

NUMBER 4
APRIL/MAY
1990

PROFESSIONAL BOATBUILDER MAGAZINE

TESTING
COMPOSITES

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EFFECTIVE
CATALOGS

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ALUMINUM
ASSEMBLY

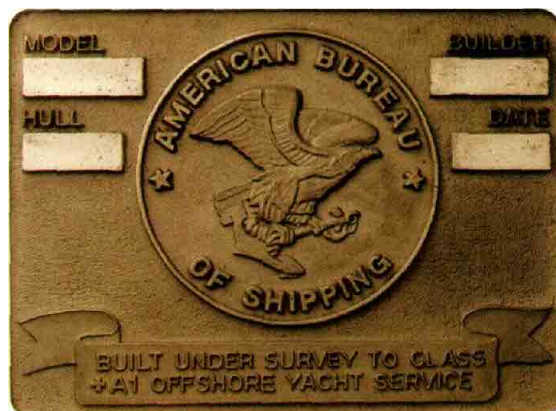
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DELTA BENCH TOP TOOLS			
Model	Description	List	Sale
23-700	Wet/dry grinder	201	155
23-580	6" bench grinder 1/2 H.P.	81	75
23-880	6" bench grinder 1/2 H.P.	136	109
23-980	10" bench grinder 1 H.P.	246	235
11-950	8" drill press	164	135
14-040	14" drill press	313	309
40-150	15" hobby scroll saw	178	139
26-160	10" hobby band saw	189	144
31-650	1" belt sander 2.0 amp	73	70
31-480	4" belt sander 2.0 amp	178	139
31-340	"NEW" 1" belt sander 2.0 amp	226	175

DELTA STATIONARY			
Model	Description	List	Sale
34-761	10" universal 1 1/2 H.P.	1715	1399
34-340	Super 10" motorized table saw	690	429
34-429	10" tilting arbor bench saw		
	1 1/2 H.P.	1479	875
33-990	10" radial arm saw	727	569
11-072	32" radial drill press	487	409
30-280	6" motorized jointer	440	379
50-179	1/4 H.P. 2 stage dust collector	435	339
50-180	1 H.P. dust collector	535	439
50-181	2 H.P. dust collector	760	599
37-154	Hedge DJ-15 6" jointer		
	w/1/4 H.P. motor	1288	1029
22-661	13" planer w/2 H.P. motor	1750	1095
33-050	"NEW" 8 1/4" Sawbuck	742	545
34-330	"NEW" 8 1/4" Table Saw 13A	321	209
34-670	10" motorized table saw	437	379
34-985	1/4 H.P. chip feeder	698	599
32-800	"NEW" stationary plate jointer	645	459
36-680	"NEW" 8 1/4" compound miter saw	216	155

MILWAUKEE TOOLS			
Model	Description	List	Sale
0095-1	"NEW" 1/2 corded variable speed drill, charger & case	280	155
0095-1	9.6V cordless drill w/ case	254	149
0095-1	9.6V cordless drill w/ case	277	165
0095-1	7.2V cordless drill w/ case	174	105
0224-1	3/4" drill 4.5A magnum	189	114
0234-1	1/2" drill 4.5A mag 0-850 rpm	199	107
0244-1	1/2" drill 4.5A mag 0-600 rpm	199	107
0272-1	3/4" drill 3.5A 0-1000 rpm	174	99
0282-1	3/4" drill 3.5A 0-1000 rpm	164	95
0282-1	3/4" close quarter drill	208	119
0279-1	1/2" close quarter drill	243	149
0539-1	Cordless screwdriver 190 rpm	113	69
0540-1	Cordless screwdriver w/ case	154	95
0540-1	Cordless screwdriver 200 & 400 rpm	120	75
3102-1	Pimber rt angle drill kit	330	189
3102-1	Electrician rt angle drill	320	199
5299	1/2" D-handle ham drill kit	304	175
1676-1	H.D. Hole Hawk w/ case	415	224
0511	2 spd SawZall w/ case	214	125
0405	8 1/4" circle saw	219	129
0750-1	Drywall gun 0-4000 4.5A	154	95
0507	TSC SawZall w/ case	229	129
0170	14" chop saw	430	275
0012	Orbital sander 3 1/2" x 7 1/2"	189	115
0012	Orbital sander 4 1/2" x 9 1/2"	199	118
0025	6 1/2" cordless circle saw	232	139
0977	7 1/2" lamp heat gun	114	75
0597-1	3/4" v. spd. hammer drill kit	332	139
0517-1	1/2" v. spd. hammer drill kit	318	185
0370-1	1/2" v. spd. rt angle drill kit	340	195
0754-1	Drywall gun 0-4000 4.5A	179	119
0441	Drywall driver 0-2500	154	99
0230-1	3/4" drill 0-1700 rpm	179	105
3300-1	1/2" v. spd. magnum rt angle kit	299	179
0560	Router 1 1/2 H.P. - 10 amp	299	189
0560	Router 2 H.P. - 12 amp	350	225
0455	7 1/2" polisher 1750 rpm	209	129
0215	16" chain saw	280	169
0975	Heat gun	89	59
0365	7 1/4" circular saw	195	114
0365	7 1/4" circular saw w/ fence & bid.	204	119
0216-1	7 1/4" v. spd. w/ fence, bid & case	232	129
0216-1	2 spd cordless drill H-torque	222	129
0235-1	1/2" drill keyless chuck mag	200	119
0915	1/4 sheet pad sander	70	45
0145	4 1/4" grinder 10000 rpm	154	95
0142	6 1/4" w/ case & access	192	115
0649-1	Drywall gun 0-2500 4.5A	189	125
0377	7 1/4" worm drive saw	295	174

FREUD SAW BLADES			
Item No.	Description	Di.	Teeth
L1072M10	Gen. Purp. A.T.B.	10"	40
L1072M10	Gen. Purp. T.C.H.	10"	40
L1072M10	Cut-off	10"	60
L1072M10	Combination	10"	50
L1072M10	Super Cut-off	10"	80
L1072M10	Ripping	10"	24
L1072M10	Cut-off	10"	60
L1072M10	Thin kerf	10"	24
L1072M10	Thin kerf	10"	60
L1072M10	Thin kerf	10"	80
L1072M10	Thin kerf	10"	100
L1072M10	Thin kerf	10"	120
P2303	Gen'l. Purp.	7 1/4"	24
P2303	Plywood	7 1/4"	24
S2306	8" Dado - Carbide	184	105
S2306	8" Dado - Carbide	186	109
P10	1 1/4" x 1/4" Biscuits 1000-0ry	32	27
F23	2 1/2" x 1/4" Biscuits 1000-0ry	34	29
W106	Asbestos Biscuits 1000-0ry	34	29
W106	6 pc. chisel set w/ case 1 1/2"	72	15
W106	10 pc. chisel set w/ case 1 1/2"	119	25
F100	16 pc. forstner bit set 1/2-1 1/2"	284	155
F107	7 pc. forstner bit set 1/2-1 1/2"	12	45
F100	5 pc. router bit set 1/2-1 1/2"	288	159
F100	Biscuit Jointer w/ case	300	159
C282	Planer w/ case, carb. bids. & guide	216	129
F2300	3 1/4 H.P. plunge router	299	189

MAKITA CORDLESS			
Model	Description	List	Sale
60700W	3/4" var. spd. rev. drill, 7.2v	130	78
60710W	3/4" var. spd. rev. drill, 7.2v	199	115
50900W	3/4" var. spd. rev. drill, 7.2v	256	139
60100W	3/4" cordless drill kit, 7.2v	164	95
60105W	3/4" cordless drill, 7.2v	99	65
04300W	3/4" angle drill, 7.2v	251	139
84000W	Hammer drill kit, 9.6v	272	145
43900W	9.6 volt cdl. recip saw kit	230	128
43000W	Jig saw kit comp., 9.6v	232	129
60120W	2 spd. driver drill		
	w/ clutch & case, 9.6v	236	117
60920W	Vsp. drill, kit complete	250	123
60930W	Vsp. drill w/ clutch - complete	261	127
68910W	Drywall gun 0-1400, 9.6v	237	135
63200W	9.6 volt battery	48	30
63200W	7.2 volt battery	40	28
5007NBA	7 1/4" saw w/elec. brake	233	125
5008NBA	8 1/4" saw w/elec. brake	284	158
004510	1/4 sheet pad sander	85	54
99000	3"x21" belt sander w/bag	266	140
992400	3"x24" belt sander w/bag	282	149
9945N	1/4 sht. tin. sand. w/bag	231	134
4200N	4 1/2" circ. saw 7.5 amp	225	127
43010V	Orb. vsp. jig saw 3.5 amp	289	155
JR3000V	W. recip. saw w/ case	227	129
LS1020	New 10" miter saw	463	245
9820-2	Blade sharpener	373	209
10000W	3/4" planer w/ case	209	115
19118	4 1/4" planer 7.5 amp	240	139
1100	3/4" planer w/ case	401	219
92078PC	7" sander-polisher	276	155
3610V	1 1/2 H.P. router	339	195
7711	10" H.P. trimmer	199	115
050182	4" grinder, 3.5 amp	126	75
004530	6" round sander	101	59
004550	1/4" sheet pad sander w/bag	86	55
043000R	3/4" angle drill	270	148
6302	3/4" vsp. 5.2 amp drill	209	125
HP2010M	3/4" vsp. hammer drill w/ case	300	165
7705W	8 1/4" table saw	504	259
2711	10" table saw w/ brake	547	489
2303N	12" planer/jointer	3123	1789
2440	15 1/2" planer	2595	1489
19058	6 1/4" planer kit w/ case	679	359
50058A	5 1/2" circular saw	223	135
6404	3/4" drill 0-2100 rpm, 2 amp	140	65
6510LV	3/4" drill rev. 0-1050 rpm	145	79
00139H	1/2" drill rev. 6 amp	241	139
5402A	16" circular saw - 12 amp	636	349
3112	3 H.P. plunge router	377	185
9401	4"x24" belt sander w/bag	318	169
3620	1 1/4 H.P. plunge router w/ case	192	109
4302C	Vsp. orb. jig saw	302	159
50778	7 1/4" Hypoid saw	252	138
LS1440	14" Miter saw	721	435
2414	14" cut-off saw AC/DC	351	205
5007NB	7 1/4" circ saw 13 amp	209	114
31253	3 H.P. plunge router sq/bise	377	195

DELTA TOOLS			
Model	Description	List	Sale
34-444	Table Saw Complete w/1 1/2 H.P. motor & stand	619.00	
34-445	Table Saw complete w/30" Unifence	799.00	
33-150	8 1/4" Saw Buck	485.00	
28-233F	14" Band Saw w/enclosed stand & 5/2 H.P. motor	699.00	
70-200	NEW 20" Drill Press	705.00	
17-900	15 1/2" Floor Drill Press	385.00	
40-501	18" Scroll Saw w/stand and blades	699.00	

SKIL SIZZLERS			
Model	Description	List	Sale
6850-02	"NEW" 1 1/2" EMH hammer drill w/ case 4 amp	255	129
5510	(551) 5 1/2" circ saw	112	105
5625	(552) 6 1/2" circ saw	175	129
5656	(553) 7 1/4" circ saw	132	125
5750	(807) 7 1/4" circ - drop foot	196	145
5790	(810) 10 1/4" circ - drop foot	400	275
5825	(807) 6 1/2" worm saw	220	154
5865	(825) 8 1/4" worm saw	250	164
4580	Var. - orbit jig saw w/ case	144	105
3810	10" Miter saw	263	125
3810S	3810 w/60 tooth carb. bide	239	
7575	1 1/4" palm sander	52	49
77	7 1/4" worm drive saw	230	145
5350	2 1/2 H.P. circ saw	80.99	77
5250	2 1/4 H.P. circ saw	68.99	65
2735-04	12v cordless drill complete w/ case & 2 batt.	210	144

LEIGH DOVETAIL JIGS			
Model	Description	List	Sale
D1258-12	List 314.00 - Sale 269.00		
D1258-24	List 375.00 - Sale 305.00		
LEIGH INSTRUCTIONAL VIDEO - SALE 29.00!!			
MMT 500	NEW 24" multiple mortise & tenon jig	509	399
MMT	12" multiple mort. & tenon attachment for D1258-12	269	219
MMT	24" multiple mort. & tenon attachment for D1258-24	299	239

HITACHI TOOLS			
Model	Description	List	Sale
TR8	Plunge router, 1 1/2 H.P.	219	119
MT12	NEW 3 H.P. var/spd. router	437	249
TR12	Plunge router, 3 H.P.	354	195
C10FA	10" disk, mitre saw	400	275
C12FA	"NEW" 12" mitre saw	586	339
CBF8	8 1/4" slide compound saw	859	469
FREUD L107M10	8 1/4" c/bld 48 tooth	58	49
C15F8	15" miter saw	745	409
FREUD L108M15	15" c/bld 108 tooth	361	115

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PIRANHA By Black & Decker			
Model	Diameter	#Teeth	List Sale
73-715	6-1/2"	18	13.70 7.35
73-750	6-1/2"	36	30.45 16.85
73-717	7-1/4"	18	13.90 7.99
73-737	7-1/4"	24	17.20 9.29
73-757	7-1/4"	40	31.30 16.79
73-758	8"	40	43.80 24.85
73-759	8-1/4"	44	44.65 24.99
73-719	8-1/4"	22	19.65 10.95
73-739	9"	30	32.35 16.79
73-759	9"	60	68.35 35.99
73-715	5-1/2"	16	13.70 7.49
73-704	7-1/4"	16	20.20 12.85

THE SPECIAL BLACK AND DECKER			
PIRANHA BLADE PRICES ARE BACK!!			
Model	Diameter	#Teeth	List Sale
73-740	10"	32	33.20 15.95
73-770	10"	60	61.48 29.95
73-711	10"	50	65.08 29.95

JORGENSEN STEEL I-BAR CLAMPS			
Model	Size	List	Sale
7224	24"	27.11	17.55
7236	36"	29.10	18.65
7248	48"	31.96	18.75
7260	60"	35.60	23.55

ADJUSTABLE HANDSCREWS BY JORGENSEN			
Item No.	Jaw Length	Open Cap	List Sale
#30	6"	3"	15.57 8.89
#20	7"	3 1/2"	16.74 9.35
#10	8"	4 1/2"	16.63 11.95



Between a Rock and a Hard Place

Last month, we got the cold shoulder from three boatbuilding companies we had hoped to use as sources for feature articles.

In one case, a very large, well-known firm politely but firmly declined our request to visit the plant and discuss the efficiency of its layout. In another—again, involving a big, national company—our phone calls seeking information on assembly methods went unanswered. In the final instance, one of our writers gained entrance to a custom builder's facilities but was told he could take no photographs and was not to discuss the particulars of any boat under construction.

What motivated all three boatbuilders to shun our involvement in their operations was a simple, genuine, and justifiable concern: They were worried that our publishing what we saw and heard would give their competition some information that might mean the loss of an edge in a valuable segment of the market.

The irony of this situation is that the single most common request we get from our readers (boat building and repair companies) is, "Be more specific; we need technical detail!" Well, we'd like nothing better than to comply, but we can't do it alone. In short, the information this magazine provides will never be any better—i.e., more specific—than what boatbuilders and repair yards are willing to share with us.

Don't assume that we're ignorant of the competitive pressure on your company. We respect what you're up against, and we aren't in the least interested in selling your operation down the river. At the same time, however, there's got to be some give and take when it comes to information. It's unreasonable and unrealistic to expect *Professional BoatBuilder* to get all its answers from "the other guy."

Besides, we just phoned him, and he told us to call you.

Chris Cornell

Number 4 April/May 1990

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Professional BoatBuilder (ISSN 1043-2035) is published bimonthly in February, April, June, August, October, and December in Brooklin, Maine, by WoodenBoat Publications, Inc., Jonathan A. Wilson, president. Editorial, advertising, and subscription offices are at P.O. Box 78, Brooklin, ME 04616, tel 207-359-4651.

Subscription rate is \$39.95 for one year (six issues) in the United States and its possessions. Canadian rate is \$52, U.S. funds. Overseas first-class rate is \$52, U.S. funds. Third-class postage paid at Brooklin, ME, 04616, and additional mailing offices.

POSTMASTER: Please send Change of Address (form 3579) to Professional BoatBuilder, P.O. Box 78, Brooklin, ME 04616.

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CONTRIBUTIONS: Address all editorial communications to **Executive Editor, Professional BoatBuilder, P.O. Box 78, Brooklin, ME 04616**. We are happy to consider contributions in the form of manuscripts, drawings, and photographs. All material must be identified with sender's name and address, and when sent with sufficient return postage, submissions will be returned if unsuited to our requirements. Care is taken with contributions, but we are not responsible for damage or loss.

Printed in the United States.

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A jacking carriage simplifies the removal and resetting of damaged keels. Richard Cadwalader explains.

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Selling these versatile small craft to a diverse audience takes some doing. Steve Cole tells why.

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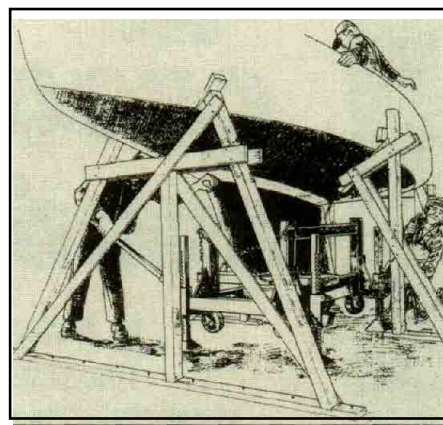
Many of today's manufacturers use rivets, but other methods are gaining. Bruce Buls visits three plants.

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Producing a package that informs and sells needn't break the bank. Ted Hugger offers proven techniques.



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DEPARTMENTS

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58 Tools of the Trade

A replacement for acetone, a dust-extraction system, and hazardous-chemical storage sheds lead the list.

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Meade Gougeon points out that an aging fleet is demonstrating how well various composites hold up.



Testing marine composites. Page 22.

On the coven Riveting teams assemble aluminum skiffs at the Grumman Boat plant. Photo by Tom Pich.

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Blister Protection

To the Editor:

The comments made by Whaler design chief Bob Dougherty (PBB issue No. 2) attributing the cause of gelcoat blisters to the use of steam-cleaning equipment by boatyards have some merit. Sometimes, an FRP hull comes out of the water after 1^{1/2}-2 years of immersion with no blisters on the wetted surface area, yet after 2—3 days in the hot sun, blistering is evident. But actually, very few boats have their bottoms steam cleaned, and those that don't still have blisters.

While the explanations for blistering can be theoretically complex and convoluted, the consensus of published research is that four basic requirements need to be met during materials selection and construction to minimize the occurrence of blisters:

- 1) Use a hydrolytically stable resin that is not prone to excessive leaching of compounds by absorbed water.
- 2) Select glass reinforcements with hydrolytically stable binders in low

amounts—or no binders at all. (See Ghotra, J.S., and Pritchard, G., "Osmotic Blister Formation and Prevention in FRP Marine Laminates," proceedings of the 28th Annual SAMPE Symposium, April 12-14, 1983, pp. 807-817.)

3) Use the minimum amount of catalyst and promoter needed to properly cure the resin. Overcatalyzing and promoting to increase production—or to compensate for an adverse environment—will compromise the blister resistance of the hull once it is put into the water.

4) Follow proper laminating procedure to ensure maximum glass wetout and to minimize the formation of voids, where fluids accumulate and expand when subjected to localized heat. These voids are where the fluid, rich in compounds leached from the laminate by absorbed water, accumulate and cause blisters on the bottom of boat hulls. (See Adams, R.C., "Variables Influencing the Blister Resistance of Marine Laminates," proceedings of the 37th Annual Technical Conference

of the Reinforced Plastics/Composites Institute, Society of the Plastics Industry, Inc., January 11-15, 1982, section 21-B, pp. 1-7.)

Rick McLean
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Piedmont, California

Professional Public Relations

To the Editor:

In the "Letters" section of issue No. 2, reader Paul Williams had a good point in suggesting that if a company wants a professional image in the public relations arena, it should hire a professional. However, even companies that hire PR professionals need to know what they are buying. Your article on PR was excellent and serves well as a primer for all marine businesses—with and without PR budgets.

Kudos to your publication for becoming the heartbeat of the boatbuilding industry in just a few short months.

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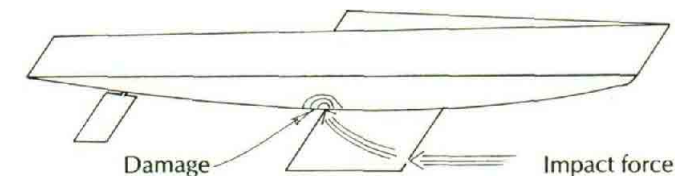
by **Richard Cadwalader**, Senior Editor
 Drawings by **Sam Manning**

Resetting keels on mid-sized sailboats is a common assignment for yards specializing in repairs, and the task can be awkward. Last year, while working in a Swedish boatyard, I was introduced to a caster-mounted, welded-steel carriage that simplifies handling of the keel and helps make resetting it easier in a tight corner of the shop.

Materials for the jacking carriage are all commonly available, dimensional-steel shapes. The casters should be ball-bearing mounted and have hard-rubber, non-inflatable wheels. Ratchet jacks are preferred over hydraulic units because they permit fine adjustment of the keel's angle and alignment. This is crucial when guiding the keelbolts back into their holes and for plumbing the keel once it is bedded and ready for final securing.

It's no coincidence that I first encountered the jacking carriage in Sweden. This nation probably has the highest number of boats per capita in the world, and despite an almost genetic sailing heritage, Sweden's boat folk often run aground in the Baltic's vast, granite archipelagoes. My boss, Jack Svensson, was fond of saying, "We have more water than rocks out there, but this boat managed to find a small stone." Fixing keel-damaged hulls and leaking keelbolts was a great source of business for the Svensson family's yard.

Several factors make keel resetting a more common job today than in the past. Obviously, the popularity of sailboats from 25' to 45' has swelled the number of boats in this size category. Coupled with this proliferation are cer-

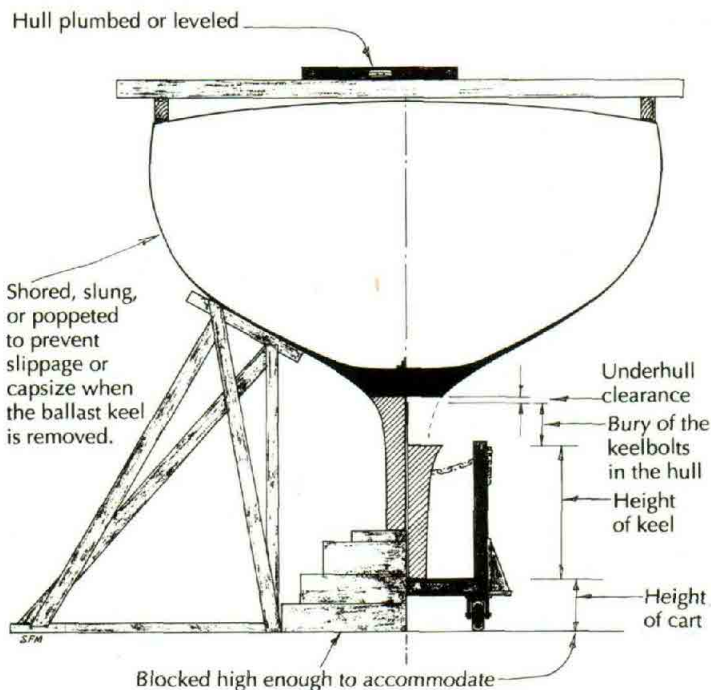


tain modern hull types which, despite the efficiencies of their underwater configurations, are more vulnerable to damage from groundings and hard sailing. Most susceptible in this regard are the IOR-influenced designs. Their fin keels tend to concentrate heavier forces in smaller areas, and hull structures are often too light to absorb large impacts or heavy, cyclical loading over time.

