969	7.159	4.535	13.993	11.694	0.975	1.167	0.836

V2 NETTEC CAMBERED VEE OTTERBOARD AT 0° HEEL

OTTERBOARD NO. S.6
TEST NO. S.6.1

CENTRE OF PRESSURE CALCULATION

IS TOW ARM/CHAIN HINGED? Yes=1,No=0 0

WARP POS.N x1	y1	BRIDLE POS.N x2	y2	A of A rads	W.Angle rads	B.Angle rads	Decl.n rads
0.110	0.037	0.453	-0.151	0.430	0.275	0.372	0.120
0.120	0.040	0.453	-0.151	0.463	0.276	0.377	0.104
0.124	0.040	0.453	-0.151	0.491	0.275	0.372	0.104
0.143	0.040	0.453	-0.151	0.544	0.284	0.387	0.090
0.130	0.071	0.453	-0.151	0.554	0.275	0.375	0.120
0.149	0.066	0.453	-0.151	0.585	0.278	0.378	0.122
0.145	0.048	0.453	-0.151	0.596	0.279	0.384	0.105
0.154	0.086	0.453	-0.151	0.627	0.276	0.375	0.107
0.158	0.104	0.453	-0.151	0.663	0.273	0.369	0.122
0.168	0.126	0.453	-0.151	0.711	0.260	0.365	0.100
0.179	0.146	0.453	-0.151	0.768	0.268	0.367	0.100
0.209	0.138	0.453	-0.151	0.777	0.269	0.362	0.104

Drag A rads	Arm Ang rads	y1'	X	Y	Centre of Pressure x/L
0.547	0.000	0.037	0.322	-0.143	0.445
0.560	0.000	0.040	0.317	-0.139	0.442
0.558	0.000	0.040	0.304	-0.133	0.430
0.576	0.000	0.040	0.296	-0.126	0.425
0.580	0.000	0.071	0.310	-0.125	0.447
0.615	0.000	0.066	0.309	-0.121	0.445
0.603	0.000	0.048	0.280	-0.114	0.407
0.653	0.000	0.086	0.312	-0.115	0.451
0.709	0.000	0.104	0.315	-0.109	0.451
0.759	0.000	0.126	0.326	-0.105	0.468
0.809	0.000	0.146	0.322	-0.095	0.464
0.875	0.000	0.138	0.350	-0.106	0.495

NETTEC CAMBERED VEE OTTERBOARD AT +15° HEEL

OTTERBOARD NO. S.6
TEST NO. S.6.2

LENGTH	-M	0.686	
HEIGHT	-M	0.427	
AREA (P)	-M²	0.288	(PROJECTED)
ASPECT RATIO		0.622	
WEIGHT	-Kgs	22.000	

Area M²	Speed M/Sec	Heel deg	A of A deg	W.Load Kgs	B.Load Kgs	W.Angle deg	B.Angle deg	Decl.n deg
0.288	0.904	15.000	24.500	28.454	19.747	15.750	21.750	6.219
0.288	0.908	15.000	28.416	33.068	22.329	15.416	21.000	6.219
0.288	0.900	15.000	32.670	34.621	22.393	15.580	21.160	6.681
0.288	0.908	15.000	35.160	36.507	23.059	15.830	21.416	6.681
0.288	0.896	15.000	37.500	33.645	20.310	15.500	21.330	6.315
0.288	0.907	15.000	37.660	33.740	20.753	15.910	21.660	6.681
0.288	0.896	15.000	38.330	30.893	17.464	15.330	21.500	6.700
0.288	0.900	15.000	39.080	29.666	16.525	15.910	21.580	6.980
0.288	0.902	15.000	42.000	27.905	14.217	16.000	21.670	6.988
0.288	0.897	15.000	46.750	25.880	12.217	15.500	21.000	6.988