The first obvious sign of problems is leakage around the keelbolts or in the area just aft of the point at which the keel joins the hull. In the latter case, leakage may be the result of forces transmitted in a grounding.

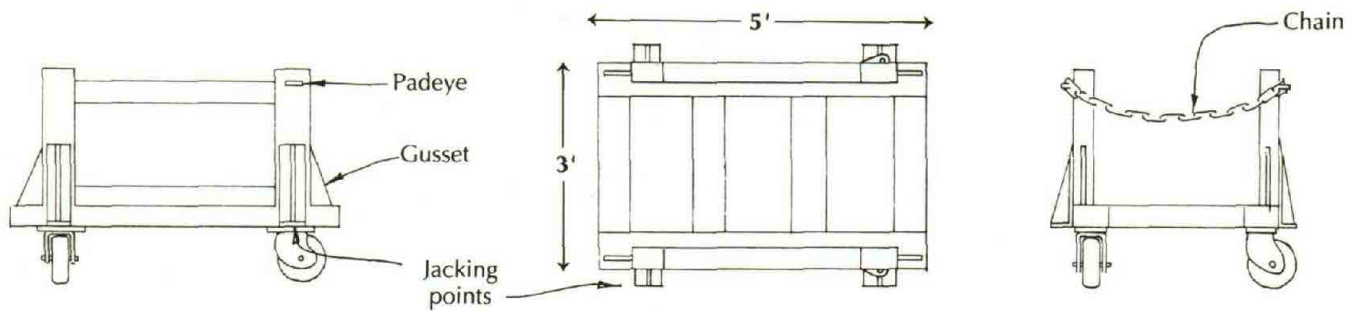
When the boat is hauled, it should be inspected while still suspended in the slings. This may show clearly that the keel-to-hull seam is started or perhaps even open. Problems in this area can be hidden if the boat is cradled right out of the water, since an open keel seam may be pressed tightly shut when the weight of the hull is allowed to rest on top of the keel.

If inspection reveals that the keel should be dropped off for resetting or repair, keelbolt length must be considered when placing blocking and removable



wedges under the ballast keel and storage cradle. If there is not adequate distance between the keel and shop floor, the tops of the bolts won't clear the bottom of the hull when the keel is lowered in the jacking carriage. (The proper distance = keelbolt length + carriage-bed height + dunnage under keel in carriage.) This is easy to forget if the boat is being rushed into winter storage, and the keel work is scheduled for a later date, months away.

Simplifies Keel Repair



The shape and construction of the storage cradle also deserve special attention. Allowance must be made for the placement of extra shoring and restraints to hold the lightened but relatively more top-heavy hull when it is free of the ballast keel. In addition, the cradle's design must allow the jacking carriage to be rolled into place around the keel.

Getting to Work

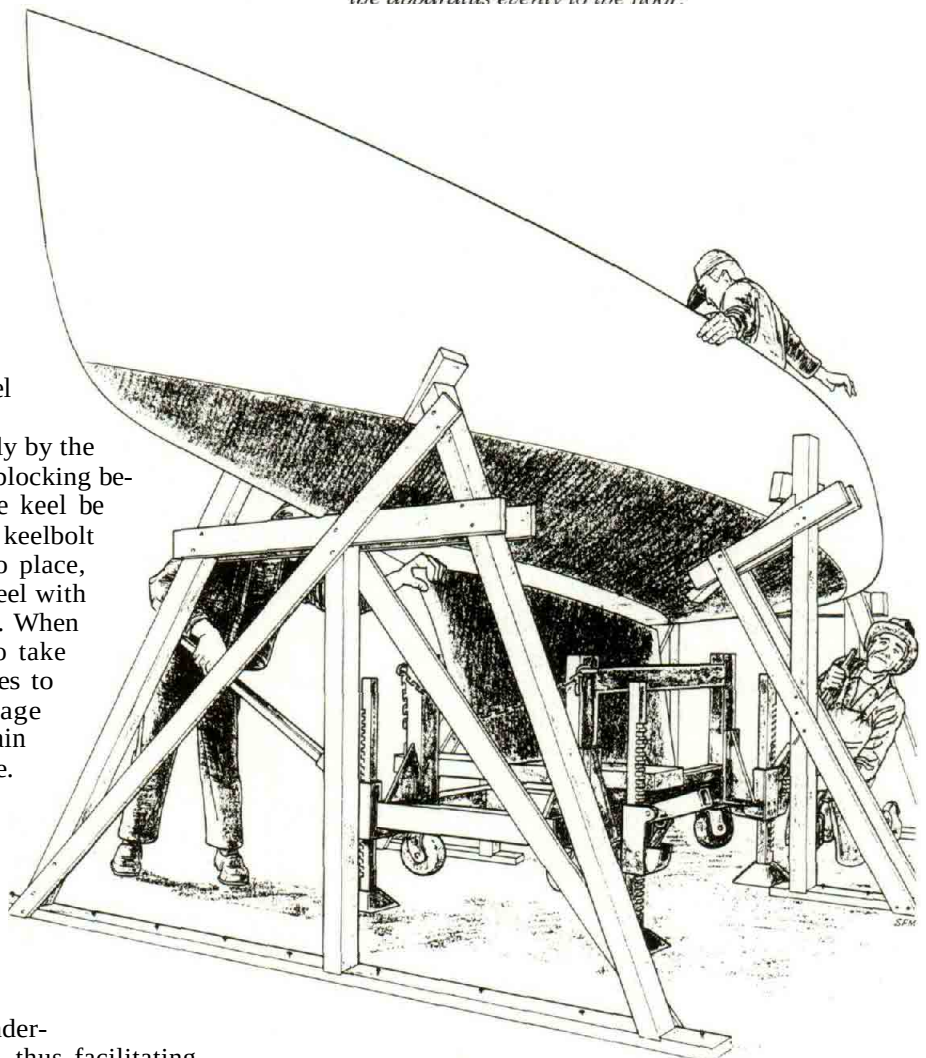
Once the boat is secure and plumb in its cradle, the keelbolts can be loosened and wedges driven along the keel seam to start the ballast away from the hull. A few dozen small, thin wedges can be made quickly from 3" lengths of steel bar-stock sharpened at one end.

When the keel is loose and held only by the nuts on the keelbolts and the support blocking below, remove the blocking and let the keel be held suspended by the still-fastened keelbolt nuts. Wheel the jacking carriage into place, and raise the carriage up around the keel with the ratchet jacks placed on each corner. When the carriage is level and beginning to take some of the keel's weight, use wedges to secure the keel between the carriage uprights, and fasten the carriage's chain restraint around the keel's leading edge. Remove the keel nuts, and begin to lower the carriage with even steps on the four ratchet jacks. If the keel is moving downward without binding or sticking, continue to lower the loaded carriage to the floor.

Once the carriage is back on the floor, it can easily be rolled aside, permitting clear access to the underside of the hull or the top of the keel, thus facilitating needed repairs.

Above—Side, overhead, and end-on views of the jacking carriage demonstrate its simple design and construction.

Below—With the carriage bearing the keel's weight, the keel nuts are removed, and the ratchet jacks are used to lower the apparatus evenly to the floor.

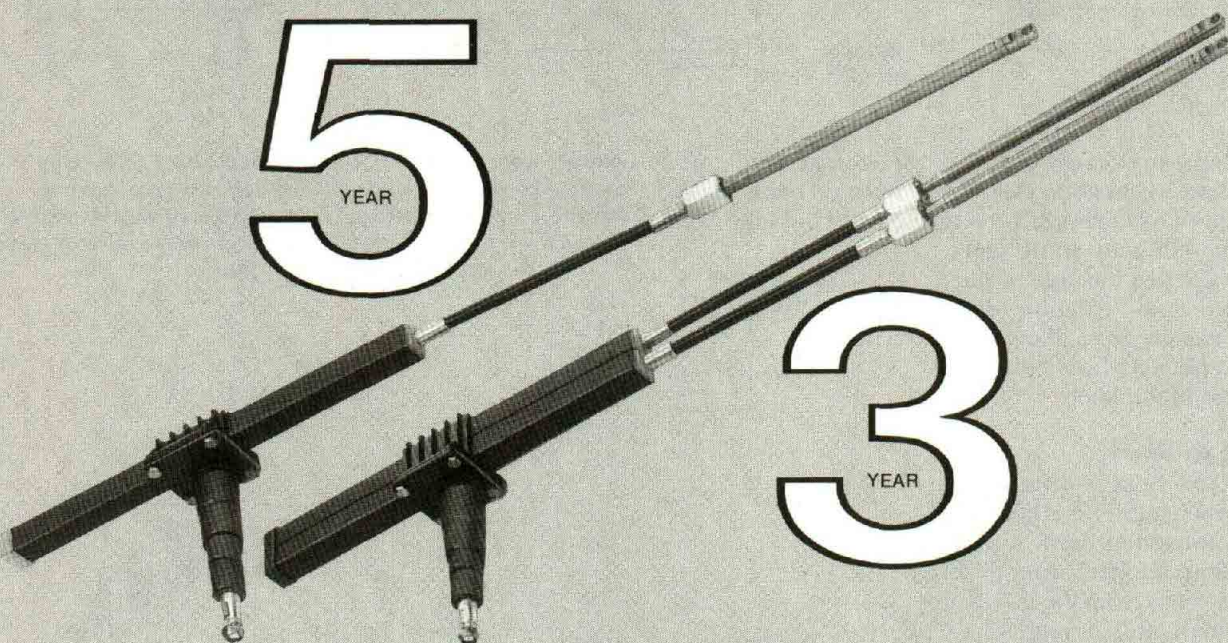


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Circle Reader Service No. 3

Marine Trade Associations

A host of diverse groups is addressing the critical needs of boat builders and repairers

by Nancy Griffin

"There's strength in numbers," says a builder of glass-over-plywood skiffs. Plying his trade on Cape Cod and in Florida, he belongs to local marine trade associations in both places.

In return for his membership fees, he gets priority for booth space in both groups' annual boat shows, where small builders can reach a large pool of interested buyers for a reasonable price. He also receives news of legislation the associations are monitoring at the state level, laws that could come between him and his business interests, or the interests of his customers.

Such political watchdogging is one of the primary functions of marine trade associations. In Florida, trade groups are working to overturn what they see as a restrictive, prepaid boat-use tax in their state. Staffers at the **Marine Industries Association of South Florida** say they get dozens of calls each week from out-of-staters who are scared to bring their boats to Florida because they don't understand the complicated tax or its many exemptions.

The South Florida group is a good example of an active trade association in a region with large year-round and seasonal populations of pleasure boaters.

MIASF's primary fund-raiser is its 30-year-old Fort Lauderdale International Boat Show, the largest in-water show in the world. Unlike some smaller trade associations that cannot afford to maintain an office or staff, MIASF has

a 13-member board of directors.

After boat shows and lobbying, the group's next order of business is maintaining a flow of information: keeping members informed of the government's latest attempts at restriction and the association's moves to block those restrictions. MIASF reaches its nearly 500 members through a monthly newsletter that tells of critical local, regional, and national issues. Also announced in the group's newsletter are the numerous business seminars and workshops MIASF offers its members each year.

California claims the second highest number of registered boats in the country, but **the Southern California Marine Association** attracts its 900 members from all over the United States. Of the group's 141 member boatbuilders, only 75 are based in California.

Like its counterparts elsewhere, SCMA is in the boat show business; the group puts on four annual shows, one of them a major event in Los Angeles. But revenues from this activity go into political work. Three years ago, a dispute between a boat owner and a repair yard operator touched off an attempt by a San Diego legislator to place boatyards under the jurisdiction of a state agency that oversees auto repair.



Among its other services, the National Marine Manufacturers Association (NMMA) offers a certification program. Here, one of the group's engineers inspects the dash of a new boat for compliance with government and industry construction standards.

four full-time employees, many volunteers who serve on committees, lobbyists on retainer in the state capital, and

"We successfully modified that effort into a bill that requires boat repairers to provide written estimates before doing any work, a practice most of them should have been doing anyway," says Harry Monahan, advertising and government relations manager for SCMA. This year, a similar dispute in the northern part of the state has provoked another legislative attempt to police boatyards through a separate agency established specifically to oversee their work.

"We get really vocal about these

issues," says David Wheeler, executive director of the **Northern California Marine Association** in Alameda. NCMA is currently fighting several attempts at what it describes as overzealous regulation by state government. For example, California's assembly has asked Congress to ban the dumping of dredge spoils inside 1,000 fathoms. "The Port of Oakland wants to dredge for container ships," says Wheeler. "But other cities, such as San Francisco, don't want Oakland to get bigger ships into that port, so they have

asked Congress to say they can't dump because the spoils may be toxic. We see a problem there for the small marina owners who now dump their dredge spoils in the middle of the bay. This ban would make it economically impossible for them to dredge."

Also of concern are national economic trends and their impact on future boat sales. Wheeler feels that the additional cuts into profitability for small marinas and repair yards may result in even fewer people entering the world of recreational boating.

ABYC and ABBRA—A Different Breed of Cat

Two national marine trade organizations do not lobby but take another tack. The first helps write the standards others lobby for (or against). The second informs its members of technological developments, health and safety issues, and legislative machinations.

Safety standards are the work of the **American Boat and Yacht Council**, headquartered in Millersville, Maryland. The 2,000 members of this non-profit educational organization represent every segment of the boating world, from insurance companies to engineers. About 10% of its members are boatbuilders or repair yards.

Formed by a U.S. Coast Guard-sponsored council in 1954, ABYC is charged with the responsibility of developing safety standards for the construction of boats and allied equipment, says Lysle Gray, executive director. Concentrating on small craft (20' or under), the group comes up with specifications that are widely referred to by the Coast Guard. "Our standards form the basis for most of the Coast Guard regulations that refer to recreational boats and some small passenger vessels," says Gray. "Our [specifications for] fuel, electrical, and ventilation systems apply to all gasoline-powered boats, regardless of size."

Equal shares of ABYC's budget come from members' dues, from a grant provided by NMMA, and from the sale of industry publications. The Coast Guard also provides a small grant (funded by a boating-fuel tax), usually for a specific project. Members

may purchase the 300-page book of ABYC standards for \$25 (non-members pay \$100), and updates are sent out as they occur during the year. ABYC will also sell portions of the complete standards book by individual topic—electrical specifications, for instance. Finally, members receive a quarterly newsletter that provides council news, plus one or two technical articles per issue.

"What members are really buying," Gray explains, "is a system of boating-safety standards that will help them produce a safe product. Such a product will be more attractive to the public because they won't be fearful of being hurt by it. And, because of the inevitability that accidents will happen, they'll be in a better situation to defend themselves."

Gray points out that boating-safety statistics have improved greatly since the 1971 Federal Boat Safety Act went into effect. At that time, over 20 fatal accidents occurred for every 100,000 boats. Last year, this figure dropped to fewer than six fatalities per 100,000 boats.

ABYC standards are developed by project technical committees made up of people who are experts in the particular field under scrutiny. A typical 10- to 20-member technical committee is made up of Coast Guard personnel, consumers, marine surveyors, and insurance representatives. One-half to three-quarters of the committee will come from the manufacturing organization that deals with the product under review. The committee's draft

standard is reviewed by two groups: a technical board and the ABYC board of directors.

After the first review, the standard is offered to the general membership for comment. All suggestions and questions are addressed by the technical committee, whose members then prepare a final draft of the standards for review by both boards before publication. The whole cycle takes about two years.

ABYC has developed 70 standards since its inception, and all are reviewed every five years. (Gray says 16 committees are now at work analyzing all 70 standards.) The organization has also written compliance guidelines for Coast Guard regulations and prepared posters that spell out for boatbuilders the details of fuel- and electrical-system regulations.

The **American Boat Builders & Repairers Association**, based in Boston, Massachusetts, is 46 years old. Although it's a business organization, the group considers its work primarily educational, informational, and supportive.

Most of ABBRA's 300 members are service and repair yards, some are marinas or sail lofts, and about 40% are boatbuilders, says Richard Guild, executive director. Besides dues, all members pay an initiation fee of \$300, for which they receive the *ABBRA Health and Safety Manual* (non-member price: \$400) and the *Boatyard Manual* (non-member price: \$40). The *Health and Safety Manual* is a compilation of procedures and practices, as

"And," he says, "we depend on new families constantly coming into boating."

"I think this year's slump in sales—down 30% from last year in California—is a reflection of the fact that recent administrations have been working to eliminate the middle class. High-paying blue-collar jobs are scarcer because factories have moved overseas and unions are weaker. Guys who used to drive a forklift for \$12 to \$15 an hour are now making \$8. Henry Ford was smart: He raised

everybody's pay so they could afford to buy Fords."

Thinking Big

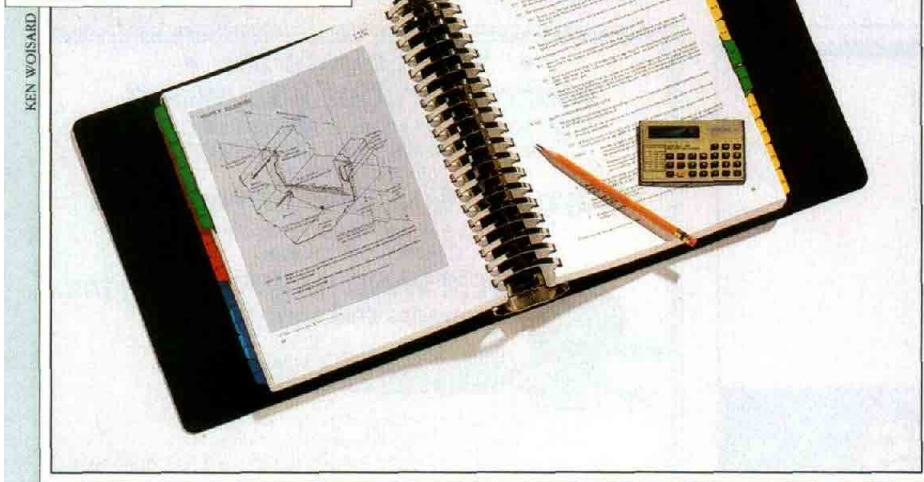
Where boat construction becomes shipbuilding and companies assume more importance in an area's economy, shipyards and operators sometimes band together to form statewide groups. The **Louisiana Shipbuilders and Repairers Association** is solely devoted to the welfare of those who build and repair large vessels. The 17-year-old LSRA was formed in response

to requests from the state's many shipbuilders.

Retired Navy admiral Tom Rinard, LSRA's executive director for the past two years, says members range from "mom-and-pop" repair or construction yards, to large operations building ship-size barges for the oil industry. "We have all the major shipbuilders in the state," says Rinard, who adds that his group has associate members from other Gulf Coast states, as well. Along with his informational and watchdogging duties, Rinard serves on a state



The primary purpose of the American Boat and Yacht Council is to develop and disseminate safety standards for the manufacture of small craft and allied equipment. The council's 300-page manual of construction and installation practices is updated continually.



well as OSHA safety data sheets and laws governing boatyard functions. The *Boatyard Manual* provides boatyard and marina operators with business information on forms, computers, and finances.

"ABBRA is a symposium of people all over the United States getting together with different and similar problems and working them out," says Patricia Norton-Pratt, of the Norton Shipyard in Rhode Island. Norton-Pratt is president of the board of the Rhode Island Marine Trade Association and a member of ABBRA's board of direc-

tors. "I've been associated with ABBRA for 10 years now, and I haven't seen anyone, anywhere, that sponsors such beneficial programs," says Norton-Pratt.

The association holds a day and a half of educational seminars in conjunction with its December annual meeting, and organizes another three days of intensive seminars in the spring. One ABBRA program, called the "Dispute Response Process," provides members with a means of mediating business arguments with customers. It calls on a three-person com-

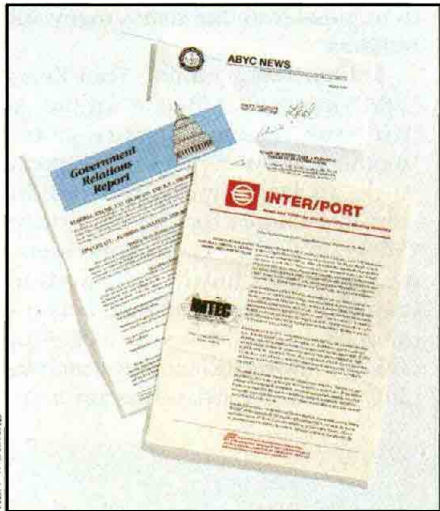
mittee to render a non-binding, advisory opinion that may keep the parties out of expensive litigation. ABBRA also sends its members a bi-monthly newsletter that provides legislative notes of interest and related boating news.

The group doesn't get particularly high marks from some members located far from Boston. Still, several say ABBRA's manuals and workshops were especially vital to them when their businesses were new. Others say they joined for the now-defunct insurance program and feel they no longer benefit from belonging.

But ABBRA's supporters are fiercely loyal, citing the group's "humanity" in helping members. As an example, when a fire destroyed a member yard's facilities recently, the association started a relief fund to help the owners rebuild.

Robert A. MacGregor, of the Concordia Company in South Dartmouth, Massachusetts, sums up many members' attitudes toward the group: "The most important part of ABBRA is that it provides an opportunity to share industry-wide problems and to pool information. Although I've never used it, the dispute-resolution process sounds good. The chemical-compliance program is another example of the organization's strengths. ABBRA endorses an outside firm that can show the feds if your yard is up to snuff."

"Most of our members are smaller companies, and that influences the kind of organization we are. We're in a business that tends to be regional, which is a real challenge for ABBRA as a national group."



KEN WOISARD

Regularly publishing newsletters to inform members of crucial legislative, trade, and safety issues is part of every marine trade association's duties.

committee working for changes in Workers' Compensation rates.

Training is another area that gets LSRA's attention. "We are very concerned with the educational processes in the state," Rinard says. On the

group's behalf, he works on a board of advisors for the state vocational-technical schools to make sure that "schools continue to offer updated curricula to support our shipbuilding and repair industries, which shift dynamically from time to time."

On a National Level

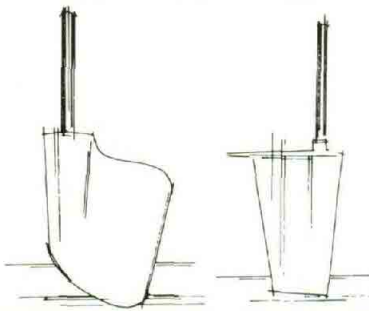
More than 1,600 marine manufacturing companies, associated businesses, and marine trade groups (like the **National Association of Boat Manufacturers**) comprise the membership of the 10-year-old **National Marine Manufacturers Association**. Perhaps the best known of all marine industry groups, NMMA lobbies the federal government on behalf of production and custom boatbuilders, and their allied suppliers.