W.Drag Kgs	B.Drag Kgs	W.Lift Kgs	B.Lift Kgs	S.Drag Kgs	S.Lift Kgs	CL	CD	CL/CD
27.225	18.341	7.678	7.317	8.883	14.996	1.250	0.741	1.688
31.691	20.846	8.739	8.002	10.845	16.741	1.383	0.896	1.544
33.122	20.883	9.235	8.083	12.239	17.319	1.457	1.029	1.415
34.884	21.467	9.891	8.420	13.417	18.311	1.513	1.109	1.365
32.225	18.919	8.937	7.388	13.306	16.324	1.385	1.129	1.227
32.227	19.288	9.186	7.660	12.940	16.846	1.395	1.072	1.302
29.590	16.249	8.112	6.401	13.342	14.512	1.231	1.132	1.088
28.318	15.367	8.072	6.078	12.951	14.150	1.190	1.089	1.093
26.625	13.212	7.635	5.250	13.413	12.884	1.079	1.123	0.961
24.754	11.406	6.865	4.378	13.348	11.243	0.952	1.130	0.842

V2 NETTEC CAMBERED VEE OTTERBOARD AT +15° HEEL

OTTERBOARD NO. S.6
TEST NO. S.6.2

CENTRE OF PRESSURE CALCULATION

IS TOW ARM/CHAIN HINGED? Yes=1,No=0 0

WARP POS.N x1	y1	BRIDLE POS.N x2	y2	A of A rads	W.Angle rads	B.Angle rads	Decl.n rads
0.108	0.023	0.453	-0.151	0.428	0.275	0.380	0.109
0.141	0.025	0.453	-0.151	0.496	0.269	0.367	0.109
0.145	0.045	0.453	-0.151	0.570	0.272	0.369	0.117
0.150	0.064	0.453	-0.151	0.614	0.276	0.374	0.117
0.145	0.093	0.453	-0.151	0.654	0.271	0.372	0.110
0.152	0.075	0.453	-0.151	0.657	0.278	0.378	0.117
0.110	0.154	0.453	-0.151	0.669	0.268	0.375	0.117
0.160	0.110	0.453	-0.151	0.682	0.278	0.377	0.122
0.175	0.130	0.453	-0.151	0.733	0.279	0.378	0.122
0.205	0.130	0.453	-0.151	0.816	0.271	0.367	0.122

Drag A rads	Arm Ang rads	y1'	X	Y	Centre of Pressure x/L
0.535	0.262	0.022	0.298	-0.138	0.412
0.575	0.262	0.024	0.297	-0.126	0.418
0.615	0.262	0.043	0.283	-0.111	0.405
0.632	0.262	0.062	0.285	-0.105	0.412
0.684	0.262	0.090	0.286	-0.097	0.413
0.655	0.262	0.072	0.276	-0.095	0.402
0.743	0.262	0.149	0.291	-0.097	0.413
0.741	0.262	0.106	0.304	-0.099	0.434
0.805	0.262	0.126	0.312	-0.094	0.445
0.871	0.262	0.126	0.312	-0.078	0.449

APPENDIX III

RESULTS FOR MUNKEBO VEE OTTERBOARD

MUNKEBO VEE OTTERBOARD AT +15° HEEL

OTTERBOARD NO. S.7
TEST NO. S.7.1

LENGTH	-M	0.816	
HEIGHT	-M	0.420	
AREA (P)	-M²	0.315	(PROJECTED)
ASPECT RATIO		0.515	
WEIGHT	-Kgs	10.700	

Area M²	Speed M/Sec	Heel deg	A of A deg	W.Load Kgs	B.Load Kgs	W.Angle deg	B.Angle deg	Decl.n deg
0.315	0.912	15.000	31.250	33.642	21.545	15.750	21.420	4.091
0.315	0.912	15.000	33.330	36.154	22.518	15.500	21.250	4.972
0.315	0.908	15.000	35.250	36.498	21.922	15.750	21.250	4.819

W.Drag Kgs	B.Drag Kgs	W.Lift Kgs	B.Lift Kgs	S.Drag Kgs	S.Lift Kgs	CL	CD	CL/CD
32.296	20.057	9.109	7.868	12.240	16.977	1.271	0.917	1.387
34.708	20.987	9.625	8.161	13.721	17.787	1.332	1.028	1.296
35.004	20.431	9.872	7.945	14.572	17.817	1.346	1.101	1.223

V2 MUNKEBO VEE OTTERBOARD AT +15° HEEL

OTTERBOARD NO. S.7
TEST NO. S.7.1

CENTRE OF PRESSURE CALCULATION

IS TOW ARM/CHAIN HINGED? Yes=1,No=0 1

WARP POS.N x1	y1	BRIDLE POS.N x2	y2	A of A rads	W.Angle rads	B.Angle rads	Decl.n rads
0.153	0.220	0.695	-0.057	0.545	0.275	0.374	0.071
0.178	0.235	0.695	-0.057	0.582	0.271	0.371	0.087
0.191	0.238	0.695	-0.057	0.615	0.275	0.371	0.084

Drag A rads	Arm Ang rads	y1'	X	Y	Centre of Pressure x/L
0.625	0.098	0.219	0.353	0.004	0.433
0.657	0.116	0.233	0.369	0.015	0.454
0.686	0.109	0.237	0.359	0.029	0.443

APPENDIX IV

RESULTS FOR BISON 3 SLOT OTTERBOARD

BISON 3 SLOT OTTERBOARD AT 0° HEEL

OTTERBOARD NO. S.8
TEST NO. S.8.1

LENGTH	-M	0.673	
HEIGHT	-M	0.423	
AREA (P)	-M²	0.263	(PROJECTED)
ASPECT RATIO		0.629	
WEIGHT	-Kgs	11.400	

Area M²	Speed M/Sec	Heel deg	A of A deg	W.Load Kgs	B.Load Kgs	W.Angle deg	B.Angle deg	Decl.n deg
0.263	0.893	0.000	23.750	16.211	11.635	15.580	21.080	6.123
0.263	0.906	0.000	28.250	19.946	14.407	15.660	21.000	6.123
0.263	0.905	0.000	33.500	23.508	16.687	15.330	20.500	5.739
0.263	0.900	0.000	37.330	25.941	18.020	15.580	20.580	5.739
0.263	0.900	0.000	41.580	27.764	18.379	16.000	20.830	6.315
0.263	0.890	0.000	43.910	27.939	17.796	15.660	20.750	5.068
0.263	0.885	0.000	48.250	27.440	16.569	15.160	19.830	6.123

W.Drag Kgs	B.Drag Kgs	W.Lift Kgs	B.Lift Kgs	S.Drag Kgs	S.Lift Kgs	CL	CD	CL/CD
15.526	10.856	4.329	4.185	4.670	8.514	0.796	0.437	1.823
19.096	13.450	5.353	5.163	5.646	10.516	0.956	0.513	1.863
22.558	15.630	6.184	5.844	6.928	12.028	1.096	0.631	1.736
24.863	16.870	6.932	6.334	7.993	13.267	1.222	0.736	1.660
26.527	17.178	7.606	6.536	9.349	14.142	1.302	0.861	1.513
26.797	16.642	7.512	6.305	10.155	13.817	1.301	0.956	1.361
26.334	15.587	7.135	5.621	10.747	12.756	1.215	1.024	1.187

V2 BISON 3 SLOT OTTERBOARD AT 0° HEEL

OTTERBOARD NO. S.8
TEST NO. S.8.1

CENTRE OF PRESSURE CALCULATION

IS TOW ARM/CHAIN HINGED? Yes=1,No=0 0

WARP POS.N x1	y1	BRIDLE POS.N x2	y2	A of A rads	W.Angle rads	B.Angle rads	Decl.n rads
0.075	0.125	0.504	-0.037	0.415	0.272	0.368	0.107
0.105	0.128	0.504	-0.037	0.493	0.273	0.367	0.107
0.160	0.125	0.504	-0.037	0.585	0.268	0.358	0.100
0.205	0.108	0.504	-0.037	0.652	0.272	0.359	0.100
0.212	0.124	0.504	-0.037	0.726	0.279	0.364	0.110
0.220	0.128	0.504	-0.037	0.766	0.273	0.362	0.088
0.240	0.144	0.504	-0.037	0.842	0.265	0.346	0.107