With a main office in Chicago and branch offices in five other states, NMMA maintains a staff of five professional lobbyists in Washington, D.C., and keeps others on retainer in the 15 busiest boating states to monitor legislative activity there. When operating

at the state level, NMMA usually works with local marine trade associations. Occasionally, however, the national and local groups find themselves on opposite sides of an issue.

"It may be something the local organization doesn't find important, but we find detrimental," says George Rounds, NMMA's Chicago-based director of association services. "For instance," he recalls, "when Connecticut tried to license boat operators, the local association didn't fight it, but we did. Usually, though, we're in Washington trying to keep the government out of our wallets."

Besides lobbying efforts and watchdogging, NMMA offers its members cooperative advertising and promotion; business consulting; group insurance programs; boat certification; discounts on technical, legislative, and special-interest publications; and reduced rates for exhibiting at NMMA's 11 consumer and trade boat shows. In addition, the association offers a full range of boating and industry statistics; a weekly newsletter; access to mailing lists;



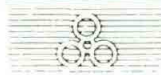
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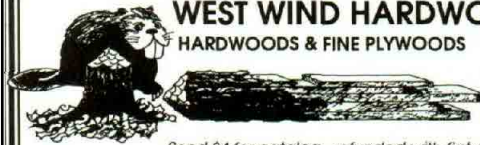
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periodic conferences and training programs; and a week-long "Washington Legislative Seminar," during which members can meet with lawmakers.

Most large boat manufacturers say their membership in NMMA is well worth the cost. (Dues are based on annual sales; the higher the sales, the higher the membership fee.) Most cite the group's lobbying efforts as the foremost benefit but say that's just the beginning.

"Without getting together, you don't focus on your real competition—other products such as recreational vehicles and golf clubs on which the consumer can spend his discretionary dollars." That's the opinion of George Sullivan, vice president of marketing and communications for giant U.S. Marine, the parent company for Bayliner and several other boat, engine, and trailer manufacturers. "Focusing inward, on other builders, doesn't help. NMMA gets you to look more at the customer and how to meet his needs rather than at thwarting the efforts of someone else in the industry."



Associations often make membership a prerequisite for exhibit space in boat shows they operate, and some manufacturers resent the practice. The associations counter that, without this incentive, they wouldn't get the members—and dollars—needed for effective political action.

"It's the boating media news for us," says Blaine E. Timmer, vice president of operations for Four Winns, part of the OMC Boat Group, a subsidiary of Outboard Marine Corp. "NMMA is

also the source of most of the boating research that allows us to form our strategy for years to come. But the key [benefit of membership] is the collective clout we have as a result."

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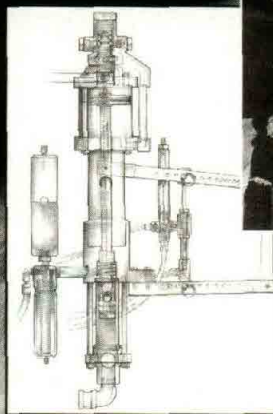
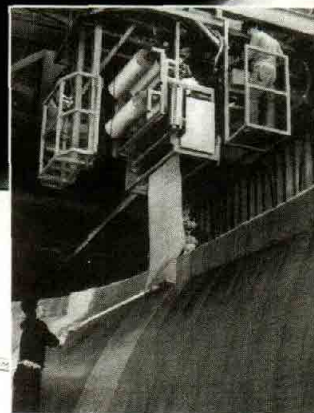
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Many associations cover their considerable expenses by operating boat shows. The Fort Lauderdale International Boat Show, above, bolsters the war chest of the Marine Industries Association of South Florida.

Timmer recalls the 1980 gasoline crisis, when President Jimmy Carter suggested conserving fuel through a ban on weekend boating. That ban, however, never occurred. "Why?" asks

Timmer. "Because NMMA had all the facts and figures, and was able to show Congress that boating, altogether, used only about 1% of the total gas consumed."

Smaller builders have a more mixed response to NMMA, ranging from echoes of the larger outfits' high praise for the association's common voice and lobbying efforts, to resentment that "you almost *have* to belong to get into their shows." NMMA's boat-certification program wins praise from some builders, who think it gives their line a "quality" image. But owners of some small shops we surveyed say if it weren't for the boat shows, they probably wouldn't join until their companies grew much larger.

New Orleans, Louisiana, still the No. 1 port in the United States in terms of tonnage, is also home to the **Off-shore Marine Service Association**. The group is comprised of 210 member companies, of which about a dozen are builders and/or repairers. Working principally on the national level, the 33-year-old association monitors legislation that might affect the operation of offshore vessels engaged in support of the petroleum industry and affect related vessel-construction activities.

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According to Charles Havnen, OMSA's vice president, "We analyze, review, and disseminate information on laws, regulations, or treaties that impact our members. We also represent them before Congress, state legislatures, or agencies (such as OSHA or EPA) that might be involved in the promulgation or implementation of laws that will affect members on a global basis."

OMSA represents several different groups of vessels, including small crewboats, large construction barges, and a variety of specialized offshore craft. The staff includes two full-time lobbyists. Members receive a newsletter; assistance with the development of improved inspection, drydocking, and certification procedures; and general legal, insurance, and contract information. Although builders comprise a minority of OMSA's membership, Havnen says they are often the biggest employers and regularly represent the group's associate members before its board of directors.

The National Association of

Passenger Vessel Owners in Washington, D.C., is a full-service trade association that tracks Coast Guard issues and legislation, primarily for owners of excursion and dinner boats, car and passenger ferries, and some charter fishing vessels. The group pub-

NMMA was able to head off a Congressional ban on weekend boating because it had the hard numbers to prove that boaters were using only 1% of the total gasoline being consumed.

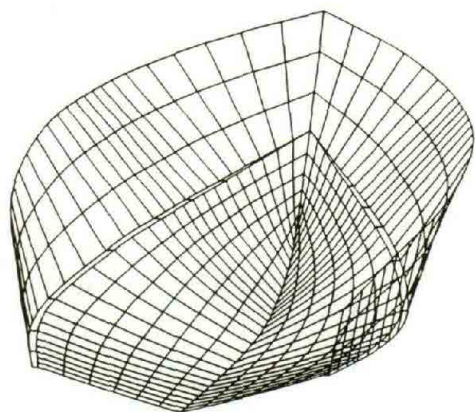
lishes a monthly newsletter, sponsors an annual national conference, and offers an insurance program, technical consulting, and a legal hotline. Although NAPVO counts only 10 smaller yards among its 430 members, the association includes a boatbuilder on its Public Policy Committee to represent the marine manufacturer's point

of view. "Anything that concerns or affects the owners, concerns or affects the builders," says NAPVO's executive director, Eric Scharf.

Founded in 1944, the ***American Waterways Operators*** organization in Arlington, Virginia, represents 250 members, primarily owners of tugs and barges. Within AWO are several "conferences" devoted to specialized groups. One of these is the American Waterways Shipyard Conference, with about 50 members.

"In 1976, a group of shipyards joined AWO and formed a conference to focus on issues that concerned them," explains Cornel Martin, director of AWSC. These builders primarily construct and repair barges and tugs for inland waterways and the coastal trade, but some of their work is now swinging toward passenger vessels and ferries. "We cover the whole spectrum of yards and vessels," says Martin. "The main purpose of AWSC is to represent small and medium-sized shipyards before Congress and regulatory agencies to protect their inter-

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Marine Trade Associations

ests." AWSC regularly publishes surveys on wages and benefits; occupational injury and illness; and shipyard employment, production, and trends.

AWO employs two full-time lobbyists and two regulatory-agency contacts. The primary issue AWSC is tracking now on the federal level is reflagging, whereby companies purchase American hulls, take them overseas, completely rebuild them, and return them to commercial service in the United States, still flagged as American vessels. Several firms have converted offshore supply boats to fish processors by this method. AWSC has joined several of other groups in a lawsuit to overturn a Coast Guard ruling that created this loophole in the Anti-Reflagging Act of 1987.

The **Shipbuilders Council of America**, based in Washington, D.C., has 60 members drawn mostly from the larger builders and repair yards. But the group also includes allied industries, such as equipment suppliers and naval architects, and associate members, such as lawyers and consult-

ing firms involved in maritime work. Sy O. Nunn, the council's vice president, says SCA's members employ 90% of U.S. shipyard workers.

Besides benefiting from the group's lobbying efforts, members receive numerous publications: a weekly newsletter that is also mailed to decision-

"Without getting together, you don't focus on your real competition—other products such as recreational vehicles and golf clubs on which the consumer can spend his discretionary dollars."

makers in Congress, the Navy, and other branches of government; a legislative newsletter that informs members of Congressional activity; and quarterly publications relating to Department of Defense contracts, ship repair and shipbuilding, and labor. In

addition, SCA publishes special reports on topics such as foreign shipbuilding subsidies and an analysis of the U.S. shipbuilding and repair industry's ability to assist during a national mobilization.

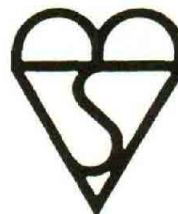
Generally, members interviewed about all these groups gave them high marks for their work on behalf of the marine industry. On the federal level, these associations are fielding more than a dozen full-time, professional lobbyists—as well as countless volunteers who are fighting politically for the best legislative and regulatory interests of manufacturers, builders, and repairers. "If it weren't for them," says Scott Tibbs, Jr., sales representative of Gulf Craft of Patterson, Louisiana, "we wouldn't have one voice in the matters that affect us." **PBB**

About the author: A veteran news reporter and feature writer, Nancy Griffin is currently a Field Editor at National Fisherman magazine.

More on Marine Trade Associations on page 18...



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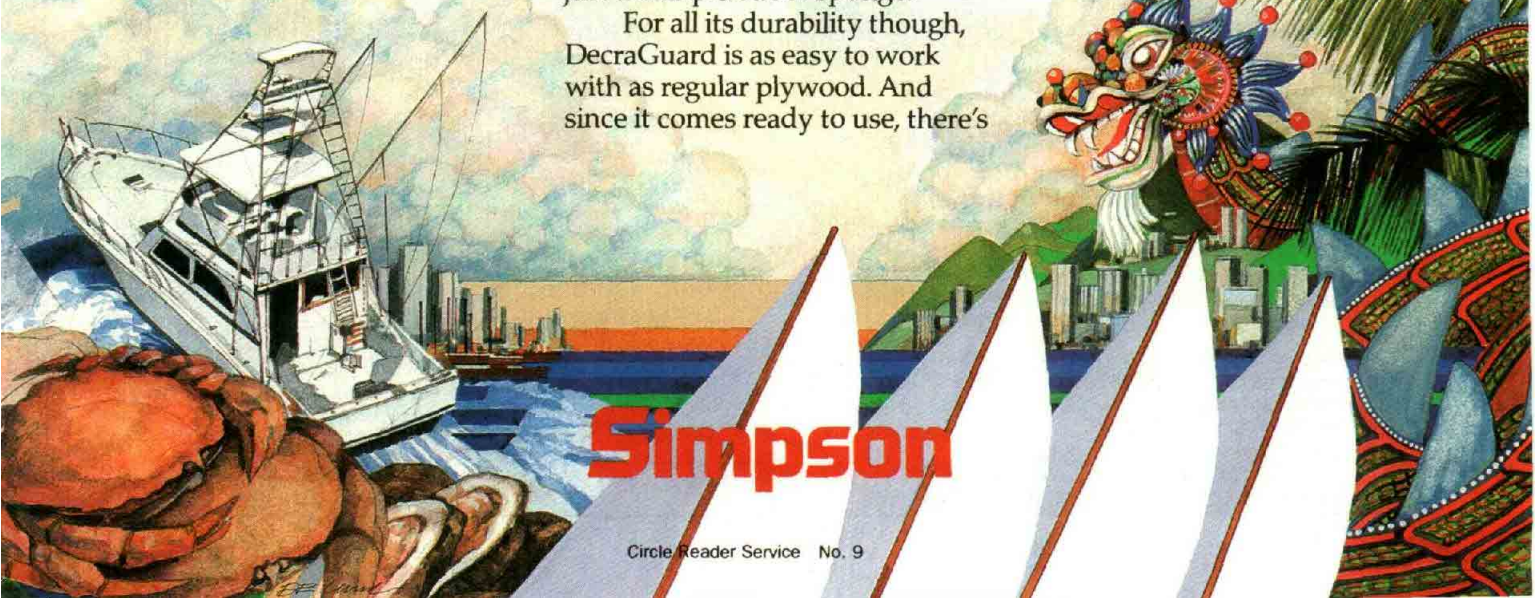
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Local, State, and National Groups Unite to Buck Boating Bill



FLORIDA DEPARTMENT OF MARINE RESOURCES

Boating restrictions aimed at protecting the manatee were included in an omnibus bill whose other provisions caused an uproar among Florida trade groups.

In Florida, environmental groups are trying to save the manatee, an endangered marine mammal (often thought to be the mermaid seen by

sailors). To accomplish this, they have called for a statewide boat speed limit and a virtual moratorium on marina construction. During 1988, 133 manatees died in Florida, and fully 43 of those deaths occurred during collisions with boats. Environmentalists believe that only 1,200 to 1,400 of the endangered mammals now remain in Florida waters.

In an omnibus bill it presented to the Legislature, the state's Department of Natural Resources proposed not only the aforementioned steps to protect manatees, but also a tax on all new-boat sales, the licensing of boat dealers, an increase in boat registration fees, the registration of all

boats, and mandatory boating-safety training. The legislation also incorporated a host of other measures, such as giving DNR broad powers to create restricted-wake zones throughout the state.

These proposals caused an uproar that saw representatives of all the state's marine trade associations lobbying against the bill. Moreover, the debate was heated enough to draw the attention of the Chicago headquarters of the National Marine Manufacturers Association (NMMA). Normally, that group's lobbyists address national legislative issues that threaten the pleasure-boating industry as a whole. Nonetheless, if proposed state legislation has far-reaching consequences, NMMA will get involved and cooperate with state associations. The bill proposed by Florida's DNR was just such a case.

"We don't want to make manatee-burgers out of all the manatees," said

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Marine Trade Associations

Michael Dickman, director of association services for the Fort Lauderdale-based Marine Industries Association of South Florida (MIASF). "But, at the same time, we don't want to shut down recreational boating because of the animals. That sounds cruel, because the animals were here first. It's difficult for us to do anything without looking like mongrels.

"Still, we see a lack of updated information on the manatees. The environmentalists say 1,200 manatees remain, but that figure is six or seven years old. We're saying that maybe more manatees are getting hit because there are more manatees, not more boaters."

Today, the Marine Industries Association of Florida (comprised of all the state's marine trade associations) is working with NMMA and local groups such as MIASF to ensure that the boating law finally passed by the Legislature will be as fair as possible to everyone—from manufacturers to manatees.

—Nancy Griffin

NAMES & ADDRESSES

Editor's note: Due to space limitations, the following list includes only those marine trade associations covered in our feature story.

American Boat and Yacht Council
P.O. Box 747
Millersville, MD 21108
301-923-3932
fax 301-923-3988

American Boat Builders & Repairers Association, Inc.
715 Boylston St.
Boston, MA 02116
617-266-6800

Louisiana Shipbuilding and Repair Assn.
5163 General DeGaulle Dr., Suite 213
New Orleans, LA 70131
504-392-5757

Marine Industries Association of South Florida, Inc.
1875 West Commerical Blvd., Suite 110
Fort Lauderdale, FL 33309
305-491-7016
fax 305-491-0132

National American Waterways Operators
1600 Wilson Blvd., Suite 100
Arlington, VA 22209
703-841-9300

National Association of Passenger Vessel Owners
1511 K Street N.W., Suite 715
Washington, DC 20005
202-638-5310

National Marine Manufacturers Assn.
401 N. Michigan Ave.
Chicago, IL 60611
312-836-4747

Northern California Marine Assn.
Suite 103, 2236 Mariner Sq. Drive
Alameda, CA 94501
415-521-2558

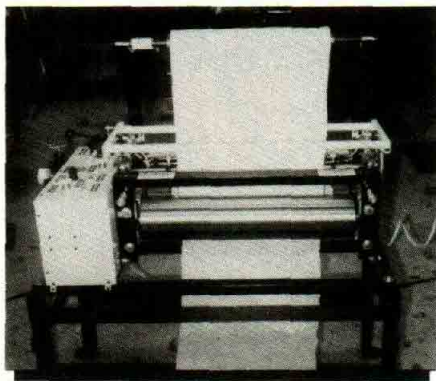
Offshore Marine Service Assn.
1440 Canal St., Suite 1709
New Orleans, LA 70112
504-566-4577
fax 504-566-4582/OMSA

Shipbuilders Council of America
1110 Vermont Ave., N.W.
Washington, DC 20005
202-775-9060

Southern California Marine Assn.
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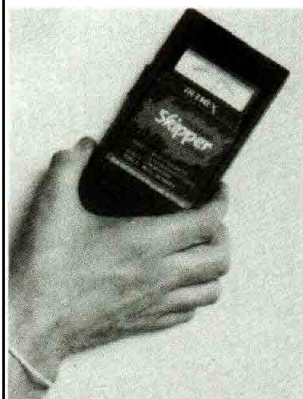
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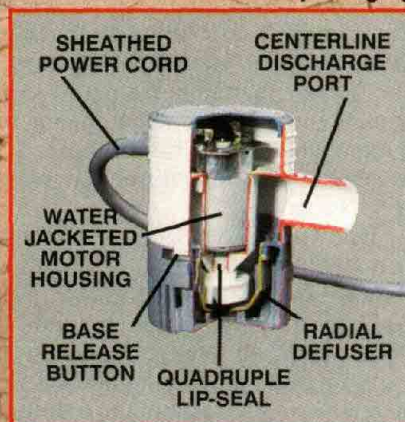
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TESTING C

WHAT THE LABS AND PRODUCT DATA SHEETS

by Bruce Pfund, Technical Editor

ALL

marine professionals—whether naval architects, engineers, component salesmen, or boatbuilders—have to deal with the realities of materials testing: How strong is that stuff? How hard does it get? Why choose resin A instead of resin B? Does the job call for woven or knitted reinforcements?

If a problem develops in the fabrication of a particular part, logic dictates going back to the manufacturer's test data to check out what's expected for the product, whether it's core, resin, reinforcement, or gel-coat that's misbehaving. The builder may also decide to send out a sample for laboratory analysis and, when the results come back, to relate the numbers to the test data. Unfortunately, drawing solid conclusions from the information in the product data sheet (PDS) or the test lab report may be a perilous exercise at best.

Lest there be any misunderstanding, however—the numbers on the PDS don't lie. The manufacturers and distributors of the many materials that are incorporated into modern composite boats are *not* fudging the testing. Nor are independent labs cutting corners, for they follow accepted test methods to the letter. Their results are valid, repeatable, and can *sometimes* be used as a means of comparing materials.

However, most of the tests used by component manufacturers and independent labs bear little if any relevance to what a boat experiences during normal operation. They're *laboratory procedures*, and they're commonly conducted on samples made *under ideal circumstances* that don't come close to the dusty, sticky conditions in most boatshops. These factors, com-

bined with a host of other variables associated with boat construction, lead to a scary situation:

The people operating your boats don't know anything about materials testing; they simply want and expect a safe, reliable product. Every time those customers leave the dock, however, they're really conducting a test of your boats' quality and integrity—under conditions far less controlled than those on the shop floor or in the test lab.

Does it matter how a hull laminate will behave a year down the road if, in fact, the boat will be going 60 knots some 12 weeks after it's popped from the tooling?

Somewhere in the distant past, there was a smart caveman who decided to whack a convenient rock with the branch he'd selected as a club before heading out to bash a mastodon for dinner. If the first club broke, he'd select others until he found one that didn't fail. Today, sophisticated labs use fabulously expensive testing machines and procedural manuals that are mind-boggling in detail. Nonetheless, testing all boils down to the same thing: trying to develop information about how materials function when stressed, whether they're meant for tranquilizing dinner or building boats capable of punching through 6' swells at 50 knots.

The American Society for Testing and Materials (ASTM) was formed to standardize test methodology and equipment used in the analysis of steel, aluminum, concrete, and wood, the primary engineering and building materials of the early 20th century. Most of the test data you'll find in a manufacturer's PDS (see accompany-

ing story) has been developed from ASTM testing. Tensile, flexural, and compressive behavior will all be identified by specific ASTM test-procedure numbers.

Standardized testing is important—it ensures both comparability and repeatability. Tests run on identical samples in New York and Tokyo on a Monday should produce identical results, and those results should be exactly the same if the tests are repeated on the following Friday. ASTM testing prevents "apples-versus-oranges" comparisons and has gone a long way toward increasing our understanding of materials and how they behave under load.

There are, however, more than a few snags in the use of standardized testing for boatbuilding materials. For one thing, composites don't really behave like the metals for which many ASTM tests were developed. They're "directional materials," where fiber orientation has a big effect on strength. By contrast, aluminum is aluminum is aluminum, regardless of the direction in which the load is applied.

Yet another big difference between composites and metals can skew test results: Over time, if left alone in a benign environment, composites increase in strength due to continuing chemical reactions. That's not the case with metals, which remain unaffected if protected from corrosion and kept in an unloaded condition. Many test procedures for composites specify a "conditioning" cycle that attempts to duplicate the effects of aging within a short time span. No one can afford to age samples for a year at ambient temperatures before testing, but the rub is that a panel exposed to elevated temperatures may yield very different

COMPOSITES

CAN—AND CAN'T—TELL BOATBUILDERS



Those who rely on laboratory analysis of test panels must remember that the pounding and twisting forces exerted by heavy seas will ultimately determine whether a laminate is sufficiently strong.

test results than a laminate produced in a boatshop. Few boatbuilders can cure their composites with the kind of heat available in the laboratory.

In sum, sample conditioning is a source of tremendous errors in the testing procedures used with marine composites—not because the concept is invalid, but simply because it doesn't duplicate the way boats are built. Does it matter how a hull laminate will behave a year down the road if, in fact, the boat will be going 60 knots some 12 weeks after it's popped from the

tooling? Undercatalyzed composites, a subject addressed in PBB issues No. 1 and 2, will never approach their potential strength when exposed to ambient temperatures for decades of real-world operation. And yet, just a few hours of conditioning time can do wonders for their performance. The point is: Which will the boat owner be operating—the lab samples or the boat?

The bottom line is that the numbers developed from conditioned samples are irrelevant if the conditioning pro-

cedure can't be regularly duplicated on the shop floor.

Tales from the Test Lab

I recently spent an afternoon with Bill Bertelson in the test lab at Gougeon Brothers in Bay City, Michigan. When I walked into the facility, I didn't find the sedate, library-like atmosphere I had expected. Instead, Bertelson was wearing soundproof headphones, and the big MTS (Material Testing Systems) tester over in the corner was working hard, pulsing away as it tortured a



BRUCE PFUND

A wood/epoxy laminate fails under compression during cyclic fatigue testing at the Gougeon Brothers lab. This company intentionally builds defects into its test samples.

sample section of windmill blade eight times per second. I jumped about a foot when the coupon (test panel) exploded with a gigantic BANG!