Drag A rads	Arm Ang rads	y1'	X	Y	Centre of Pressure x/L
0.502	0.000	0.125	0.259	-0.026	0.381
0.493	0.000	0.128	0.242	-0.004	0.359
0.523	0.000	0.125	0.250	0.022	0.370
0.542	0.000	0.108	0.259	0.037	0.379
0.584	0.000	0.124	0.254	0.058	0.365
0.634	0.000	0.128	0.254	0.070	0.364
0.700	0.000	0.144	0.266	0.092	0.376

BISON 3 SLOT OTTERBOARD AT -10° HEEL

OTTERBOARD NO. S.8
TEST NO. S.8.2

LENGTH	-M	0.673	
HEIGHT	-M	0.423	
AREA (P)	-M²	0.263	(PROJECTED)
ASPECT RATIO		0.629	
WEIGHT	-Kgs	11.400	

Area M²	Speed M/Sec	Heel deg	A of A deg	W.Load Kgs	B.Load Kgs	W.Angle deg	B.Angle deg	Decl.n deg
0.263	0.899	-10.000	26.000	17.079	12.707	15.750	21.080	5.739
0.263	0.903	-10.000	27.910	19.033	14.094	15.910	21.420	5.739
0.263	0.909	-10.000	32.910	22.711	16.544	15.910	21.250	5.931
0.263	0.903	-10.000	34.160	23.419	16.876	15.910	20.910	5.931
0.263	0.901	-10.000	37.000	24.933	17.469	16.000	21.330	5.835
0.263	0.901	-10.000	39.500	26.325	18.022	16.000	21.080	5.835
0.263	0.897	-10.000	40.330	26.870	18.161	16.000	21.250	5.835
0.263	0.896	-10.000	42.580	27.820	18.270	16.000	21.080	5.835
0.263	0.899	-10.000	44.830	28.618	18.306	16.000	21.330	5.835

W.Drag Kgs	B.Drag Kgs	W.Lift Kgs	B.Lift Kgs	S.Drag Kgs	S.Lift Kgs	CL	CD	CL/CD
16.355	11.857	4.613	4.570	4.499	9.183	0.848	0.415	2.041
18.212	13.121	5.191	5.147	5.092	10.338	0.946	0.466	2.030
21.724	15.419	6.192	5.996	6.305	12.189	1.100	0.569	1.933
22.401	15.765	6.385	6.023	6.637	12.408	1.135	0.607	1.870
23.843	16.272	6.837	6.354	7.571	13.191	1.212	0.696	1.742
25.174	16.816	7.219	6.482	8.358	13.701	1.259	0.768	1.639
25.695	16.926	7.368	6.582	8.769	13.950	1.293	0.813	1.591
26.604	17.047	7.629	6.571	9.556	14.200	1.319	0.888	1.486
27.367	17.052	7.847	6.659	10.315	14.506	1.339	0.952	1.406

V2 BISON 3 SLOT OTTERBOARD AT -10° HEEL

OTTERBOARD NO. S.8
TEST NO. S.8.2

CENTRE OF PRESSURE CALCULATION

IS TOW ARM/CHAIN HINGED? Yes=1,No=0 0

WARP POS.N x1	y1	BRIDLE POS.N x2	y2	A of A rads	W.Angle rads	B.Angle rads	Decl.n rads
0.085	0.130	0.504	-0.037	0.454	0.275	0.368	0.100
0.097	0.128	0.504	-0.037	0.487	0.278	0.374	0.100
0.116	0.153	0.504	-0.037	0.574	0.278	0.371	0.104
0.137	0.143	0.504	-0.037	0.596	0.278	0.365	0.104
0.155	0.162	0.504	-0.037	0.646	0.279	0.372	0.102
0.168	0.169	0.504	-0.037	0.689	0.279	0.368	0.102
0.170	0.175	0.504	-0.037	0.704	0.279	0.371	0.102
0.180	0.178	0.504	-0.037	0.743	0.279	0.368	0.102
0.195	0.181	0.504	-0.037	0.782	0.279	0.372	0.102

Drag A rads	Arm Ang rads	y1'	X	Y	Centre of Pressure x/L
0.456	0.175	0.128	0.244	-0.014	0.363
0.458	0.175	0.126	0.234	-0.006	0.348
0.477	0.175	0.151	0.230	0.020	0.339
0.491	0.175	0.141	0.232	0.028	0.340
0.521	0.175	0.160	0.249	0.035	0.363
0.548	0.175	0.166	0.249	0.048	0.360
0.561	0.175	0.172	0.251	0.051	0.362
0.592	0.175	0.175	0.248	0.065	0.353
0.618	0.175	0.178	0.254	0.072	0.360

APPENDIX V

RESULTS FOR EURONETE "PORTUGUESE TYPE" OTTERBOARD

EURONETE "PORTUGUESE TYPE" OTTERBOARD AT 0° HEEL

OTTERBOARD NO. S.9
TEST NO. S.9.1

LENGTH	-M	0.750	
HEIGHT	-M	0.417	
AREA (P)	-M²	0.275	(PROJECTED)
ASPECT RATIO		0.556	
WEIGHT	-Kgs	11.400	

Area M²	Speed M/Sec	Heel deg	A of A deg	W.Load Kgs	B.Load Kgs	W.Angle deg	B.Angle deg	Decl.n deg
0.275	0.902	0.000	25.330	18.924	13.009	16.330	21.830	5.739
0.275	0.897	0.000	25.660	19.080	13.179	16.330	21.500	6.123
0.275	0.895	0.000	28.660	20.248	13.690	16.330	21.910	6.123
0.275	0.907	0.000	31.750	22.884	14.748	16.250	21.670	5.931
0.275	0.897	0.000	32.000	22.267	14.204	16.500	21.580	6.796
0.275	0.902	0.000	34.750	22.208	13.579	15.910	21.080	6.123
0.275	0.901	0.000	37.910	21.111	12.047	15.910	20.910	6.123
0.275	0.905	0.000	44.580	21.057	10.549	15.750	21.000	5.739

W.Drag Kgs	B.Drag Kgs	W.Lift Kgs	B.Lift Kgs	S.Drag Kgs	S.Lift Kgs	CL	CD	CL/CD
18.070	12.076	5.294	4.837	5.993	10.132	0.888	0.526	1.690
18.206	12.262	5.334	4.830	5.944	10.164	0.901	0.527	1.710
19.320	12.701	5.661	5.108	6.619	10.769	0.959	0.590	1.627
21.852	13.706	6.369	5.446	8.146	11.815	1.025	0.707	1.450
21.200	13.208	6.280	5.224	7.992	11.504	1.020	0.709	1.439
21.235	12.670	6.053	4.884	8.565	10.937	0.959	0.751	1.277
20.186	11.254	5.754	4.300	8.933	10.054	0.884	0.785	1.125
20.165	9.848	5.687	3.780	10.316	9.467	0.825	0.899	0.918

V2 EURONETE "PORTUGUESE TYPE" OTTERBOARD AT 0° HEEL

OTTERBOARD NO. S.9
TEST NO. S.9.1

CENTRE OF PRESSURE CALCULATION

IS TOW ARM/CHAIN HINGED? Yes=1,No=0 0

WARP POS.N x1	y1	BRIDLE POS.N x2	y2	A of A rads	W.Angle rads	B.Angle rads	Decl.n rads
0.155	0.103	0.594	-0.045	0.442	0.285	0.381	0.100
0.150	0.105	0.594	-0.045	0.448	0.285	0.375	0.107
0.162	0.130	0.594	-0.045	0.500	0.285	0.382	0.107
0.177	0.162	0.594	-0.045	0.554	0.284	0.378	0.104
0.175	0.165	0.594	-0.045	0.559	0.288	0.377	0.119
0.187	0.187	0.594	-0.045	0.607	0.278	0.368	0.107
0.198	0.205	0.594	-0.045	0.662	0.278	0.365	0.107
0.222	0.250	0.594	-0.045	0.778	0.275	0.367	0.100