The ear protection suddenly made sense, as did the shield surrounding the sample in the tester. This wasn't anything like the ASTM testing I was used to, where the tester's ram extends at a very leisurely pace. It was more like World War II, or the times when I've been aboard a vessel at sea and something has let go in a big way.

I asked Bertelson about the relevance of ASTM testing in the evaluation of boatbuilding materials. "ASTM test procedures were developed for analyzing the strength of metals," he said. "Like all materials, metals have a 'range of elastic deformation' within which they can be tortured, but will return to their original shape. Single-cycle tests can analyze their behavior very accurately. For most applications—say, building construction—the loads on materials are 'static,' or constant, and ASTM tests do a wonderful job of developing data on how test coupons behave under static loads, within the range of elastic deformation."

Boats, however, are about as different from buildings as you can get; they're dynamic structures. Just imagine surfing 20' waves in the Southern Ocean, and you'll get an idea how quickly the loads on a composite boat change. Pushing, pulling, or bending a sample just once or twice, and deciding that everything's OK, is a scary proposition when you consider that many composite boats are in service for a decade or longer.

In his paper on the fatigue characteristics of marine composites, Meade Gougeon lists some frightening numbers: At one wave every three seconds, a boat hull will have experienced 1 million loading cycles after 833 hours of operation. Since there are plenty of 10-year-old boats out there, and 83 hours' use per season isn't unreasonable, shouldn't we question whether they're still safe?

Before my visit to Gougeon, I had always wondered why all-out racing sailboats and aerospace components are laminated with epoxies instead of polyesters, since the latter get "harder" when cured. My error was equating hardness with strength. On the basis of a single, static ASTM test I was right, but Bertelson showed me data from the MTS fatigue tester that graphically illustrated a very fundamental property of epoxies: fatigue resistance. It's a

Tougher resins—like vinylesters and epoxies—are perceived as "softer," but are actually more damage tolerant because of their higher elongations.

characteristic that is easily missed if you look only at hardness and ASTM test characteristics for flexural, tensile, and compressive strengths. Yes, epoxy has lower values in a single-cycle static test, but over time—when the coupon is tortured for thousands or millions of cycles—epoxies show their true colors and hold up better.

Secondary Properties

Whale and iceberg impacts in the open ocean are often listed as the reasons for the sudden sinking of composite vessels, but Meade Gougeon doesn't buy that explanation. "Fatigue is the curse of the composite industry," he says. "Tests developed for isotropic [the same in every direction] materials

don't address the complications of analyzing 'directional' materials like composites. Torture a metal sample from a number of directions, and it will behave the same way in each. In contrast, composites exhibit 'secondary properties.' If you pull perpendicular to the fibers, the strength may be $1/50$ to $1/100$ of what you'd get pulling in line with the reinforcements. What you're testing [in a one-direction stress trial] is the strength and toughness of the resin, *not* the reinforcing fibers."

Data Scatter and Size Effect

"Data scatter [the range of variations in test results] is another problem in analyzing composites," continues Gougeon. "Because they're directional materials, composites exhibit huge variations in strength when they're tested. The variations when a metal is tested are much smaller. Even with samples made under optimum conditions, variations in fatigue-testing results can be on the order of ten to one. Interpreting the data is almost an art form. There's no black and white, and often the range of results stems as much from tester variability as from material variability."

Gougeon speculates that many sinkings attributed to whales and icebergs are actually caused by dramatic, fatigue-induced laminate failures. "No one is keeping track of sudden, catastrophic sinkings," he says, "and not too many of the vessels are recovered for post-mortems. Boats are a nightmare for composite analysis, and 90% of what

we need to worry about is the secondary properties—factors like resin toughness and bonding to the reinforcing fibers. Test a laminate made with poorly sized fibers just once, and it will seem OK. Yet under cyclic loading, it will fail rapidly."

I inspected quite a few exploded test coupons in the Gougeon lab before I noticed something very peculiar: they all had defects. The samples were multi-layer veneer laminates representative of windmill blades, and there were a number of pronounced gaps between the veneers in every one. Explained Bertelson, "The flaws aren't in the material but are actually built into the samples. They introduce weakness similar to that caused by



Many builders have their best laminator make up test panels under ideal conditions, forgetting that what happens on the production floor, where the boat is actually built, is something altogether different.

joints and overlaps in fiberglass."

Added Gougeon, "The Department of Energy insisted that we test samples with deliberate flaws because no matter how skilled the work force and how good the equipment and materials, there will be defects." Gougeon also mentioned the ominous "size effect," a concept developed by a mathematician named Weibull in 1939. It predicts that the strength of a structure decreases as its size increases because of the possibility that random defects may group together in one area. "Due to the size effect, we had to increase the safety factor for our 400'-diameter windmill blades by 15% in comparison to the smaller blades," reports Gougeon. "It's a serious issue—

especially as boats continue to get larger—and there's very little test data on the subject."

Do We Make Unrealistic Samples?

In most boatbuilding facilities, the standard method for making test samples is to send the best laminator to the cleanest corner of the shop. Working with clean tools and fresh materials, his job is to make the best possible laminates. To borrow a term from my days as a welder, most test coupons are made "horizontal-down," which is easiest but not particularly realistic. I've always recommended that samples be laminated at a 45° angle, which comes closer to duplicat-

ing the orientation of the laminates in the mold. Even so, the goal has always been to produce a top-quality sample that would yield the highest values during testing. But does that goal make any sense?

Failures in marine laminates generally occur in areas of poor workmanship—sloppy overlaps, voids, dry spots, and puddles. It's an old but valid cliché that states, "A chain is no stronger than its weakest link." What's the point in fabricating and testing the best laminates a shop can make, when it's the worst ones that will cause problems?

The size effect is random and beyond our control, but what about the factors we *can* change? Should test coupons have reinforcing-fabric overlaps? Should the overlaps be standard size or undersize? Should there be air bubbles at the overlap, like those you'd get if the butt edge of one layer wasn't sanded to a taper before the next layer went down? And what about cores—should there be gaps representative of poorly spiled butt joints? What about the slots between the block on "contour-cut" materials? How thick should the bond line be, and should the samples contain bond line variations?

Some may argue that these issues are irrelevant, that in a single-cycle test, poorly tailored overlaps of badly fitted core probably won't change the test results one bit. Still, late in 1989 I conducted sea trials on a powerboat with a flying bridge that shuddered and shook with every swell. Thinking back, I realize that I was conducting real-world dynamic fatigue testing, with human beings along for the ride. That's just what is going on aboard every boat in the water today. It's a situation that should leave every builder thinking about the strength of his materials.

Scrutinizing a Standardized Test

ASTM D-790 is a standard "load-deflection" test, where the sample is supported near its ends, and a load is applied at the center of the panel. In D-790, the tester's ram extends at 0.4" per minute, far slower than the rate at which panels in a boat underway at sea are loaded.

That's significant, because the flexural characteristics of composites, particularly cored ones, change dra-

matically as the frequency of load application changes. When tortured at a faster rate than called for by D-790, some types of cored panels yield load-deflection numbers that are at least 20% higher than those indicated by the standardized test. In short, both the rate of torture and the ASTM specification that the coupon be bent only once can introduce a significant "unreality factor" into the results of the standardized test.

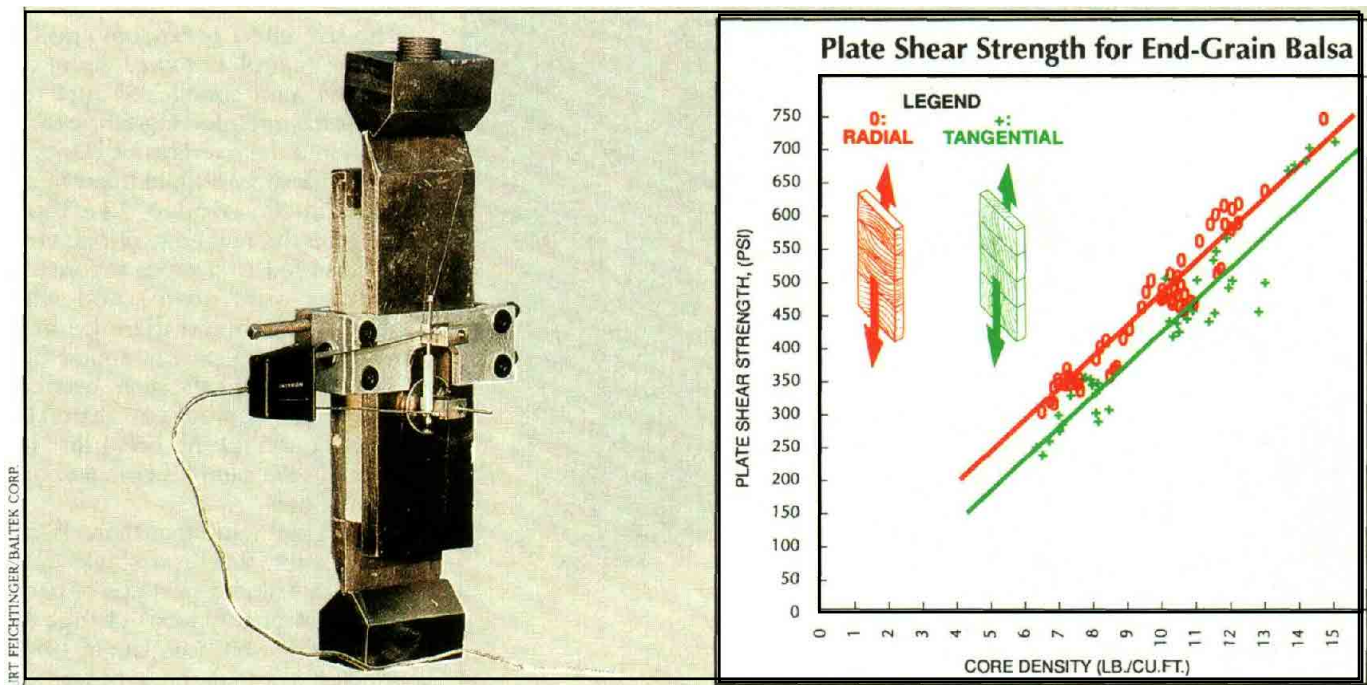
Experts agree that a problem exists. Rick Strand works for Comtex Devel-

opment Corp., a testing laboratory and engineering-design firm that specializes in composites. His comments highlight the difficulties of testing composites in general and using ASTM D-790 in particular:

Strand: There are real problems with the standard test. When we're testing laminates, we often hear all sorts of pops and twangs at the very beginning of the test, even though we're only approaching 40% to 50% of the expected ultimate strength of the sample. What we're hearing is first-ply failures within the laminate, and those failures

affect the ASTM calculations. It's essential to subtract for first-ply failures when running this test. Failure to do so will lead to depressed strength readings.

Strand: Quite possibly. The widespread use of brittle polyester resins is a big black mark against the marine industry. Vinylesters and epoxies, which are perceived as "softer," are actually more damage tolerant because of their higher elongations. Many laminate failures are, in fact, resin failures. [Editor's note: Consider the "secondary properties" described earlier by Meade Gougeon.] It takes more en-



Among the many standardized tests used to evaluate boatbuilding materials is ASTM C273-61. Here, a sample of 1/2"-thick balsa core is glued to two steel plates that are pulled in opposite directions (left) to evaluate shear strength. The results are then graphed (right). When built into a fiberglass boat, however, such cores may—or may not—perform in an identical manner.

When built into a fiberglass boat, however, such cores may—or may not—perform in an identical manner.

PBB: Will the ASTM D-790 load-deflection test accurately predict how the composites used in boats actually behave?

Strand: There are real problems with the standard test. When we're testing laminates, we often hear all sorts of pops and twangs at the very beginning of the test, even though we're only approaching 40% to 50% of the expected ultimate strength of the sample. What we're hearing is first-ply failures within the laminate, and those failures

characteristics; flexural strengths may be up to 25% lower than tensile strengths. In metals, the numbers are more closely matched.

PBB: What about the elevated-temperature conditioning cycles specified for D-790?

Strand: The test calls for a post-cure of three hours at 150°F. That's right around the heat-distortion temperature for orthophthalic polyesters, and well over the HDT for most boatbuilding epoxies. Using the standard post-cure cycle could seriously degrade an epoxy-resin laminate and generate depressed test results.

PBB: Are certain test results perhaps giving boatbuilders the wrong impres-

ion about the relative performance of epoxies versus polyesters?

PBB: What does the ASTM conditioning cycle do to polyester resins?

Strand: Post-curing both cross-links and evaporates some of the styrene monomer remaining within the laminate. It's not uncommon to see a sample's weight change by 1% or 1.25%. [Editor's note: On a 100' boat made with 25 drums of resin, that's a change of over 100 lbs.] Styrene trapped within the laminate acts as a plasticizer, and even slight amounts

can reduce the strength indicated by a D-790. The conditioning procedure was developed so that all resins could be evaluated at equivalent cure states.

PBB: Can the post-curing/conditioning cycle mask problems that are built into the boats on the shop floor, where identical cures aren't possible?

Strand: Sure. For example, a laminate made with a vinylester resin catalyzed at 1.5% will get very hard after post-curing. Moreover, its D-790 results

will be quite close to the numbers from a laminate made with resin catalyzed at 2.25% and run through the same conditioning cycle. However, in the real world of ambient-temperature curing in the boatshop, the laminate made with less catalyst in the resin will never get anywhere near as hard. Blister resistance is particularly influenced by post-curing and undercatalyzing.

PBB: Can D-790 results on a test panel be compared to the D-790 test figures listed on a Product Data Sheet?

Strand: Not unless the materials and fabricating conditions—catalyst levels, reinforcements, temperatures and humidities, void contents, and a host of other factors—are identical. Only rarely can we duplicate PDS data when we attempt to match the manufacturer's samples here in the lab.

PBB: Where does this leave the boat designer and boatbuilder when it comes to evaluating material performance? If the strength data on the product literature doesn't correspond to

EYEING THE PRODUCT DATA SHEET

The salesman may grunt and grumble when you request a Product Data Sheet (PDS) for every type of resin you buy, but providing this information is part of his job. The PDS is different from the Material Safety Data Sheet (MSDS) that you probably get from your supplier as a matter of course, because it details both the physical properties and the working characteristics of the resin.

If you're lucky, each PDS will provide data on gel times at various temperatures and catalyst ratios. If not, you will have to determine those important

details on your own. Be sure to read the fine print on the PDS, noting especially whether the manufacturer mentions minimum catalyst levels and minimum shop temperatures.

Art Wolfe at Sigma Technology laboratories in Pinellas Park, Florida, furnished us with the accompanying sample PDS.

Asked about its specification of an elevated-temperature post-cure, Wolfe remarks: "I don't know why all of them [the resin manufacturers] do that. The PDS test results tell you nothing about how boats made with that resin will behave, because shops can't duplicate that cure cycle. Parts do continue to cure in the field—especially on hot days—and the only reason I can see for the post-curing is to hurry things up for testing.

"We 'condition' our samples to ASTM specifications prior to testing. It's not a post-curing cycle but an attempt to get the materials adapted to a 'standard environment.' The conditioning cycle specified is 48 hours at 77 F and 50% relative humidity." Wolfe concedes that even these conditions don't really duplicate what a boat experiences, but he says 77° is a lot closer

Lloyd's, you'll discover that the other post-curing cycle they'll accept is aging under ambient conditions for 100 days!"

Wolfe stresses that test results from clear resin castings, as listed on our hypothetical but typical PDS, cannot safely be used in an analysis of how the resin will behave in a fiber-reinforced composite. Once again, the concept of "secondary properties" surfaces (see main story). Says Wolfe, "Imagine testing a laminate made with unidirectional reinforcements, but applying the stress 'off-axis'—let's say, perpendicular to the di-

rection of the filaments. This tests the resin, not the reinforcement, and what's surprising is that strength of the resin will actually be lower than that registered by a clear casting cured under the same conditions. When you're testing for 'secondary properties' like this, the fibers actually behave like defects in the structure and initiate cracking and resin failure."

So, get those product data sheets, and read the fine print. Deviate even slightly from the recommended catalyst chemistry, and you're totally on your own. But, even if you follow the manufacturer's directions to the letter, chances are you'll discover that the only way to determine how strong your products will be is to make some samples and send them to a test lab.

—Bruce Pfund

SAMPLE PRODUCT DATA SHEET — TYPICAL PHYSICAL PROPERTIES

Barcol Hardness	ASTM D 2583-75	40
Heat-Distortion Temperature	ASTM D 648-72	148°F
Tensile Strength, psi	ASTM D 638-80	9,100
Tensile Modulus, psi x 10 ⁵	ASTM D 638-80	5.35
Flexural Modulus, psi x 10 ⁵	ASTM D 790-80	5.20
Flexural Strength, psi	ASTM D 790-80	10,680

Resin Cure Conditions: Clear castings were produced with proprietary hardener ABC-456. Overnight room-temperature cure, followed by a two-hour post-cure at 250°F. Test results based upon use of specified hardener. Deviation from this catalyst selection requires requalification of material properties.

to reality than the 250" listed on the typical PDS.

Temperature and humidity are big factors to consider when evaluating composites. It's no coincidence that boats in the South have a higher incidence of gelcoat blisters than their Northern sisterships: The weather is warmer down there, and the boats are in the water for much longer periods.

Wolfe comments favorably on testing practices adopted by Lloyd's of London, which sets scantlings and engineering specifications for many composite vessels produced overseas. "At Lloyd's, post-curing cycles are a lot more realistic," he says. "The written specifications require 16 hours at 104 F, which is a lot more attainable in service than 250". If you don't have a high-temperature oven and you call up

Strand: Designing from the published numbers is dangerous. It's critical to build a few test panels and watch how they behave before starting to build a boat. These laminates should be produced under conditions

PBB: What about selecting a test lab? What should a designer or builder be looking for when he's got a sample that needs testing or a problem that needs analysis?

In the case of analyzing a problem laminate, we sometimes make a duplicate—with the same resins and reinforcements—to see how a laminate produced under controlled conditions compares to the sample we got from the builder or surveyor.

Testing Outside the Lab

One of the men in the crew was big—and I mean huge—yet wonderfully good natured. His nickname was "Fat Boy." I guess he didn't mind being called that, because he knew he could stomp anyone in the shop if he got the urge. When it came time to evaluate how many layers of glass should go into a hull bottom, or how dense a core to use in a particular area, Fat Boy would step onto a sample panel whose ends were set on cinder blocks.

28 PROFESSIONAL BOATBUILDER

Some samples failed the minute he set foot on them, emitting tortured snaps and twangs just like those Rick Strand mentions above. Some panels bottomed-out on the floor immediately, while others bent just a little. For fatigue testing, Fat Boy would do a dance on the panel. Sometimes it didn't take long at all for the sample to weaken; sometimes it required a minute or so.

Spraying the panel with black gel-coat and setting it out in the Florida sun on the black asphalt driveway was our "conditioning cycle." We noticed tremendous differences between panels brought inside for the "Fat Boy Test" while they were still hot, and those that were allowed to cool before they were tortured. If a panel looked really impressive, Fat Boy would jump off a sawhorse onto it, and I can't remember too many that survived.

There's no ASTM "Fat Boy Test," yet in many respects the homegrown procedure is every bit as valid as D-790 or any of the others listed on a typical product data sheet. What we did in the Florida shop was "real-world" testing. Lab testing, done by a skilled technician to ASTM standards, can certainly provide some interesting numbers, but using those numbers to determine whether a product is or isn't satisfactory is tricky.

A good test lab will be able to advise you not only on what standardized tests to run, but also on how to deviate from the ASTM procedures so that your dollars will generate more relevant test data. Furthermore, getting set up to run some simple tests on your own isn't difficult or expensive, and it's a topic that will be covered in a future article.

The Right Way to Use a Lab

Lab testing is invaluable for checking your product—but only if your samples are fabricated in the same way your boats will be built. Try making the samples on an incline, and think about asking your worst laminator to make them, not your best. Consider, too, that you may not be able to duplicate the strength of August samples in a boat or component built in January. Any number of factors can affect the quality of work your shop produces. Think carefully about the variables at your facility, and either eliminate them or try your best to duplicate them when making samples.

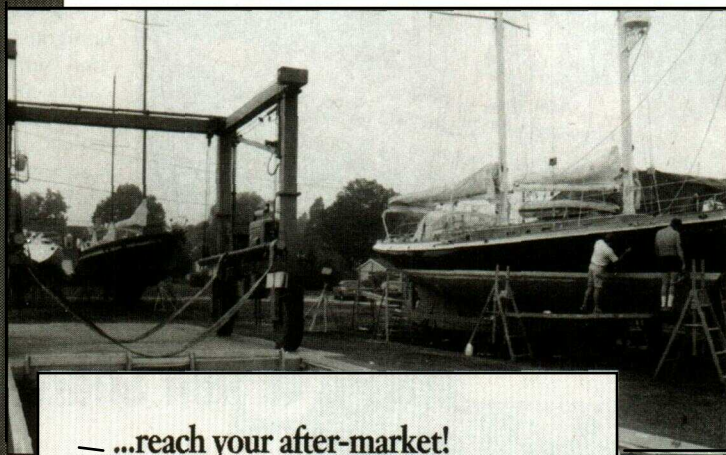
The appropriate time for lab testing is before production, when it can generate realistic numbers for analysis by the engineers and naval architects who double-check the laminate schedule. Once that's done, running some really basic tests like the ones I saw in Florida may be an appropriate means to involve the crew in making a high-quality boat.

Don't get snowed by standardized test numbers and arcane laboratory procedures. ASTM hasn't written stan-

dards for boat operation. There's no "Dock Piling Impact XYZ-123" test protocol or any procedure that duplicates the "Wave-Jumping-Drunken-Maniac-Bottom-Smash" tests I see just off the beach each summer here in New England. Every hour your boat is on the water represents an hour of real-world, no-holds-barred testing, and those hours add up.

Only time will tell whether you've done a good job of engineering and materials selection. PBB

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Ocean Rescue Vessel/Workboat

Bill Lapworth designed this 28' high-endurance workboat as a test platform for its builders, Maritime Outfitters (Costa Mesa, California). Set up to operate in nearly any sea conditions, the aluminum hull incorporates three watertight compartments, as well as sealed controls and instrumentation. In addition, the radar arch houses an elevated air intake for the two, Nanni-converted, 105-hp Mercedes Benz diesels, both equipped with Kaama engine silencers. Twin 18" three-bladed props are connected to Hurth 360 reduction gearing, and top speed is reported to be 26 knots. The prototype was used to test various solventless urethane coatings that are intended to improve protection by eliminating surface porosity and inhibiting marine growth.



Tunnel-Slot Hull

Ken Hankinson Associates (La Habra, California) has developed a 46' high-speed cruiser named *Slot Machine* after the hollow channel running the length of the underbody. The 14,200-lb concept boat, built by Dencho Marine (Long Beach, California), integrates the best characteristics of both catamaran and deep-V hull forms in a shape that performs where the others suffer. The yard's client was particularly interested in comfort at 40 to 45 knots in conditions that would force another boat to slow down. The hull is a vacuum-bagged laminate of balsa core, S-glass skins, and vinylester resin. Decks, stringers, and ring frames are PVC cored, and carbon-fiber reinforcements are used in areas of critical stress. *Slot Machine* is powered by twin Merlin 450-hp diesels coupled to Arneson surface drives via Newage DC 1.19:1 gearboxes.