Drag A rads	Arm Ang rads	y1'	X	Y	Centre of Pressure x/L
0.534	0.000	0.103	0.301	-0.027	0.398
0.529	0.000	0.105	0.292	-0.023	0.387
0.551	0.000	0.130	0.303	-0.011	0.403
0.604	0.000	0.162	0.319	0.004	0.426
0.607	0.000	0.165	0.315	0.006	0.421
0.664	0.000	0.187	0.323	0.021	0.433
0.726	0.000	0.205	0.319	0.039	0.429
0.828	0.000	0.250	0.323	0.073	0.435

EURONETE "PORTUGUESE TYPE" OTTERBOARD AT -10° HEEL

OTTERBOARD NO. S.9
TEST NO. S.9.2

LENGTH	-M	0.750	
HEIGHT	-M	0.417	
AREA (P)	-M²	0.275	(PROJECTED)
ASPECT RATIO		0.556	
WEIGHT	-Kgs	11.400	

Area M²	Speed M/Sec	Heel deg	A of A deg	W.Load Kgs	B.Load Kgs	W.Angle deg	B.Angle deg	Decl.n deg
0.275	0.905	-10.000	24.830	18.859	13.085	16.500	21.500	6.219
0.275	0.902	-10.000	26.750	20.571	14.310	16.250	21.000	5.931
0.275	0.904	-10.000	27.580	20.952	14.263	16.500	21.750	5.835
0.275	0.900	-10.000	30.250	21.904	14.709	15.830	20.910	6.123
0.275	0.900	-10.000	30.830	22.325	14.577	16.250	21.660	5.739
0.275	0.900	-10.000	31.750	22.123	14.199	16.250	21.580	5.739
0.275	0.902	-10.000	34.670	21.972	13.737	15.830	20.830	5.739
0.275	0.897	-10.000	37.830	21.752	12.593	16.080	21.250	6.123
0.275	0.906	-10.000	41.580	21.865	12.078	16.000	21.420	6.123
0.275	0.902	-10.000	44.080	21.499	11.017	16.080	21.420	6.123

W.Drag Kgs	B.Drag Kgs	W.Lift Kgs	B.Lift Kgs	S.Drag Kgs	S.Lift Kgs	CL	CD	CL/CD
17.976	12.175	5.325	4.796	5.801	10.120	0.882	0.505	1.744
19.643	13.360	5.726	5.128	6.284	10.854	0.952	0.551	1.727
19.985	13.248	5.920	5.285	6.737	11.205	0.978	0.588	1.663
20.953	13.740	5.941	5.250	7.213	11.191	0.987	0.636	1.552
21.326	13.548	6.216	5.380	7.778	11.596	1.021	0.685	1.491
21.133	13.204	6.160	5.222	7.929	11.382	1.003	0.698	1.435
21.033	12.839	5.964	4.885	8.194	10.848	0.952	0.719	1.324
20.782	11.737	5.990	4.564	9.045	10.555	0.936	0.802	1.167
20.898	11.244	5.992	4.411	9.654	10.403	0.904	0.839	1.078
20.540	10.256	5.921	4.023	10.284	9.944	0.873	0.903	0.967

V2 EURONETE "PORTUGUESE TYPE" OTTERBOARD AT -10° HEEL

OTTERBOARD NO. S.9
TEST NO. S.9.2

CENTRE OF PRESSURE CALCULATION

IS TOW ARM/CHAIN HINGED? Yes=1,No=0 0

WARP POS.N x1	y1	BRIDLE POS.N x2	y2	A of A rads	W.Angle rads	B.Angle rads	Decl.n rads
0.150	0.091	0.594	-0.045	0.433	0.288	0.375	0.109
0.163	0.120	0.594	-0.045	0.467	0.284	0.367	0.104
0.123	0.160	0.594	-0.045	0.481	0.288	0.380	0.102
0.172	0.146	0.594	-0.045	0.528	0.276	0.365	0.107
0.172	0.146	0.594	-0.045	0.538	0.284	0.378	0.100
0.180	0.163	0.594	-0.045	0.554	0.284	0.377	0.100
0.192	0.187	0.594	-0.045	0.605	0.276	0.364	0.100
0.205	0.211	0.594	-0.045	0.660	0.281	0.371	0.107
0.222	0.233	0.594	-0.045	0.726	0.279	0.374	0.107
0.240	0.253	0.594	-0.045	0.769	0.281	0.374	0.107