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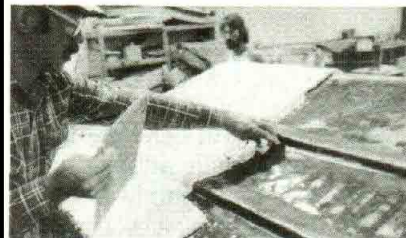
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Classic Knockabout

Bill Harding of Doughdish fame recently discovered the forgotten hull of a 28' day-sailer designed by L. Francis Herreshoff in 1932 for one Willoughby Stuart. Harding, of E&D Stuart (Marion, Massachusetts), interested a nearby yard in a production run of the boat, and construction on the sixth hull is underway. The keel/centerboard design utilizes a PVC board, and the new boats show a stability gain over the original due to the addition of 400 lbs of ballast.

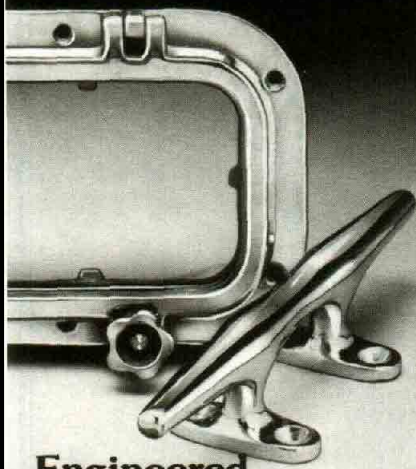
The hull is a 1"-thick sandwich of mat, roving, and unidirectional glass over a 1/2" Airex core. To complement the knockabout's traditional appearance, she has a buff-colored, tapered-aluminum spar and considerable wood trim, including a teak facing on her artful transom.

Angel Island Taxi

The California Department of Parks and Recreation has just received a new 48' water taxi from SeaArk Marine (Monticello, Arkansas). Built of welded aluminum, the ferry has an enclosed, heated seating area, and a canopied afterdeck to shelter its 30 passengers. The 48-footer will carry visitors, island-resident school children, park employees, and work crews to and from Angel Island State Park in San Francisco Bay. Twin Detroit Diesel 8V-71Ns each deliver 272 shp at 2,100 rpm, giving the vessel a reported 28 mph in sea trials. A 12-kw Northern Lights generator supplies electrical power.



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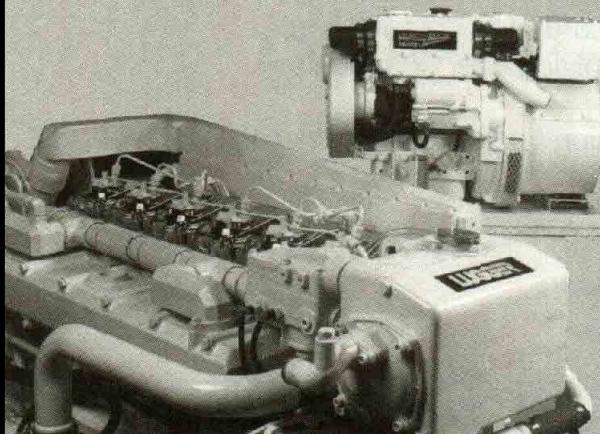
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Reprieve for Roamer

One of Chris-Craft's Roamer series of aluminum cruisers is getting a major refit at Denison Marine (Dania, Florida). More than 120 of these popular family motoryachts, measuring 31' to 74', came off Chris-Craft production lines in the mid-1970s. As with most aluminum yachts, well-preserved Roamers have retained their value. When rebuilt and outfitted with custom interiors, the rejuvenated Roamers can fill a gap in today's mid-sized aluminum yacht market. Denison's current retrofit, for attorney F. Lee Bailey, will serve as a demonstrator for future Denison-Roamer projects. The yard is hacking the job, which should come in under \$1 million, with an extended service warranty similar to that offered on new construction.



One Tough Shell

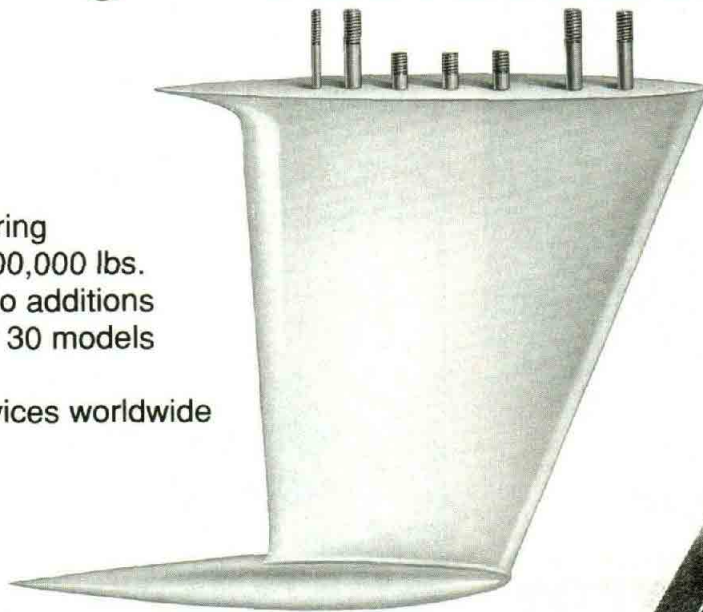
The Felker Boat Company (Austin, Texas) is producing competition-ready rowing shells. Their Racer, whose hull weighs in at a mere 32 lbs, is a boat for middleweight oarsmen. Lay-up consists of Spectra sandwiched between carbon fiber, and wet-out can involve polyester, vinylester, or epoxy, depending on the customer's preference. Rigidity through the midsection is increased by the use of an all-carbon cockpit module, and builder Clay Felker is proud of what he says is a really stiff boat quite unlike fragile traditional shells. The builder says of his Racer, "You can't hurt it with a framing hammer." PBB

Work in Progress, a regular column, is dedicated to spreading the news of noteworthy boats currently under construction, repair, or design. Please help by sending us a description and a color slide or a drawing that relates to the project your company is working on—regardless of the boat's size, type, or intended use. Address your news and photos to: Work in Progress, Professional Boat-Builder, P.O. Box 78, Brooklin, ME 04616.

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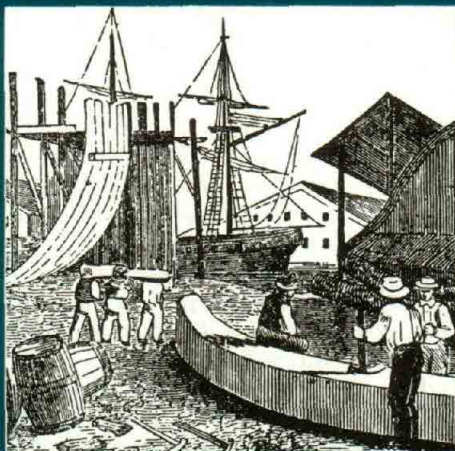
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Paddling to Profitability

*canoe manufacturers
strive to cash in
on the sport's revival*

by Stephen A. Cole

Not long ago, the word "canoe" conjured only two images in the minds of most people: Indians and fur traders moving through the wilderness in birchbarks, or summer-camp kids paddling clunky, aluminum pods across a lake.

Forgotten is the time, only 100 years ago, when the English reintroduced Americans to canoeing as a sport. Canoe clubs flourished, and well-to-do Victorians cruised rivers and bays, sailed lakes, and competed in paddling and sailing competitions. Forgotten, too, is the preeminent canoe builder and enthusiast of that day, J. Henry Rushton of Canton, New York. Known for his trim, strong, and light cedar craft, Rushton was also canoeing's entrepreneur.

Since the early 1970s, this country has seen a canoe revival, spawned by modern-day Rushtons who are sportsmen, manufacturers, and promoters. Mad River Canoe of Vermont, Wenonah Canoe in Minnesota, Blue Hole Canoes of Michigan, Easy Rider Canoe & Kayak Company from Seattle, and Dagger Canoe Company of Tennessee all entered the market and have prospered in this time span. And their

ranks have been swelled by a host of smaller canoe makers. These new firms traded on the strength of the environmental movement, which naturally brought folks to the simple, human-powered sport of canoeing and offered craft of new materials and designs in what had been a stagnant sector of the boating industry.

Laminate technology was applied to the canoe, and Royalite Thermoplastic's Royalex, DuPont's Kevlar, and other proprietary, hybridized laminates joined fiberglass as the materials of choice. Designers varied canoe hull shapes and keel lines, which had been traditional and unchanged for years. The result was a new generation of boats—in a tremendous array of sizes, weights, styles, and materials—for old and new uses, from fishing to flat-water racing.

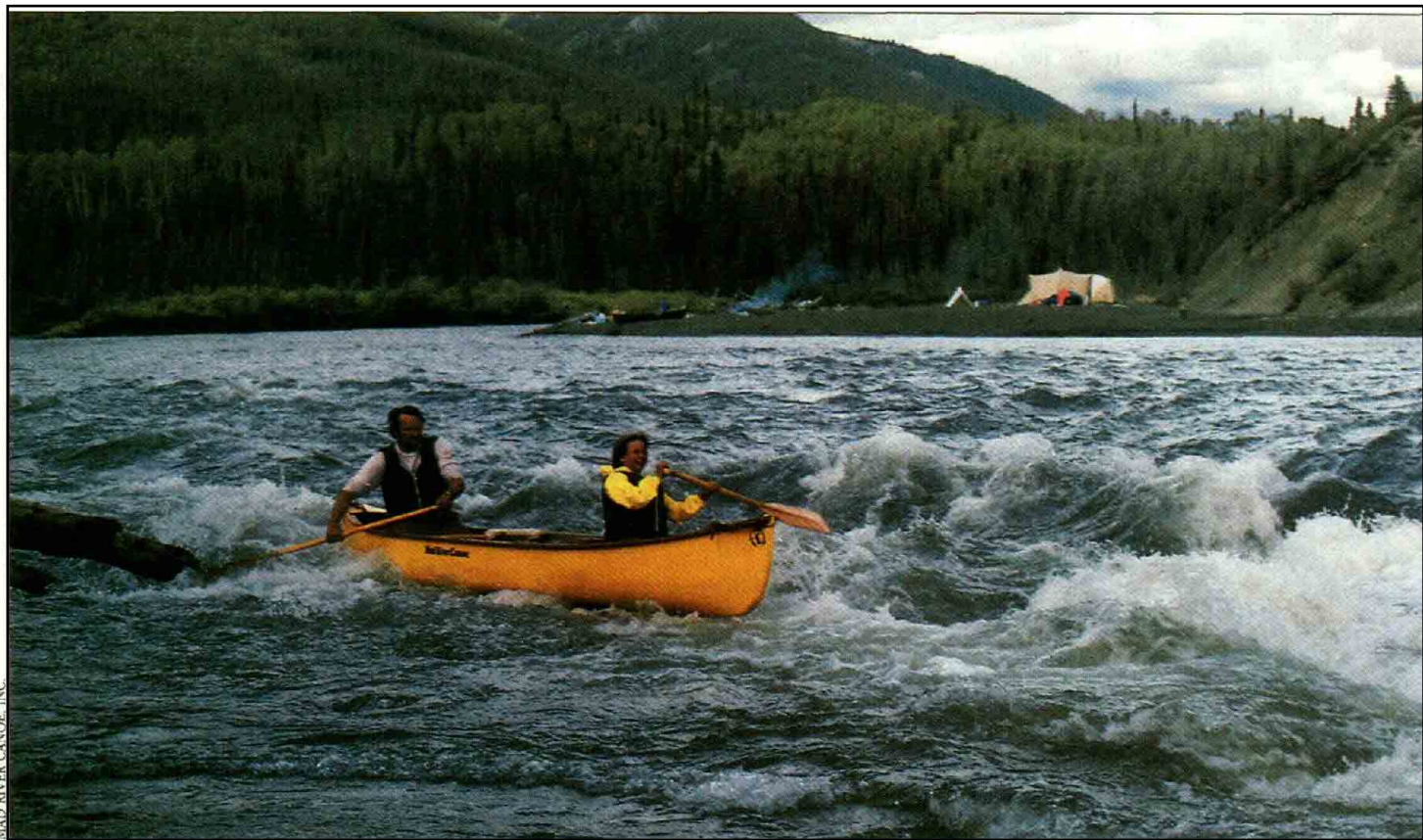
STEADY GROWTH

Almost 20 years since the start of its revival, how is the canoe market faring today? Who are its customers, and what are their preferences? How are manufacturers and retailers promoting canoeing, and what trends do they see developing in the future? To learn the

answers to these questions, we spoke with canoe builders and sellers large and small across the country.

The bottom line is that the market is seeing modest, steady growth: up about 14% since 1985. Canoe sales reported to the National Marine Manufacturers Association in 1988 total 89,800 units, but the actual number is undoubtedly higher because many small and some moderate-sized builders do not turn in their sales figures to NMMA. Interestingly, the market is strong both at its low end (where boats sell for \$350 to \$600) and at its high end (with canoes commanding from \$800 to more than \$1,000). These figures bear out market research suggesting that most buyers are either new to the sport and are purchasing something simple, or have canoed for more than five years and are buying a more specialized, expensive craft.

Between 1980 and 1986, the number of participants in "paddle sports" (canoeing, kayaking, and rafting—among others) grew by 57%, a figure eclipsed only by the rise in popularity of good old softball. More facts: 61% of all paddlers are male. They are between 30 and 49 in age, they earn



MAD RIVER CANOE, INC.

Demographics show that most of today's canoe buyers are highly educated and making good money, but the wide variety of ways in which these consumers use their canoes has led to marketing difficulties.

more than \$35,000 a year, and a large number hold graduate degrees. Most live in the Midwest in their own homes with their wives, two children, and two automobiles. In short, canoe buyers are part of the classic, upwardly mobile American family.

Canoes are now sold for all kinds of paddling, including cruising, sport (hunting and fishing), tripping, white-water work, and competition. Nevertheless, the bulk of them are purchased for simple family recreation, which perfectly fits the paddler profile. The recreational canoe is a versatile canoe, perfect for a three-hour excursion on a nearby lake with the kids, but light enough so that Dad can handle it by himself for some fishing or solo paddling. Canoe outfitters, rental services, and summer camps are a strong force among recreational canoe buyers nationwide. For example, one rental service located on the Delaware River puts 3,500 canoes on the water in the course of a pleasant summer weekend.

One emerging market trend finds retailers selling canoes to more people on the far side of 50. According to Gordy Sussman, who founded Wis-

consin's Rutabaga paddle sport centers, "When an elderly couple tells me that their 75-lb aluminum canoe has become too heavy to lift, I'm able to sell them a 35-lb Kevlar canoe, and they are ecstatic. I sell as much Kevlar to people over 50 as I do to people under 50." Dana Grover, the ebullient sales director at Sawyer Canoe in Oscoda, Michigan, has also targeted older customers. He's found that couples and individuals in their mid-50s and up have time, money, a low mortgage, and a yen for upscale, active pursuits such as cross-country skiing and fly fishing.

A second market drawing the attention of this former canoe retailer consists of single, professional women—a growing segment of the population. Grover reports that there are now 33 million single women over the age of 40, and—in his words—their general thinking is, "I'm going to buy toys for me." When they do buy canoes, he says, what they want is what the post-50 group wants: quality, attractiveness, and light weight.

Other, more specialized markets are beginning to emerge, as well. Many high-end, high-tech boats are going

In the 1980s the number of people participating in canoeing has increased rapidly, but the jump in consumer spending has been far smaller.



CEDRIC CHATTERLEY

At the venerable Old Town Canoe plant, cedar strips and canvas have largely given way to fiberglass, polyethylene, and PVC. Like the majority of present-day boat owners, canoeists insist on minimal maintenance.

out the door with weekend athletes and daredevils who are using their canoes in triathlons, for competitive paddling, on white water, and for cross-training purposes. Lee Moyer, whose Seattle-based Pacific Water Sports deals solely in paddle sports, sells a good number of advanced-design Royalex canoes to the members of local white-water canoeing clubs.

A demand for solo canoes, with a seat mounted mid-boat, emerged in the 1980s and has stimulated sales to some degree. But, according to retailers, the one-man-canoe market has been hurt by the strong growth of kayaking—a sport traditionally seen as complementing canoeing. Paddlers wanting a solo boat will often purchase a touring or sea kayak instead, believing it to be a more versatile craft.

OLD TOWN'S DISCOVERY

The biggest and oldest name in paddling is Old Town Canoe of Maine. Now a subsidiary of Johnson Worldwide Associates, Old Town is also the only canoe manufacturer owned by a major corporation. (Coleman, which certainly makes canoes, is primarily a manufacturer of outdoor equipment.)

Since 1904, Old Town has been quietly and conservatively building quality boats and is the only brand with national name recognition. In a business that is still largely regional, Old Town is also *selling* nationwide, a status it shares to some degree with Mad River Canoe. Old Town has long focused on the recreational-canoe market, in keeping with Sales and Marketing Director Roger Bill's description of canoeing as "a simple, elegant sport that the whole family can participate in."

Since 1985, Old Town has dominated a vast territory in its specific segment of the market, and the company has accomplished this feat with a single canoe. That model is the Discovery, a rotationally molded boat of foam core sandwiched between two layers of cross-linked polyethylene (see accompanying story). The result of this process, says Bill, is a well-made, \$500 canoe that is more durable than fiberglass and more appealing than aluminum.

Prior to the introduction of the Discovery, Old Town claimed a mere 10% of the canoe market. Today, however, its share is about 25%, and

the Discovery accounts for more than 50% of the 22,000 canoes the company builds yearly. This demand keeps the roto-molding machines running 24 hours a day, seven days a week. The invention and manufacture of the Discovery line are widely recognized as canoeing's technological coup of the 1980s. In fact, Old Town Research and Development Director Lew Gilman received patents on both the molding method and the Discovery hull. Overall, the work leading up to the production of the Discovery took Gilman a decade.

The market's low and middle range, where the Discovery has made such a splash, formerly belonged to aluminum and fiberglass canoes—and to the Coleman Company's Ram-X boats. According to one retailer, aluminum is "a 40-year-old technology that is gone and probably will not return," and Coleman's more than decade-long presence in the canoe trade has been diminished by the Discovery. The Ram-X model is a thermally formed, single-layer polyethylene canoe in which internal aluminum bracing is used to provide structural integrity and limit flexibility. Ram-X is

pretty tough stuff, but as Old Town staffers will tell you, it lacks the stiffness imparted to the Discovery by this model's foam core.

Jeff Parker manages Coleman's Thermal Division, which turns out picnic coolers and jugs as well as canoes, and he says he has a "tendency to lump these products together" in marketing discussions. Noting that Coleman's canoe sales have been flat for the past three years, Parker sees Old Town's Discovery as "a major competitive force." Ram-Xs and Discoverys are not often sold in the same arena, however. "Building for the masses," as Parker puts it, Coleman sells its canoes through thousands of department and discount stores, where the Coleman name is well known. In such outlets, Ram-X models can retail for as little as \$349. By contrast, the higher-priced Discoverys are usually found in specialty shops. Like some other industry insiders, Parker also questions whether the ultraviolet-light inhibitors in rotationally molded boats like the Discovery will hold up over years of use, particularly under the tough conditions imposed by livery service.

Yet, even some retailers and manufacturers who are more comfortable servicing canoeing's high end give Old Town and its Discovery considerable credit. At Rutabaga, Gordy Sussman sells more Discoverys than any other kind of canoe. He calls it "a lot of canoe for the money," and adds, "Someone spending just a little doesn't have to buy an inferior product." Dana Grover at Sawyer Canoe acknowledges the "Disco" as a major player in the lower-end market despite its being heavier than comparable fiberglass models. But, as he notes, weight doesn't matter that much to the recreational paddler using a canoe twice a month. In fact, Grover wonders aloud whether Sawyer's similarly priced Oscoda fiberglass model can thrive in a market shared with the Discovery.

Why is it that no other canoe manufacturer has pursued roto-molding? Grover puts it down to "sheer stupidity," believing that this market segment is capable of supporting more than one company. But he concedes that the time for other, smaller canoe builders to launch a rotationally molded boat may have come and gone, given the necessary development work and considerable start-up costs involved.

FORM AND FUNCTION

At the upper end of the canoe business, it's the application of aesthetics to technology that sells boats. In the words of one marketer, "We're selling canoes to granola-eaters with PhDs in engineering who want space-age composites and wooden rails." For years, the high-end builders have been able to offer canoes of Kevlar, Royalex, and hybrid laminates. And beyond offering all-purpose boats, each company has carved out a niche in the market. Dagger, Mohawk, and Mad River are known for white-water canoes; Sawyer does a big business in solo craft; We-no-nah is renowned for competition canoes in general, and flat-water racing models in particular; Old Town and Mad River do well in the expedition or tripping market.

Today, virtually all these manufacturers are adorning their boats with wood. It's as if modern canoeists need some reminder that the synthetic boat they are paddling is an ancient and traditional craft first made of wood. Mad River Canoe seems to have started the trend, introducing wood trim with its first canoes in 1970. Since then, ash

Prior to the introduction of the roto-molded Discovery, Old Town claimed a mere 10% of the market. That share has now jumped to about 25%.



Wood trim—in the form of gunwales and caned seats—is either standard or optional on most of the canoes now in production. Consumers seem eager for a manageable touch of tradition.



Several companies are putting a high priority on attracting women and canoeists over 50 to their boats. Marketing strategies are dictating lightweight models and pastel colors.

gunwales and cane seats have been standard on all Mad Rivers, which are the most expensive canoes on the market.

Interestingly, Mad River began offering an optional *synthetic* gunwale and seat system for its RoyaleX canoes in 1989. At the same time, Sawyer Canoe introduced optional wood trim on its line and saw sales rise accordingly. Old Town employs a mix-and-match approach to wood: Vinyl rails combined with cane seats are standard on some models and optional on others, with a full wood trim optional on higher-priced boats.

But upscale buyers want more than "feel-good wood"; color and personality are also part of the equation. Notes Mark Walters of We-no-nah Canoe, "The industry has proved it can build light, well-engineered canoes; now people want attractive and unique boats" For generations, the dominant canoe colors were dark green and red, but today's boats are sold in teal, gray, burgundy, and sand. We-no-nah offers its models in nine colors.

The arrival of decorator colors in canoeing has meant changes in buy-

ing patterns: "The guy will pick out the canoe, but his wife will choose the color," reports Rob Fischer at New Jersey's Ramsey Outdoor stores. But it's in the category known as solo white-water "play boats" that colors and even model names get crazy. Old Town's Otter comes in international orange, while Mad River's play boats—called Me and Flashback—are offered in a particularly brilliant lime green. The production crew at We-no-nah regularly finishes off white-water canoes with splatter patterns.

MARKETING BLUES

Canoe manufacturers and retailers generally agree that they have not done a good job in exploiting the upper end of the canoe market, which, nevertheless, is growing. In Dana Grover's words, "God forbid if we did it right." The source of the industry's self-flagellation are figures that look at participation and spending in canoeing as opposed to biking and skiing, two established, high-end sports that have come of age in the last 30 years. In the 1980s, the number of people participating in canoeing has increased faster than the number taking part in

either skiing and biking, but the jump in consumer spending has been far smaller. Lots of folks, it seems, are giving paddling a try, but they are not necessarily buying canoes.

Many reasons are cited for the slow spending increase; one is a combination of market segmentation and dealer ignorance. *Canoe* magazine's 1990 buyer's guide lists no fewer than 11 categories of tandem and solo canoes: casual recreation, touring, daytripper/weekender, cruising, wilderness tripping, white-water, decked canoe, competition cruising, downriver, sport (freestyle), and sportsman. For retailer Sussman, this represents "an insane plethora of product—the result of a mature market." For other retailers, extreme segmentation represents confusion (about the difference between touring and tripping canoes, for instance) and stimulates fear that customers will be unsure about the kind of canoe they need.

The great variety of canoes and canoeing is no problem for a knowledgeable salesperson who can size up a buyer's wants quickly. But the industry cannot claim the legions of committed retailers that many believe to be

essential in a high-end "life sport." Grover estimates that only one-eighth of Sawyer's retailers know the line well enough to represent it properly. His planned solution is to pare the number of sales outlets back to a core willing to promote canoeing and Sawyer boats with energy and skill.

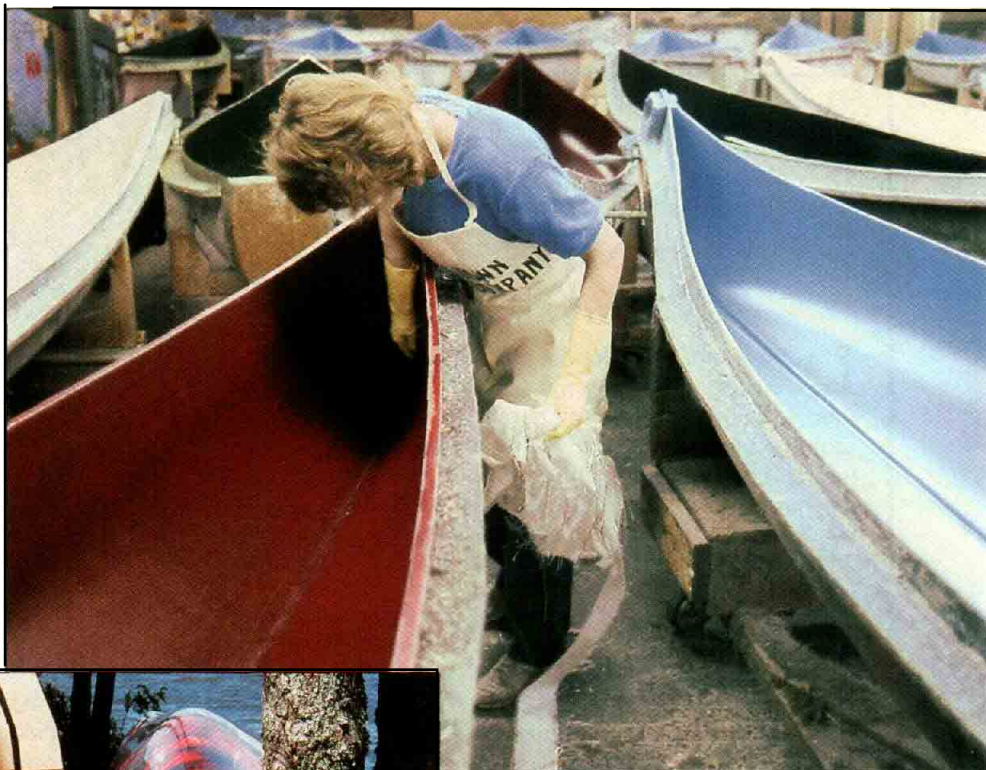
Mad River Canoe has long used road shows as a means to educate retailers and customers about paddling and the company's line. Mad River Canoe Days are held nationwide from early spring through summer. At these events, technical representatives and shop owners demonstrate a variety of Mad River models, give instruction, and provide test-paddling opportunities. Other canoe manufacturers employ the road show as well, but none so extensively or effectively as Mad River. For their part, many paddle-sport pro shops around the country regularly offer canoeing classes, trips, and demonstrations. To make selling canoes and buying canoes easier for all concerned, builders are also modifying their catalogs. For 1990, We-no-nah is contemplating a separate catalog for its racing models. Mad River's catalog now classifies its canoes in three groupings only: Versatile, Focused, and Specialty.

Though they may have been overshadowed by canoes built of newer molded plastics like Royalex, economical fiberglass models maintain a significant presence in the market.

SELLING THE SPORT

Pioneers in a small but growing sport, the members of the canoeing confederation are just beginning to learn the ropes of large-scale promotion. They are grappling, too, with the need to promote their products and sport simultaneously. Lee Moyer at Pacific Water Sports is adamant that manufacturers need to sing the praises of canoeing as a wonderful, varied outdoor recreation for all age groups more loudly than they have to date. He's particularly distressed by Old Town's promotion campaign for the Discovery, which is depicted as being stove in by a Jeep Wagoneer, then recovering its original shape. "Would you buy a bicycle because you can run

One builder estimates that only one-eighth of his retailers know his line well enough to represent it properly.



CEDRIC CHATTERLEY



Old Town uses the toughness of its Discovery to push this model, shown at left being crushed by a Jeep Wagoneer. A subsequent promotional photo demonstrates that the canoe escaped unharmed.

OLD TOWN CANOE COMPANY

over it with a semi and still ride it?" he asks.

Whether a manufacturer has focused on the body of the boat or the soul of the sport is even evident in company slogans. Old Town markets "a tradition of quality." Sawyer announces, "Nothing paddles like a Sawyer." We-no-nah builds "for the people who know and love canoeing," while Mad River's catalog exclaims, "Catch the canoeing spirit!"

Judy Harrison, who publishes *Canoe* magazine and happens to have 19 paddle-sport boats in her backyard, sometimes wonders if the industry wants U) grow. She questions whether the enthusiasts who have become manufacturers want to share their sport and rivers and lakes with the uninitiated. Harrison is doing her part by

putting out *CKI News*, a quarterly industry newsletter that publishes articles like, "How to Plan a Great Promotion" and "How Do We Sell Paddling?"

Paddling will sell, Harrison believes, when it gets some media recognition and when the industry begins to promote its own heroes. Canoeing got some coverage at the 1988 Seoul Olympics, where Greg Barton and Norm Bellingham took gold medals in flat-water racing. The sport may receive more air time in 1992, when white-water canoeing becomes an Olympic event. In the meantime, Harrison wants manufacturers and retailers alike to use Olympians Barton and Bellingham for product endorsements, feature them in promotions, and make the pair and their sport as well known as skiing's Phil Mahre and speed skat-

ing's Eric Heidon. Finally, Harrison asks, "Was it the gold medals, Jean-Claude Killy, or stretch pants that launched skiing?" Paddle sports need some fashionable togs, she asserts, to give its athletes an identity and following. Few outfitters have yet taken up this challenge.

Is canoeing poised to become in the 1990s what skiing was to the 1960s and biking was to the 1980s? Watch nearby waterways and the 1992 Olympics in Barcelona to find out. **PBB**

About the author: A native of southeastern Massachusetts, Steve Cole is an avid outdoorsman and canoeist. He has written extensively, most recently producing a monograph on the Rangeley boat. He now lives in Belfast, Maine.

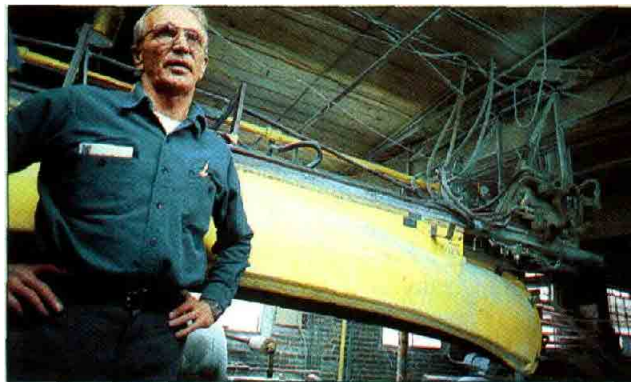
ROTO-MOLDING: Boatbuilding's answer to the Gravitron

If you've ever been foolish enough to step inside that notorious amusement park ride called the Gravitron, then you already know something about how rotational molding works. The process involves rotating a mold in two planes at the same time. (In the Gravitron, you play the part of the mold.) Because this dual-axis motion is occurring, polyethylene powder released into the heated environment of the mold coats it evenly and melts, forming a canoe.

That's the easy part, according to Lew Gilman, who pioneered rotational molding at Old Town Canoe. The hard part is timing the introduction of materials into the molding process (Old Town's roto-molded Discovery is formed of a cross-linked outer layer, a foam core, and a cross-linked inner layer). The other big challenge is controlling the manufacturing process. It was for his solutions to these problems that Gilman was granted a patent on the Discovery manufacturing process in 1989.

Perhaps equal to that honor is the one bestowed on him by Old Town in its 1990 catalog. On the inside cover is a photo of Lew Gilman and a half-page testimonial extolling his many contributions to Old Town Canoe, whose market share and sales have increased substantially thanks to Gilman's most recent efforts. An Old Town, Maine, native, Llewellyn Gilman remembers visiting the Old Town Canoe factory on Middle Street in the 1940s and breathing in the wonderful scents of canoe building: cedar and varnish. Yet, he has had much to do with the baking thermoplastics whose odor envelops these same workrooms today.

Lew Gilman's research into roto-molding began a



Lew Gilman in the Old Town factory.

decade ago, when he visited a now-defunct California manufacturer who was turning out rotationally molded canoes. The boats were fitted with an aluminum keelson to limit their flexibility, a problem Gilman would later solve for himself by including a layer of closed-cell foam in the molding sequence. In the end, he built from scratch all the roto-molding machinery Old Town Canoe uses today to churn out Discoverys. Calling the work "90% common sense," Gilman made use of many parts that were already hanging around the company's R&D shop, as well as a number of truck rear ends. Working in-house, he built \$100,000 machines that would have cost a half-million dollars each if they had been bought from outside vendors. This fact was not lost on the engineers from Johnson Worldwide Associates when they came to view Gilman's homemade roto-molders.

Where else in the boat trade can you find rotational molding in use? Mostly in the manufacture of kayaks, where the process is common. In fact, Gilman plans to have an Old Town kayak ready for sale this summer.

Despite his accomplishments, roto-molding technology is sort of lost on Lew Gilman, the consumer. He still paddles a Wood-and-canvas canoe.

—Stephen A. Cole

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Aluminum

by Bruce Buls

No matter how you go about it, production boatbuilding is always a challenge.

At the end of the production line, the goal is an attractive product that performs well and stays together. Achieving this goal requires a foundation of good design and engineering, followed by sound construction.

But the line, itself, must be efficient. If time and materials are wasted, costs will drive the operation deep into the red zone. Accordingly, the builder must identify a combination of materials, design, and construction techniques that work together to satisfy all the preceding criteria.

In the world of mass-produced boats suited for recreational fishing, waterskiing, and general running about, there are essentially two materials of choice: fiberglass and aluminum. Basically, all fiberglass boats are assembled in the same way. Though there may be significant variations in components such as cores, resins, and fabrics, the fundamental technique involves the layering of materials inside a female mold.

Aluminum, however, offers some significant options.

Basically, the alloy panels and extrusions used by aluminum-boat manufacturers are fastened together using four methods: riveting, welding, mechanical interlocking, and bonding. The first two, of course, are by far the most common. Mechanical interlocking is a patented process currently used by only one company, Duroboat, in Seattle, Washington. Bonding, or gluing, is also very limited in use, but it is common among builders of aircraft and may soon catch on with boatbuilders. Spectrum Boats in Arlington, Washington, is reportedly one of

***Editor's note:** When we decided to look hard at construction methods used by contemporary "tin skiff" builders, we quickly realized that it would be impossible and unproductive to touch base with all the companies turning out this type of boat. Instead, we chose to visit the plants of two acknowledged industry leaders and one maverick for a hands-on, in-depth look at three different building systems.*

today's boats are assembled with a combination of the two). Choosing one method over another is as much a marketing decision as a manufacturing one. Welding advocates such as Crestliner in Little Falls, Minnesota, now pride themselves on producing a boat that looks as if it were made from fiberglass. They challenge customers at boat shows to tell them at a glance whether the hull material is metal or plastic.

At Lund Boats in New York Mills, Minnesota, little attempt is made to obscure the aluminum-ness, if you will, of the boat. When the exterior is studded with hundreds of rivet heads, you can't pretend the material is anything other than what it is.

Rivets are hanging tough, welding is gaining ground, and innovative alternatives are showing promise

the first to put the technique to use, but the company isn't interested in discussing the matter at the present time.

The question of which method works best has been debated in aluminum-boat circles for many years. Everyone, from engineers and builders to dealers and boat owners, seems eager to argue the merits of the two most common techniques: welding and riveting. Salespeople, especially, like to tell horror stories about the problems associated with one or the other process. You know, "The boat came down off a wave, and the rivets just exploded like popcorn! That hull looked like a huge colander when they managed to bring it in to the beach." Or, "Not only were the welds terrible, but all the adjacent metal was fatigued. The whole boat was cracked from stem to stern. It if weren't for the foam flotation, she would have gone down like the *Titanic*!"

The fact is that both riveting and welding work well (indeed, many of

Pop Goes the Rivet

"We believe that if the process [riveting] is good enough for our friends in the airplane business, it's good enough for us," says Lanny Orvalla, Lund's director of marketing.

Or, as one of the men in the shop put it, "Howard had a good idea."

The Howard referred to is Howard Lund, founder of the company that bears his name. It seems that Howard was a sheet-metal man who started riveting together small aluminum duckboats right after World War II. According to the story, he built them for himself, but other people kept buying the boats before Howard could get them wet. Being a smart Scandinavian businessman, Howard took the hint and went into the riveted-aluminum-boat business.

Lund boats are still built in the small Minnesota town where Howard first drilled holes in his hulls. As one might expect, the operation is a big deal here. About 25% of the town's population

Boat Assembly

works at Lund, which is now owned by Genmar, the giant corporation that also owns Crestliner, Larson, and several other boatbuilding concerns.

Lund has been, and continues to be, one of the most successful builders of riveted aluminum boats in the business. From the factory on the Midwest prairie (which can't be far from mythical Lake Wobegon), thousands of boats held together by millions of rivets have been sent out to customers all over the country and beyond. Lund also has a satellite plant in Canada.

Perhaps known best as a builder of small, open fishing boats, Lund has expanded its product line to include a wide variety of models, some of which are extensively outfitted. A few even feature cabins and I/O propulsion systems. With lots of bright paint, indoor/outdoor carpeting, upholstered seats, stainless-steel rod holders, and a range of amenities shared with the offerings of other mass-market boatbuilders, many of Lund's aluminum boats actually do look similar to welded-aluminum or even fiberglass production craft. Except for the rivet heads.

Underneath all the carpeting, live-bait wells, and pedestal seats, Lund hulls are of two basic types. The smaller skiffs have flat bottoms built from one sheet of aluminum. The longer, wider models have V bottoms that are fabricated from two panels. The level of production at Lund is large enough for the company to purchase all its aluminum stock in large rolls, or coils. The material is pulled off the roll and run over a wavy form called a decoiler, which flattens the sheet before it's cut to length.

All the various parts of Lund's boats come from the resulting rectangular pieces. Depending on the thickness of the material, up to about nine sheets can be cut at once. A pattern is laid on top of the pile, and the parts are ex-





Above—A Lund employee manipulates a "broken arm" router as he cuts components out of aluminum stock.

Below—A press brake is used to bend riveting flanges into the edges of parts like bulkheads and thwarts.



Below—At Lund, flanges are manually bent into the curved portions of the bottom panels with Vise-Crips, which serve to close the straight, machine-bent run of the centerline seam.



cised with a "broken arm" router, which is a router attached to an articulated arm assembly. Some of the holes for the attachment of external hardware are also drilled while the pattern is in place.

Lund uses two press brakes to shape the edges of the panels after they're cut out. This process ranges from putting in a 90° bend for small fastening tabs, to creasing the edge of a side panel where it will be overlapped by the boat's bottom. (Lund also uses a "flanger" machine that bends the edges of transverse frame members.)

The two bottom panels used by Lund in its V-hulled models have a narrow flange bent along the straight, inboard edge of the piece by the brake. Since the forward end of the panel—the bow—is cut in a curve, this portion of the flange can't be shaped in the brake. To assemble the bottom, the panels are laid on a wooden jig with the bottom's exterior face (and flanges) facing up. The two pre-bent

flanges are clamped together with Vise-Grips while a worker with another pair of Vise-Grips hand-bends flanges into the edges of the curved sections that will become the stem.

The two forward ends of the panels are then pulled together and held temporarily by hex-headed screws. At this point, the forward flare has been defined, and the bottom starts to show its shape. Holes are then drilled through the paired-up flanges, rivets are installed, and screws are removed.

After the two bottom panels are fastened together, the new bottom is hoisted on its side so the centerline can be welded along the inside. (Yes, Lund does some welding, just as Crestliner does some riveting.) The welding not only joins the two pieces; it also creates a watertight seam. Finally, the outside of the centerline is covered with an aluminum keel extrusion that is first screwed into position and then riveted.

Adding sides (Lund calls them "freeboards") is another quick process. After a strip of seam tape is applied to the edge of the bottom panels each pre-cut side piece is set in place so that its creased edge overlaps the bottom (and the seam tape, which seals the joint). The sides are then attached with temporary screws, and a double row of holes is drilled for the rivets that secure the joint.

Like the sides, transoms are set in place with flanges facing in, fastened temporarily with screws, and then riveted. Ultimately, a plywood core and another piece of aluminum are added, creating a transom sandwich. Lund also uses plywood in a variety of other places—including under the side decks, or washboards, to provide a secure anchor for deck hardware.

For years, the company cut its plywood with a broken-arm router and patterns, just as is done with aluminum stock. But Lund recently installed a new computerized cutting machine, in which the router is guided automatically, by customized software, at the push of a button. It's very efficient—expensive, but efficient. Lund officials say they intend to replace their aluminum-cutting routers with similar equipment.

A Hands-On Process

In spite of the arrival of technological wizardry, the employees at Lund need not fear that they will be replaced

by machines, at least not yet. Most processes require a pair of hands. Riveting takes two pairs—one on the outside inserting the rivets and operating the rivet gun, and another inside to hold the "bucker," which flattens the inside of the rivet as the gun hammers on the outside head.

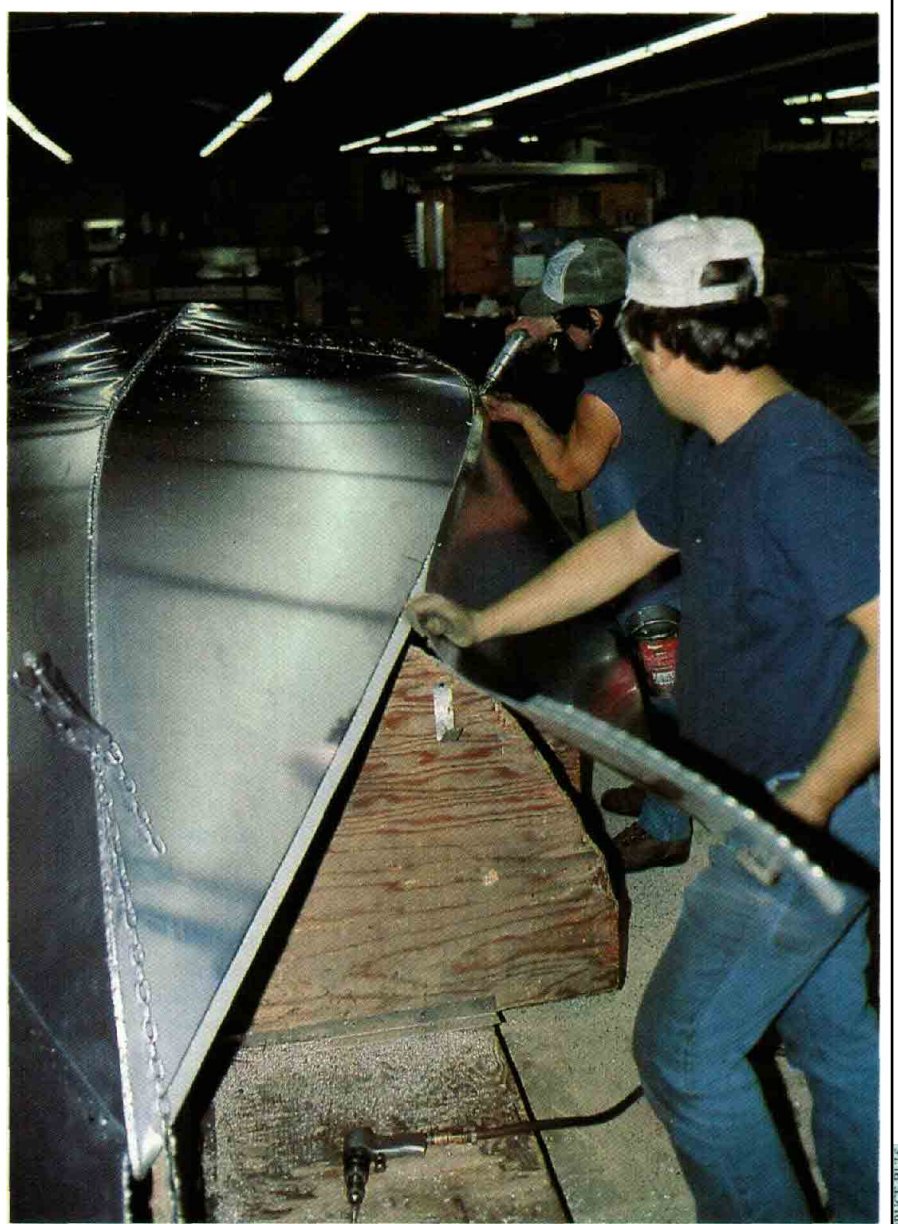
Riveting also requires a good set of earplugs and a tolerance for noise. In some cases, the man holding the buckler has to work underneath an upside-down hull. The noise is fearsome. Lund employees have their hearing checked regularly, and no one was complaining about hearing loss during our visit. Still, noise is one of the prices an aluminum builder pays for working with rivets.

Once the basic hull pieces are assembled, they are stiffened. In the plain, flat-bottomed, open skiffs, thwarts provide most of the side-to-side support. A pair of flanged, transverse uprights—held in place with the ubiquitous rivets—are installed for each thwart. The space between is filled with pour-in-place foam flotation. Some flat-bottomed skiffs also have flat floors that are set on top of a series of shallow transverse frames.

On the outside of the flat-bottomed models, a pair of extrusions fastened longitudinally to each side of the keel both provide stiffening and act as strakes for improved tracking. Another strake extrusion is added to each side for additional stiffening and knocking down spray. Extrusions are also used to cap the sheerline.

In V-bottomed boats, various transverse and longitudinal stiffeners are riveted in place, with their type and location being dependent on the model. In general, framing supports both the hull shape and the flooring. The frames tend to be longitudinal in the after portion of the boat, and transverse in the forward sections.