Drag A rads	Arm Ang rads	y1'	X	Y	Centre of Pressure x/L
0.521	0.175	0.090	0.282	-0.026	0.372
0.525	0.175	0.118	0.306	-0.015	0.407
0.541	0.175	0.158	0.301	-0.014	0.400
0.573	0.175	0.144	0.308	0.003	0.411
0.591	0.175	0.144	0.303	0.003	0.405
0.608	0.175	0.161	0.320	0.005	0.427
0.647	0.175	0.184	0.326	0.022	0.436
0.709	0.175	0.208	0.332	0.034	0.445
0.748	0.175	0.229	0.336	0.051	0.449
0.802	0.175	0.249	0.350	0.058	0.469

APPENDIX VI

RESULTS FOR BLOOE TECH VEE OTTERBOARD

BLOOE TECH VEE OTTERBOARD AT 0° HEEL

OTTERBOARD NO. S.10
TEST NO. S.10.1

LENGTH	-M	0.730	
HEIGHT	-M	0.469	
AREA (P)	-M²	0.340	(PROJECTED)
ASPECT RATIO		0.642	
WEIGHT	-Kgs	11.800	

Area M²	Speed M/Sec	Heel deg	A of A deg	W.Load Kgs	B.Load Kgs	W.Angle deg	B.Angle deg	Decl.n deg
0.340	0.901	0.000	24.580	24.923	17.761	15.830	21.160	6.315
0.340	0.898	0.000	26.910	25.701	18.176	15.910	21.420	5.739
0.340	0.904	0.000	29.080	26.917	18.579	16.000	21.670	5.547
0.340	0.907	0.000	31.160	26.293	17.718	15.830	21.250	5.835
0.340	0.897	0.000	34.250	25.222	15.881	15.830	21.500	5.739
0.340	0.904	0.000	36.670	26.018	15.894	16.080	21.670	5.164
0.340	0.900	0.000	40.330	25.717	14.859	16.080	21.670	5.547
0.340	0.907	0.000	46.330	25.754	13.169	16.000	21.670	5.547

W.Drag Kgs	B.Drag Kgs	W.Lift Kgs	B.Lift Kgs	S.Drag Kgs	S.Lift Kgs	CL	CD	CL/CD
23.832	16.563	6.757	6.411	7.269	13.169	0.936	0.517	1.812
24.593	16.921	7.010	6.638	7.672	13.648	0.977	0.549	1.779
25.753	17.266	7.385	6.860	8.487	14.245	1.006	0.599	1.678
25.165	16.513	7.135	6.422	8.651	13.557	0.951	0.607	1.567
24.144	14.776	6.846	5.820	9.368	12.666	0.908	0.672	1.352
24.899	14.771	7.177	5.869	10.128	13.046	0.921	0.715	1.288
24.595	13.809	7.090	5.487	10.786	12.577	0.896	0.768	1.166
24.640	12.238	7.066	4.863	12.402	11.928	0.837	0.870	0.962

V2 BLOOE TECH VEE OTTERBOARD AT 0° HEEL

OTTERBOARD NO. S.10
TEST NO. S.10.1

CENTRE OF PRESSURE CALCULATION

IS TOW ARM/CHAIN HINGED? Yes=1,No=0 0

WARP POS.N x1	y1	BRIDLE POS.N x2	y2	A of A rads	W.Angle rads	B.Angle rads	Decl.n rads
0.110	0.110	0.555	-0.057	0.429	0.276	0.369	0.110
0.108	0.128	0.555	-0.057	0.470	0.278	0.374	0.100
0.110	0.140	0.555	-0.057	0.508	0.279	0.378	0.097
0.124	0.170	0.555	-0.057	0.544	0.276	0.371	0.102
0.132	0.203	0.555	-0.057	0.598	0.276	0.375	0.100
0.142	0.210	0.555	-0.057	0.640	0.281	0.378	0.090
0.160	0.243	0.555	-0.057	0.704	0.281	0.378	0.097
0.210	0.234	0.555	-0.057	0.809	0.279	0.378	0.097