In some cases, the frames are constructed with flanges to hold rivets, while in others, small right-angle tabs are riveted to both the frames and the hull. When necessary, the bow is heavily reinforced with a series of closely spaced transverse frames, between which are riveted sections of extrusions that are also used as external strakes/stiffeners. In addition, Lund adds an extra layer of aluminum plate—a section the men in the shop call a "beef plate"—at the bow to back up the extrusion stiffeners.



Slides are installed in a V-hulled Lund skiff. Each bottom panel is overlapped by the pre-bent flange in the edge of the side panel. A double row of rivets secures the two sheets of aluminum. In between is a strip of seam tape, which seals the joint.

Building hulls with sufficient strength to endure the rigors of open water is not a problem for the boatbuilders in New York Mills. They've had lots of time to engineer designs and construction techniques that result in a solid piece of equipment backed by a 10-year warranty.

Rather, marketing is the challenge for Lund these days, as it is for almost all companies that seek to hang onto, if not increase, their share of a demanding market. Accordingly, Lund continues to add amenities. It would appear, for instance, that the company purchases almost as much carpeting as aluminum. But it is such finishing

touches—carpeting, swim platforms, galley units, built-in tackle boxes, instrumentation, and aerated live wells—that help keep customers coming back for bigger and fancier boats, according to Orvala.

Welding the Torch

Widening the appeal of aluminum boats is also very important at Crestliner, Inc., another Genmar acquisition located in central Minnesota. The company is based in Little Falls, a larger community than New York Mills and the childhood home of Charles Lindberg. (Little Falls is also the home of Larson Boats, a third Genmar com-

pany and a major manufacturer of fiberglass pleasure craft.)

Although Crestliner promotes many of its aluminum boats as "rivet free," several of the company's smaller models are either partially or completely riveted. However, the stars of the line—the larger, plusher boats—feature welded joints exclusively.

There are several reasons why Crestliner favors welding. One, already referred to, is that welds are more aesthetically pleasing. The lack of mechanical fastenings provides a cleaner exterior, one that, when carefully painted, looks almost as smooth

as new gelcoat on fiberglass-reinforced plastic. Another reason is that welding allows the engineers and builders more latitude. Charlie Nelson, Crestliner's director of product development and engineering, says simply, "Welding lends itself to new shapes."

And, by comparing the 1990 catalogs of Crestliner and Lund, one can see that the welding advocate of the two has developed some curves, especially at the stern, that aren't seen on the more traditional, square-transomed Lunds. Notes Nelson, "Welding enables us to take two sheets of plate, butt them together, and join them. With

mechanical fastenings, you have to break one edge to have something to fasten to. This limits the shapes."

Nelson also declares that overlapped, riveted joints eventually work loose enough to create leaks. "We must be doing something right," he says, "because we see more competitors going to welded boats. And where we used to see riveted parts, we are now seeing welded parts."

The down side to welding is the labor involved. It's one thing to drill a hole and shove a rivet through, and another to lay down a weld that is both smooth and sound. Crestliner trains new welders in-house by pairing them with experienced people. After 30 to 60 days, the new welder is either ready to work on his own or he washes out.

Even with experienced welders, the process is a delicate one. The intense heat from a continuous-feed welding machine can easily distort the relatively thin aluminum panels used in most smaller boats. Nelson says Crestliner relies on a couple of techniques to control distortion. One is clamping a heat-absorbing "chill bar" behind the sheet being welded. Another is tack-welding long, thin pieces at 6" to 8" intervals along a seam before running a continuous bead along the other side.

Despite Crestliner's ability to butt-weld sheets of aluminum, that's not how the company's basic hull is fabricated. Since all the welded boats feature V bottoms, two panels are required, just as is the case in the V-bottomed Lund. However, rather than add a center keel extrusion *after* joining the halves of the bottom, Crestliner welds the panels right into channels in the extrusion. The same process is used to attach the sides at the chine: Each bottom panel fits into one channel along the edge of the specially designed extrusion, while the side panel fits into the other.

When the hull components are assembled, the chine extrusions are first tacked in place on the bottom panels. Placed on a steel jig, the bottom panels are then welded to the keel extrusion, both inside and out. Next, the bottom edges of the side panels are set into the chine extrusions and tack-welded. (The extrusions also serve to absorb some of the heat of the welding process.)

After all the parts are spot-welded



Left— Welding transverse and longitudinal hull stringers into place eliminates the need to bend flanges into these stiffeners to provide an anchor point for rivets. The torch, however, requires more finesse than the rivet gun.

Below— A Crestliner employee grinds down a weld on the stem of a V-bottomed skiff. After this "rivet-free" boat is etched and painted, its seams will almost be invisible.



together, a continuous head is laid along the outside of the joint with a special MIG welder called a Pacer. With a small wheel for rolling the wire-feeding welder along the joint, the Pacer helps produce smooth, even welds. Crestliner shifts to the neater TIG process in areas such as the transom corners, where the welds are highly visible and appearance is important.

A Stiff Upper Lip

The side panels in Crestliner's hulls are stiffened, in part, by the simulated laps that are pressed into the aluminum by one of the large brakes at the Little Falls plant. Internal stiffening for the welded boats is provided by a series of longitudinal frames that are welded in place. Rounded extrusions bent to shape are also welded into the bow on the diagonal, and transverse frames are incorporated as needed. Side decks, fabricated in jigs from aluminum plate and extrusions, are set on the upper edges of the side panels, which fit into the sheer extrusion. The outside of this joint is welded along its entire length.

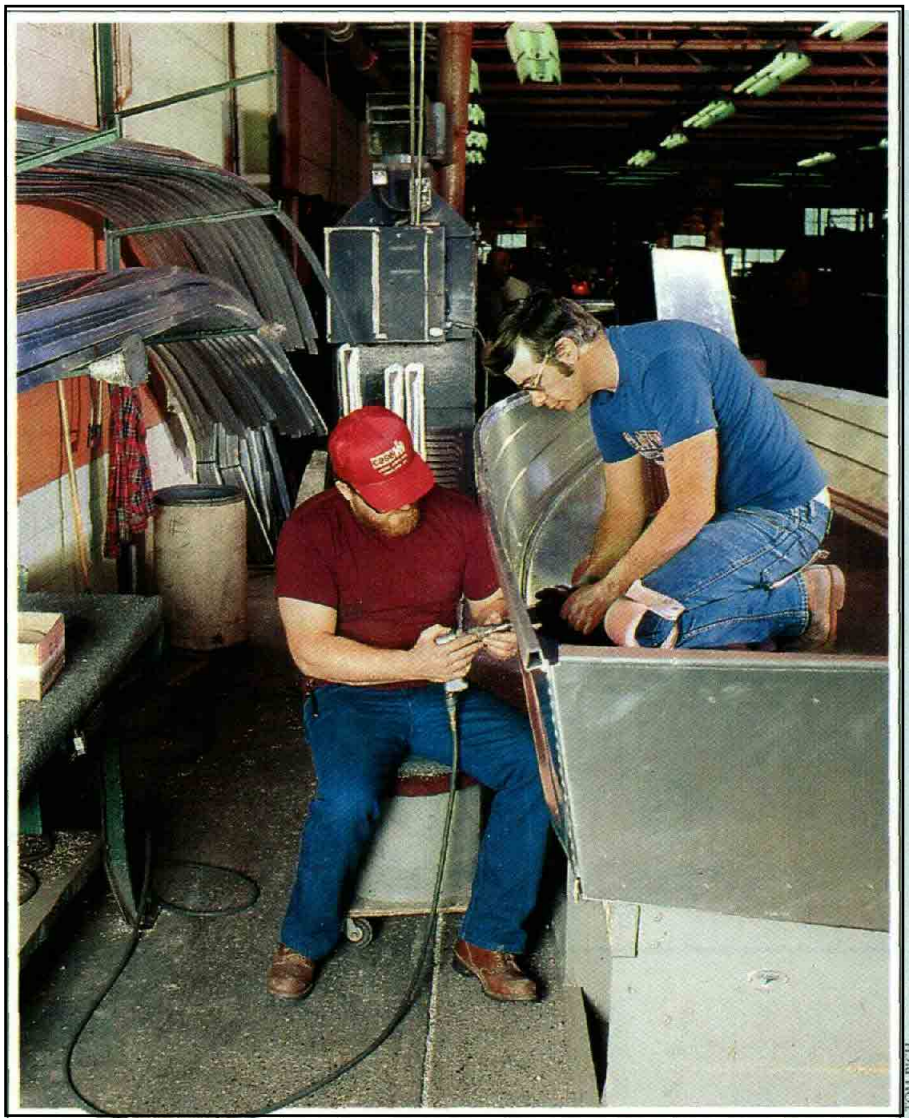
Because final appearance is so critical to the company's marketing strategy, Crestliner goes to some lengths to ensure a good finish. External welds are ground flush or, along the sheerline, hidden under a rubber strip. Bare hulls are sanded on the outside, and washed inside and out with two different solutions. First, a light acid wash removes oil and dirt from the hull and deck, and then an etching agent—Alodine—is sprayed on.

Afterwards, the boat is rinsed with water, and the remaining moisture is flashed off during about five minutes in a 375° oven. Having been sprayed with an appropriately colorful enamel, the boat is sent back into the oven to bake for about 15 minutes, again at 375°. Finally, finishing crews add all the upholstered padding and accessories that today's consumers find so irresistible—things like "designer drink holders" and roll-out coolers.

When a welded Crestliner boat rolls out the door, it goes with the company's confidence in this assembly method: Crestliner warrants the external welds for 20 years and the internal welds for 10 years.

Insert Flap A into Slot B

In Seattle, Washington, a company



A riveting team works on a skiff at Grumman Boats. Though this noisy process may seem crude in an era of sophisticated industrial technology, it minimizes the manufacturer's investment in expensive equipment and highly trained labor.

called Duroboat takes a different approach to aluminum-boat construction, making skiffs that feature "no loose rivets and no cracked welds."

Duroboats are assembled with mechanically interlocking joints. This ingenious system was developed by Australian David Payne in the late 1970s and has been used for building boats in the United States since about 1983. Payne says he created the "Durojoint" because Australians needed a boat that could withstand the punishment of running to and from the beach through pounding surf. Payne is no longer with the U.S. company he started, but, though there have been various improvements and modifications in the construction of the Duroboat, the joint remains the same.

Once they're cut to shape, the alu-

minum panels that comprise the bottom, sides, and transom of these skiffs are run through a machine that punches a series of "offsets" along the edges. The aluminum is not completely broken, just bent into a line of small tabs.

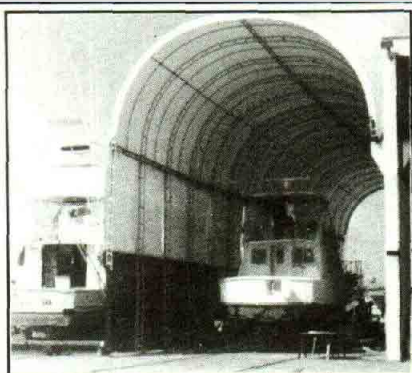
Hull assembly is a relatively simple matter of fitting these edges into specially designed extrusions. The extrusions are made so that the offset tabs on the panel are hooked into one side of the extrusion channel. A stepped, wedge-shaped, PVC strip, or "key," is hammered into place on the other side of the extrusion to lock the joint. Although very strong, the mechanical joint is not watertight at this point. To keep the water out, a line of polyurethane caulking is laid over the PVC key, inside the hull.

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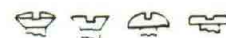


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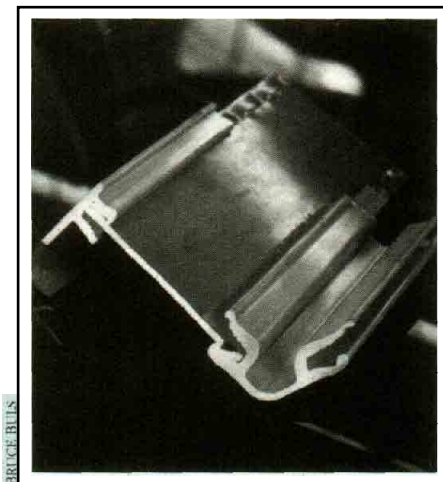
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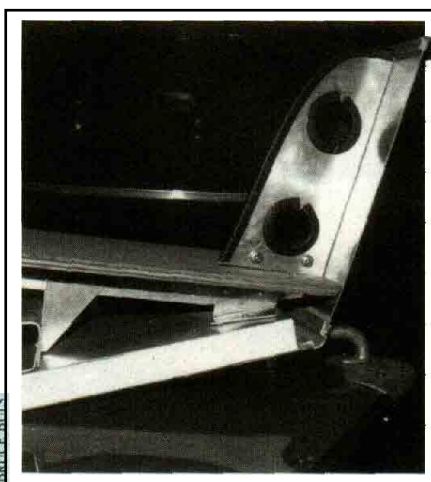


In Duroboat's mechanically interlocking joint, the machine-crimped edges of side, bottom, and deck panels are set into channels in specially made extrusions, then locked into place with wedge-shaped strips of PVC.

Duroboats feature a shallow V, so the bottom is comprised of two aluminum panels and a keel extrusion. Chine and transom extrusions link the bottoms, transoms, and sides. For reinforcement, two-piece aluminum castings (filled with caulking before assembly) are bolted into the lower corners of the transom, the center of the transom's bottom edge, and the juncture of the chines and stem. To finish off the sides and serve as a spray deflector, another extrusion is fitted along the sheerline. The sides are also impressed with strakes that provide additional stiffness and spray deflection.

The standard Duroboat hull is stiffened with aluminum thwarts fastened to the sides with machine screws and "rivnuts." The use of rivnuts is one of the modifications made at Duroboat since Payne's departure. These internally threaded sleeves are inserted in pre-drilled holes and compressed with a special tool that preserves the threading. Thus, each rivnut casing is held in place by a flange on the outside and a lump of deformed metal on the inside. The principle is similar to that of a pop rivet, but the rivnut is hollow and threaded to take a machine screw.

Rivnuts are installed in the flanged ends of the formed aluminum seats—essentially three-sided box beams that are filled with dry foam flotation. Then, the thwarts are positioned so the rivnuts line up with holes in the side panels. Machine screws are inserted through these holes, screwed into the thread-



The internal framing system in the 15' SuperSkiff features transverse and longitudinal stiffeners set atop a sheet of aluminum hatched by polyethylene flotation foam. The deck is resin-coated plywood covered with carpeting.

ing of the rivnuts, and drawn tight.

Additional stiffening is provided by a series of aluminum pipes that lie in longitudinal depressions formed in the bottom panels. Each pipe is held in place by vertical stanchions that fit into plastic "buttons" screwed to the base of the aluminum seats.

Another Duroboat model, the 15' SS (SuperSkiff), has a completely different internal-framing arrangement to accommodate an open, walk-around interior and center console. Instead of the thwart/pipe assembly, the bottom is crisscrossed with a series of transverse and longitudinal aluminum frames anchored to a sheet of aluminum that covers a bed of rigid poly-

Thwarts (transverse seats) and brackets are installed in the Duroboat skiffs with the help of special fastenings called "rivnuts." Hollow and threaded to take a machine screw, these sleeves are set into existing holes and crimped into place like rivets. Machine screws then anchor the thwart or bracket.



ethylene flotation foam. The brackets that tie these frames together are secured with pop rivets and double-sided bonding tape from 3M. Finally, the network of stiffeners is covered with phenolic resin-coated plywood and carpeting.

Currently, Duroboat only produces small, open runabouts. Keith Rogstad, the company's owner, says that the mechanical interlocking joints and internal framing systems could work successfully on larger boats, but his shop is limited by the length of material that its 16' press brake can handle.

Of the three manufacturers visited, only Duroboat is using any form of adhesive, or chemical, bonding for hull assembly. Charlie Nelson at Crestliner hinted that his company is looking at the use of adhesives, but the work is still very preliminary. Still, he forecasts new fastening techniques "that will change the shape of the business."

Spectrum Boats is said to be already using chemical bonding in its aluminum boats, but the firm apparently considers the process proprietary and is reluctant to discuss its techniques. Given Spectrum's apparent success, however, and considering advances in metal bonding developed by the aircraft industry, we could be seeing more of this alternative method of aluminum-boat construction in the near future.

In the meantime, rivets and welds (as well as mechanical interlocking) will continue to hold together a still-growing fleet of small aluminum pleasure boats from coast to coast. PBB

CATALOGS:

Thorough planning can maximize effectiveness and minimize cost

A Dozen Tips for Catalog Success

1. Know your market: Write and design your catalog to fit your potential customers.
2. Plan all the elements of your literature program—from mail room to sales floor—for efficiency and usefulness.
3. Use the best photography you can possibly afford.
4. Control your literature's design; never let it overcome your product or sales message.
5. Know what you want *before* you turn over catalog materials to your agency, creative house, or printer.
6. Rely on your agency and printer for cost-cutting production ideas and alternatives.
7. Select the right printer for the job.
8. Discuss the project with your printer early in the design process.
9. If you're not accustomed to buying printing or aren't familiar with an appropriate printer, put the job out to bid.
10. Allow a minimum of 15 to 20 working days for production of materials that the printer will set up; figure on 10 to 15 working days for production if you are providing camera-ready layouts or film (from which the press plates are made).
11. Make changes and corrections on first proofs before the job has gone to film; make sure that anyone who has the authority to make substantial changes sees the job at an early stage.
12. Proof and return materials quickly.

by Ted Hugger

Today's boatbuilders think nothing of spending thousands of dollars to develop a special gelcoat color, design a complex molded swim platform, or attend boat shows scattered across the country. Yet, when it comes to putting together a product catalog—perhaps the most critical of all sales tools—many companies invest little time, talent, or money.

Of course, other firms, often the ones who enjoy the most success, have brought the planning, design, and production of these indispensable pieces of literature to a high level.

The main component of producing an effective catalog is common sense: Approach the task with the same thoroughness and vigor that you dedicate to the manufacturing portion of your business. Developing better promotional material needn't cost a fortune; in most cases, the figure may not exceed what you're currently spending. But you will have to step back and take a long look at your existing program, and then determine new design and production criteria based on your marketing plan and available budget.

For the purposes of this analysis, it may be helpful to examine your current and future literature needs in terms of five basic components. Doing so will help you prioritize your goals and put your strengths and weaknesses into perspective. Though they overlap to one degree or another, the five components are: target audience, use and distribution, sales function, design, and production.

Target Audience

The first step in developing an effective literature program is to gain a

clear picture of your potential customers. What are their demographic characteristics: blue-collar workers looking for a fishing boat? young, middle-income families in search of their first trailerable sailboat? affluent, older couples who have already owned two or three boats and are once again moving up?

Your product line, as a whole, will appeal to a specific group of people. Then, in turn, each of the individual boats in your line (based on size, cost, and use) will appeal to more definable sub-groups. Once you've determined who your most likely customer is, you can speak directly to him or her with your catalog. The look, style, and feel of your printed material will determine just how well your message is heard by your most likely buyer.

Much of the necessary demographic information is readily available through your current customers, dealers, and marketing team. Listen carefully to what they're saying, keeping a sharp eye for emerging trends. Ask plenty of questions: What aspects of your line are targeted customers attracted to? What excites them, as a group? What don't they like? Does your current literature address the needs and wants of future buyers? What's missing? Examine your competitors' promotional efforts carefully. Have they picked up on a theme you might have overlooked?

Whenever possible, invest in market research, actually *surveying* your existing customers, your competitors' customers, and the boating public at large, then analyzing and tabulating the results. Working in still greater depth with a smaller group of boating

THE BOATBUILDER'S FRONT-LINE SALESMEN

consumers (a focus group) can also be extremely valuable. This process can identify specific strengths and weaknesses within your line and clarify how your potential customers see your boats. Once this picture is clear, use your literature to build on existing strengths or correct problems such as the improper positioning of your boats.

Your catalog's design, colors, type style, photographs, copy (text), and headlines all work together to create an image of your company and products. Properly used, this image will appeal to the consumer who is most likely to become a customer. But if you have missed the mark in either shaping or using that image, you'll be lucky to get a truly qualified consumer to pick up your catalog, much less read it and make a purchase as a result.

A glossy catalog with an expensive, embossed cover and sultry "mood" photography may project an affluent, "upscale" image and appeal to the corresponding type of buyer. If you change to a design with bright, vibrant colors and bold, contemporary typefaces, you're appealing to a more active, youthful segment of the market. Choose a lakeside photo of a few buddies sitting around the campfire cooking the fish they've caught, and you're projecting a sportsman's image.

Notice that in each example, the elements of the catalog are used to reflect a specific lifestyle that is particu-

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PLANING DORIES

Not every company can afford a four-color catalog, but good black-and-white photos and articulate product descriptions can provide the basis for a package that is both economical and effective.

lar to a certain type of consumer—and we haven't yet even talked about boats! Though your catalog may be competently designed, written, and illustrated, the image it projects could be wholly inappropriate for your particular market segment. In short, be sure your literature projects a mood, image, and message tailored to the majority of your potential customers.

Remember, you're relying on your catalog to help consumers visualize themselves *with your boat*, living the sort of life or engaged in the kind of activity they find appealing. Without a clear vision of the customer's tastes, you simply won't be able to direct your promotional materials with the needed degree of accuracy.

Use and Distribution

There are many different ways to

use product literature, and all of them should be accounted for in planning a new catalog. The piece might be mailed out as a response to an inquiry, distributed at boat shows, or offered as a point-of-purchase sales aid for dealers. It may be used by itself or in concert with other catalogs, brochures, and product sheets, each describing a specific aspect of your line.

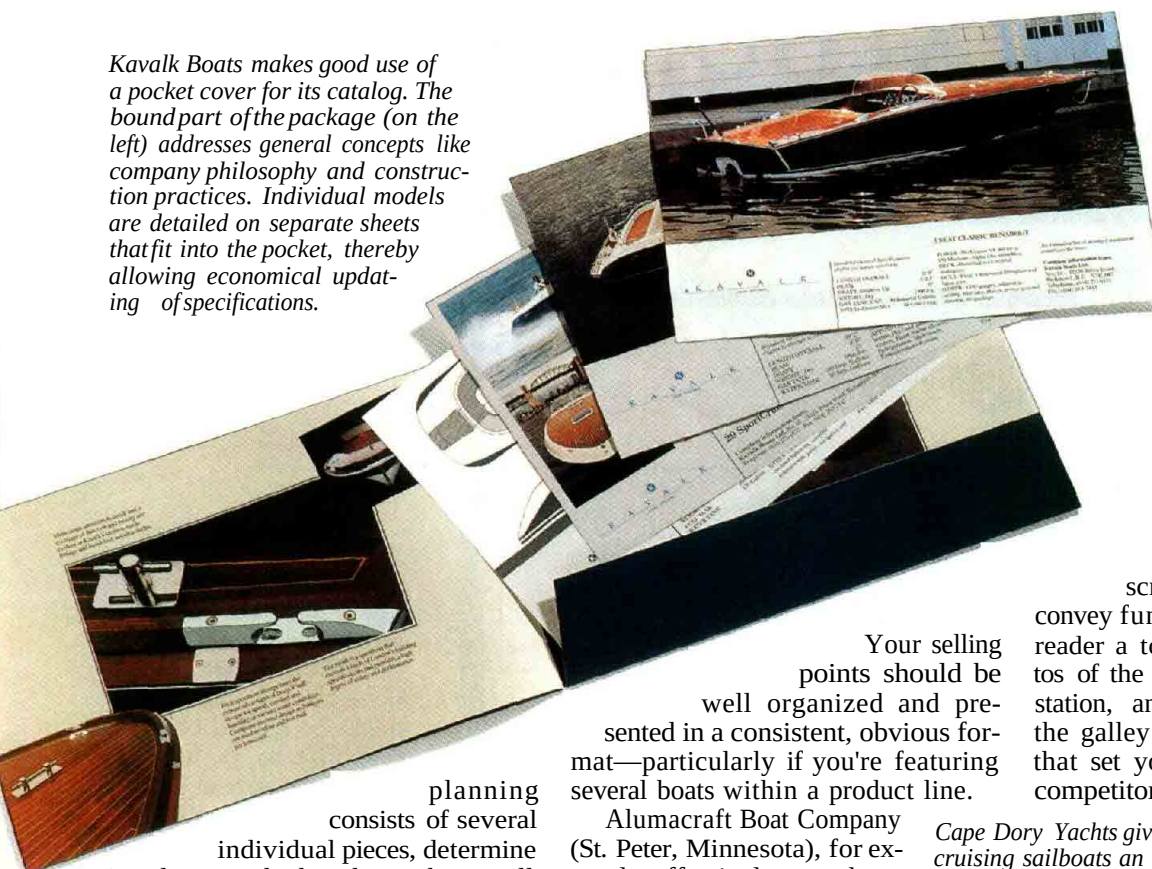
If the piece is intended for use by itself, it must convey your entire image and sales message. On the other hand, if the catalog is only one element of a presentation, you needn't

waste valuable space repeating information found elsewhere in the package.