Drag A rads	Arm Ang rads	y1'	X	Y	Centre of Pressure x/L
0.504	0.000	0.110	0.287	-0.041	0.389
0.512	0.000	0.128	0.279	-0.030	0.380
0.537	0.000	0.140	0.269	-0.020	0.368
0.568	0.000	0.170	0.293	-0.011	0.401
0.637	0.000	0.203	0.302	0.000	0.413
0.660	0.000	0.210	0.291	0.014	0.399
0.709	0.000	0.243	0.303	0.028	0.415
0.805	0.000	0.234	0.302	0.059	0.413

BLOOE TECH VEE OTTERBOARD AT +10° HEEL

OTTERBOARD NO. S.10
TEST NO. S.10.2

LENGTH	-M	0.730
HEIGHT	-M	0.469
AREA (P)	-M²	0.340 (PROJECTED)
ASPECT RATIO		0.642
WEIGHT	-Kgs	11.800

Area M²	Speed M/Sec	Heel deg	A of A deg	W.Load Kgs	B.Load Kgs	W.Angle deg	B.Angle deg	Decl.n deg
0.340	0.900	10.000	26.160	27.298	18.856	16.000	21.750	6.315
0.340	0.899	10.000	27.000	27.181	18.552	16.000	21.670	5.739
0.340	0.902	10.000	28.500	27.552	18.412	16.250	21.910	5.739
0.340	0.904	10.000	31.250	24.876	15.680	16.250	21.750	5.739
0.340	0.901	10.000	34.910	24.720	14.690	16.160	21.910	5.164
0.340	0.899	10.000	40.500	24.898	13.478	16.160	21.580	5.547
0.340	0.904	10.000	46.250	24.997	12.097	16.330	21.000	5.547

W.Drag Kgs	B.Drag Kgs	W.Lift Kgs	B.Lift Kgs	S.Drag Kgs	S.Lift Kgs	CL	CD	CL/CD
26.081	17.514	7.479	6.987	8.568	14.466	1.031	0.610	1.688
25.997	17.241	7.455	6.851	8.756	14.305	1.021	0.625	1.634
26.319	17.082	7.671	6.870	9.237	14.542	1.031	0.655	1.574
23.762	14.564	6.926	5.810	9.199	12.736	0.899	0.650	1.385
23.647	13.629	6.852	5.482	10.018	12.334	0.877	0.712	1.231
23.802	12.533	6.897	4.957	11.269	11.854	0.846	0.805	1.052
23.876	11.294	6.995	4.335	12.583	11.331	0.800	0.889	0.900

V2 BLOOE TECH VEE OTTERBOARD AT +10° HEEL

OTTERBOARD NO. S.10
TEST NO. S.10.2

CENTRE OF PRESSURE CALCULATION

IS TOW ARM/CHAIN HINGED? Yes=1,No=0 0

WARP POS.N x1	y1	BRIDLE POS.N x2	y2	A of A rads	W.Angle rads	B.Angle rads	Decl.n rads
0.105	0.128	0.555	-0.057	0.457	0.279	0.380	0.110
0.114	0.140	0.555	-0.057	0.471	0.279	0.378	0.100
0.115	0.160	0.555	-0.057	0.497	0.284	0.382	0.100
0.120	0.173	0.555	-0.057	0.545	0.284	0.380	0.100
0.135	0.208	0.555	-0.057	0.609	0.282	0.382	0.090
0.165	0.227	0.555	-0.057	0.707	0.282	0.377	0.097
0.212	0.218	0.555	-0.057	0.807	0.285	0.367	0.097

Drag A rads	Arm Ang rads	y1'	X	Y	Centre of Pressure x/L
0.535	0.175	0.126	0.283	-0.035	0.384
0.549	0.175	0.138	0.296	-0.032	0.402
0.566	0.175	0.158	0.301	-0.027	0.410
0.625	0.175	0.170	0.286	-0.011	0.391
0.682	0.175	0.205	0.298	0.003	0.408
0.760	0.175	0.224	0.289	0.035	0.398
0.838	0.175	0.215	0.287	0.070	0.396