Most boat manufacturers provide catalogs to their retail network, and any company that does so should always leave space on the piece—usually on the back cover—for the dealer's imprint. A 2 1/2 x 3 1/2" area is usually sufficient. In addition, don't make your prospects jump through a hoop to obtain more information. Just in case the dealer forgets to stamp the catalog with his address and phone number, put your company address, phone, and fax number on the piece.

It's also imperative to check postal service regulations when planning your literature. If you'll be sending out each piece individually, include room for a stamp or indicia, and space for an address label. If the catalog you're

Kavalk Boats makes good use of a pocket cover for its catalog. The bound part of the package (on the left) addresses general concepts like company philosophy and construction practices. Individual models are detailed on separate sheets that fit into the pocket, thereby allowing economical updating of specifications.



planning consists of several individual pieces, determine in advance whether the package will fit in a standard-size envelope. A custom mailer will be more expensive to produce, and you'll often incur additional postage, to boot.

Now is also the time to determine all your literature costs—including distribution expenses—and to modify the package as needed to stay within your total marketing budget. A beautifully executed catalog that never gets adequate distribution because it's too expensive won't sell any boats. If you're sending quantities directly to dealers, have your printer package them in a convenient, standard quantity. There's nothing more wasteful than having to pull groups of 250 pieces from a case of 2,500 so they can be repackaged and shipped to a dealer. For little or no additional cost, your printer will wrap those lots of 250 for you. Having him ship boxes of catalogs directly to dealers may also save you money.

Sales Function

As you create your catalog, keep in mind that it is a sales tool first and foremost, and, as such, it must deliver a solid, easily understood message. The people reading this catalog are looking for information—so give it to them in the form of detailed, complete product descriptions, performance charts, graphs, and lists of features.

Your selling points should be well organized and presented in a consistent, obvious format—particularly if you're featuring several boats within a product line.

Alumacraft Boat Company (St. Peter, Minnesota), for example, effectively uses charts to display a wealth of feature-comparison information on each two-page spread of its 20-page catalog. In addition, Alumacraft has also provided a scaled-down deck plan of each boat. All this makes it easier for the prospective customer to identify the differences between the many boat models in the company's catalog.

Don't be afraid to use plenty of descriptive text in a catalog, as long as it's well written. Such copy is appropriate and necessary if the prospect is to make an informed purchase decision. Make certain, however, that both the content of the text and the typeface selected for it are clear and easy to read. Small print and illegible typefaces deserve to be ignored, and they will be.

Boat manufacturers are fortunate in that their products are visually exciting. Consider the poor marketing people who are faced with making a wrench or a can of glue look exciting. Take advantage of this good fortune,

and use numerous photographs of the highest possible quality. In fact, if there's one area where you should dig deep into the company coffers, it's photography. Invest in the services of a professional (preferably one experienced in marine photography) to shoot the color and black-and-white photographs for your catalog.

In the eyes of the average customer, good pictures say far more about a boat than your written description. Use action shots to convey fun and excitement. Give the reader a tour of your boat with photos of the cockpit, after cabin, helm station, and engine room. Don't forget the galley and head, and any details that set your product apart from its competitors. The generous use of out-

Cape Dory Yachts gives prospective buyers of its cruising sailboats an intimate look at each vessel's interior through a full-color, overhead cutaway drawing, as well as close-up photos.

Cape Dory 30 Mk II...1987
Introduction. After ten years of production and hundreds of satisfied cruising sailors, we have retired the original Cape Dory 30, designed by Carl Alberg. To replace her, we have designed a larger thirty with more features...the CD-30 Mk II. She has the same pleasing profile...the same high quality construction...the same seaworthiness...plus 30% more interior volume. We have combined the latest in style, interior design and cockpit layout with a more contemporary version of our full keel hull to offer cruising families a thirty footer with loads of eye appeal and cruising comfort. We call it the Cape Dory 30 Mk II.

Design Partnership...The CD-30 Mk II comes from the drawing board of our in house naval architect, Clive M. Dost. Her inspiration comes from the late Carl Alberg, dean of "full keel" sailing yachts. The craftsmanship and engineering is from the New England craftsmen of Cape Dory Yachts. The CD-30 Mk II is a solid "full keel" family cruising boat built for years of trouble free enjoyment.

Truly Cape Dory...The CD-30 Mk II features all of the quality that Cape Dory is respected for...generous use of finely fitted teak...custom designed bronze opening ports...pedestal wheel steering in a "T" shaped cockpit...Westerbeke diesel power with a 23 h.p. pump. Laminated teak bowsprit with twin anchor rollers...thru bolted bronze seacocks. Custom designed Spartan deck hardware...the list goes on. It's what you expect with a Cape Dory Yacht.

A Long Tradition
Yachts has been built kindly yachts for over 4,000 "full keel" cruising designs is long company philosophy and excellence is truly

standing photography in a catalog is the next best thing to actually putting the prospective buyer aboard the boat with your dealer's best salesperson.

Both S2 Yachts (Holland, Michigan) and Grady-White Boats (Greenville, North Carolina) have clearly mastered the effective use of photography. They consistently combine dazzling large-format action shots with high-quality photographs of equipment and layouts, a strategy that makes reading their catalogs an enjoyable adventure. As an added benefit, these razor-sharp, professional photographs work to project a top-end image for both companies.

According to Marlene Barkel, manager of marketing services for S2 Yachts, a great deal of care and time is devoted to creating just the right photographic image of a particular boat. "Many of our photographs are shot specifically for a given catalog layout," she explains, "but we also cover all aspects of a boat with a variety of shots, some of which we can

use for press releases, dealer-support materials, and boat-show displays."

Barkel and colleague Jonathan Marcus, who coordinates the S2 location shoots, worked with many photographers before finding two who

could consistently deliver the vivid, high-caliber work they demanded. "It takes a special photographer," Markel says, "and a willingness to work at a project until it's right; we'll often spend days shooting a single boat to capture the perfect images to portray our boats."

Cape Dory Yachts (East Taunton, Massachusetts) produces a full-color, four-page catalog for each of its sailboats and powerboats. Every one not only utilizes lengthy copy and high-quality color photographs, but also features a beautifully executed, four-color illustration of the boat's interior layout. Far superior to line drawings, these illustrations provide a unique perspective on each boat's ac-

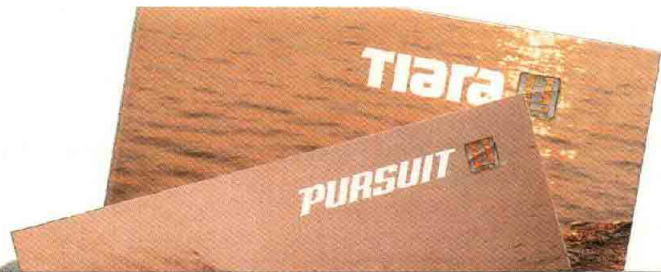
commodations, almost as though the company had sliced off the boat's cabintop and deck, allowing the reader to peer inside.

Design

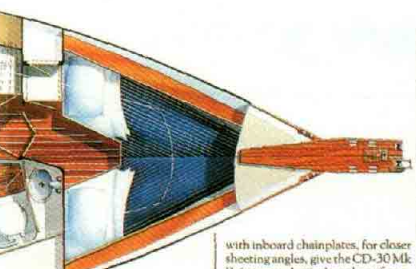
Consider the rich tradition of a Burger motoryacht, the rugged utility of a Fisher bassboat, the family-style versatility of a Four Winns cuddy: Each boat and product line has a distinct aura about it. When properly designed and produced, a catalog will project this same feeling. Design is important, and the value of employing a top-notch agency or designer for the task cannot be overestimated.

Beware, however, of the use of design for design's sake. How often do you look at an advertisement or catalog, only to end up scratching your head, wondering just what the manufacturer is trying to sell you? Is it the champagne pictured? The boat? The car? How about life insurance? Sometimes, if a designer is allowed a completely free hand, the catalog ends up being graphically stunning but fails miserably (and often expensively) to deliver a clear, understandable sales message.

This warning also applies to the indiscriminate use of graphic elements (those nifty little squares, triangles, and diamonds strewn about the page), distracting color blocks, and fancy typefaces. Keep reminding yourself (and your creative people) that you're selling boats, not abstract art. Emphasize that anything which detracts from



The S2 group, which includes Tiara, Pursuit, and Slickcraft, relies heavily on large color photos of exceptionally high quality. The company sometimes spends days shooting a single boat.



the CD-30 Mk II...a modern classic in the making.

Design and Engineering...The CD-30 Mk II all new hull form consists of a beamy canoe body with greater form stability and attached full keel. The section de-rise and garboard radius have been reduced compared to her predecessor, increasing the effective span of the keel. These factors coupled

with inboard chainplates, for closer sheeting angles, give the CD-30 Mk II improved windward performance...all the while maintaining the legendary tracking and seaworthiness of our full keel design. The deck is molded in one piece with an encapsulated end-grain balsa core for stiffness and insulation. A separate molded headliner is bonded to the underside of the deck, providing a pleasing cosmetic finish and increased insulation. The deck unit complete with the headliner is thru-bolted to the hull's internal flange for ultimate rigidity and strength.

Spacious Interior For Good Times...Cape Dory has devoted countless hours of research and development to refine and maximize the interior space of each of our models. We have recently re-engineered the interiors of our CD-30, 36, and 40. The CD-30 Mk II follows this trend. The interior is handcrafted with teak and other hardwoods. Her generous 10 foot 6 inch beam permits a new dimension in terms of interior volume. Berths for 6...a comfortable main salon...a large U-shaped galley...and a commodious head with a separate stall shower, a unique feature seldom found in

boats of this size (complete with a comfortable teak seat)...all of these features welcome and encourage extended cruising in elegant comfort.

Powerful Sloop Rig...The CD-30 Mk II has a well balanced single spreader masthead rig that delivers spirited performance in all wind conditions. You'll thrill to her responsive helm and easy tracking "full keel" stability. She's fun and easy to sail.



Simply the Best...The Cape Dory 30 Mk II carries on a tradition of boats built with integrity for lasting pleasure and value.



CAPE DORY 30

are tops at that one type of job—pocket folders, for example—and the customer will get a good-quality job at a significant savings."

Post warns that the quoted cost of a printing job can increase dramatically due to requests for expensive, last-minute changes. It's important to understand the differences between *corrections* and *changes*. Corrections are usually made at no additional charge to the client and normally involve printer's errors. For example: you specified brown headlines, but when the color proof arrives, they are red. Changes, however, are client-initiated alterations in either the original material or the instructions supplied to the printer. For example: you decide to rewrite the description of a boat at the 11th hour or switch photographs when the catalog is ready for the presses.

Post recalls, "A recent \$12,000 job—16 pages plus covers—had been in the works for nearly two months and was scheduled to go on the press the next day. Someone decided at the last minute that he'd better let the company president read the final proof. The boss didn't like it, had the whole thing rewritten, and added three new photographs. Those changes cost his company an additional \$1,800 for type, film, separations, and color proofs. It also forced us to deliver the job a week late."

Certainly, the president of that company may have been absolutely correct and the changes entirely justified. But, if he'd been included in the proofing circle to begin with, his changes wouldn't have cost his company a penny more, and the job would have been delivered on time. The lesson is simple: Have a proofing system in place, and make sure all those involved appreciate the importance of acting quickly. If your proofs linger on someone's desk for two or three days, you may lose your place in the printer's production schedule.

Cost-Saving Measures

You can also rack up some impressive savings on color separating, where a color photograph is converted into four closely registered negatives (red, blue, yellow, and black) prior to printing. This process is expensive. The cost of a separation for an 8 x 10" picture that began as a color slide will range from about \$65 to as much as \$225 for a premium-quality image in

Sample Printing Estimates

This listing provides rough cost estimates for a variety of catalog printing jobs. Each includes typesetting, paste-up, separations, and halftones. Variations in design complexity, number of halftones and/or color separations, paper stock, press run, and regional pricing will affect the actual job cost accordingly.

	2,500/ Pieces/Unit Cost	5,000/ Pieces/Unit Cost	10,000/ Pieces/Unit Cost
Six-Panel Folded Brochure 8 1/2 x 11" sheet folded to 3 1/2 x 8 1/2", four-color on both sides, eight color separations, on 80# gloss text stock.	\$2,050/.82	\$2,469/.49	\$3,045/.30
Product Sheet 8 1/2 x 11", four-color on side one, one-color on side two, on 80# gloss text stock.	960/.38	1,085/.22	1,278/.13
Four-Page Color Brochure 11 x 17" sheet folded to 8 1/2 x 11", four-color both sides, eight color sep- arations, on 100# gloss text stock.	1,945/.78	2,465/.49	2,795/.28
Eight-Page Black & White Brochure 8 1/2 x 11", self-cover, 14 halftones, on 100# gloss text stock, folded and saddle-stitched.	752/.30	1,023/.20	1,385/.14
Eight-Page Color Brochure 8 1/2 x 11", self-cover, four-color on all pages, 14 color separations, on 100# gloss text stock, folded and saddle-stitched.	2,830/1.13	3,325/.67	3,960/.40
Eight-Page Color Brochure Plus Embossed Cover 8 1/2 x 11", four-color on all pages, 14 color separations, on 100# gloss text stock, folded and saddled-stitched; plus embossed four-color cover, with varnish.	3,720/1.49	4,367/.87	5,250/.53
Eight-Page Brochure Plus Pocket Cover 8 1/2 x 11", four-color on all pages, 14 color separations, on 100# gloss text stock, folded and saddled-stitched; plus 10-pt. cover with 4" glued pocket, four-color on one side, with die-cut slits for business card.	4,030/1.61	5,080/1.02	6,395/.64
Pocket Folder 10-pt. cover stock, 4" glued pocket, four-color on one side, one color sep- aration, with die-cut slits for business card.	1,648/.66	2,319/.46	3,146/.31

which technicians have "corrected" the color of the picture to your specifications. But, the savings may be substantial if you can "gang," or group, separations made at the same percentage (of enlargement) and at similar levels of density, light, and color value. For example, you might design a page of your brochure to incorporate four 3 x 5" pictures, all 400% blowups of individual 35mm slides shot under similar light conditions inside your plant. This batch could be handled as one separation.

Looking at the catalog as a whole, let's suppose you have chosen a total of 12 photographs. If you can gang these into two or three separations, you may be able to cut an \$1,800 separation bill by 40%. Keep in mind, however, that if you go this route, you won't be able to ask for color correction on individual shots.

Whatever your investment in color separations, remember that they are reusable. By carefully planning your promotional material, you can employ the same shots in several ways—in ads and one-page brochures, as well as the catalog, for instance—thereby using your promotional budget much more efficiently.

The general style of your catalog—in other words, the type of package you choose—will also have a big effect on its price. No one design is right for all companies.

Fisher Marine (West Point, Mississippi) and Fountain Power Boats (Washington, North Carolina) have both chosen a simple 8 1/2 x 11" saddle-stitched (staple-bound) booklet to present their product lines. (Short of a single-page flyer, this is one of the most economical full-color styles.) The paper is cover-grade, glossy stock, and both companies use dramatic, four-color photographs on each two-page spread, letting the pictures tell the primary story.

Catalogs needn't be done in color to be effective, however. Nexus Marine Corporation (Everett, Washington) has produced economical, black-and-white catalogs for its line of wood/

epoxy dories and skiffs. Clean layouts, sharp photographs, easy-to-read specification charts, and descriptive copy with a warm, friendly tone make these catalogs particularly effective. Just as important, the job matched Nexus's budget constraints.

Burger Boat Company (Lantana, Florida) takes the booklet style several steps farther, with a magnificent 32-page, 11 x 10^{13/16}" catalog. It features an ultra-heavy, gold-embossed cover; onionskin fly sheets; and two, full-color spreads that fold out to an impressive 21 5/8" wide. The piece even carries a cover price of \$15. While this is an exceptionally well done catalog, its extravagance would be wholly inappropriate if Burger were producing anything other than limited-production

photograph, along with pertinent technical specifications.

There are distinct advantages to the pocket catalog design. The package can be customized for a particular prospective buyer by including only those product sheets that are of interest to that individual. Then, because of selective use, the life of expensive literature can be extended. Should you add a new model to the line or change one boat's specifications, only a single sheet need be modified and reprinted.

Home-Grown or Agency-Produced?

Although there is a trend toward bringing the production of promotional material in-house as a cost-saving measure, this shift cannot be accomplished without an investment in qualified personnel and overhead. No boat manufacturer should allow the quality of printed material to deteriorate in the name of a limited savings. In-house production may very well cost as much or more than going outside to an agency or design firm. On the other hand, it will

Although they're expensive initially, color separations made for a catalog can be reused for purposes like advertisements and one-page flyers.

yachts for an exclusive clientele. The package speaks eloquently to those who can afford a motoryacht with a pricetag between \$2 million and \$11 million.

At the other end of the spectrum, Yamaha Water Vehicles (Cypress, California) takes an upbeat, contemporary, youthful approach in its colorful, 16-page catalog. Dramatic, 17 3/4 x 8 1/2" product shots are complemented by three 2 x 2" action photos inset on each spread. Lively and fun to read, the descriptive copy is successfully aimed at the young and young-at-heart.

Kavalk Boats, a British Columbia-based manufacturer, has chosen another tack. The first six pages of the Kavalk catalog talk of company history, discuss craftsmanship, and, in general, present a very upscale image with a 2 1/4"-deep pocket that holds individual, four-color product sheets, each focusing on a single Kavalk boat. These sheets resemble each other in design and provide a 10 1/2 x 4 5/8" color

provide complete control over the creation of printed materials, offer more flexibility in setting deadlines, and eliminate the need to educate an outside person to all the nuances of the marine industry, your company, and your product line.

If you do work with an agency, there is a great deal you and your marketing personnel can do to maximize the benefits of the relationship. Begin by including the support people at the agency in honest discussions of your firm's goals, budgets, and deadlines. Insight into exactly what your literature must do, and to whom it is targeted, will greatly assist your creative partners (the agency people) to deliver the materials that will realize your marketing goals. With a clear perspective on your needs and the time frame within which you must work, they'll be able to schedule adequate creative and production time, eliminating costly, last-minute rush jobs.

PBB

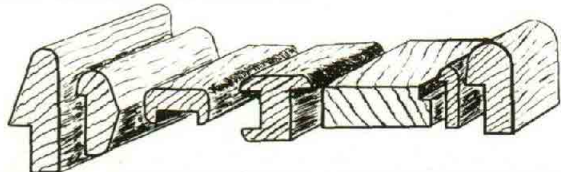


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Reichhold Chemicals, Inc., has produced a series of 14 videos to train fabricators in solving technical problems. The topics covered include testing polyester resins for non-volatile content, Brookfield viscosity, acid number, room-temperature gel, SPI gel, Gardner-Holdt bubble viscosity, laminate hardness, gel and cure rates, accelerated stability, static styrene emissions, cured color and clarity, hydroxyl content, weight per gallon, and specific gravity. Contact Bill Schramm, Reichhold Chemicals, Inc., P.O. Box 13582, Research Triangle Park, NC 27709, tel. 919-544-9225. *Circle Reader Service Number 101.*



Homelike Plumbing

Recent enhancements in SeaLand's VacuFlush marine toilets include design changes that make these units more closely resemble contemporary bathroom fixtures. Incorporating a single foot pedal, these toilets use only about one pint of fresh water per flush, eliminating the odors that accompany the use of salt or lake water. A quiet, electric, bellows-type pump draws an average of 6 amps and can run dry without damage. Contact Ron Bailey, SeaLand Technology, Inc., P.O. Box 38, 4th St., Big Prairie, OH 44611, tel. 800-321-9886 or 216-496-3211. *Circle Reader Service Number 102.*



Spill Control

Boatyards continually face fuel-dock spills and other accidental discharges of toxic materials. In response, Occidental Chemical Corporation offers several convenient "Hazorb Oil-Off-Water" products to help clean up or contain waterborne oil and other hazardous chemicals. Tests by the manufacturer indicate that of the total liquid content absorbed, less than 3% is water. Hazorb is available in several sizes for use in bilges, and the material may also be purchased in 8' tubular lengths with snap hooks for the quick formation of an absorbent containment boom. Contact M. Vandervort, Occidental Chemical Corporation, P.O. Box 809050, Dallas, TX 75380. *Circle Reader Service Number 103.*

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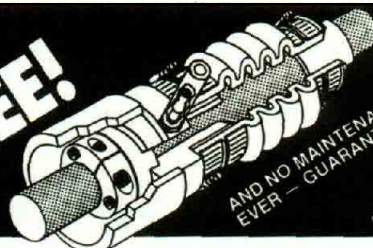
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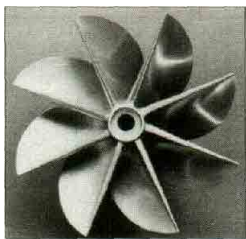
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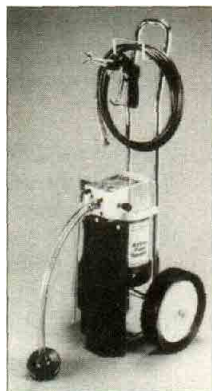
State-of-the-Art Propeller

Rolla SP Propellers has introduced a new high-performance, eight-bladed propeller. Incorporating cleaver geometry and stainless-steel construction, this wheel is capable of withstanding high stress and unexpected forces. Intended exclusively for surface-piercing applications, the REXP 38/39 is designed to operate with all gasoline and diesel engines up to 1,500 hp. Available diameters range from 18.5" up to 21.25", and pitches run from 29" to 31". Features include complex cylindrical cambered sections to augment overall performance, reduced blade thickness for hydrodynamic efficiency, and proportioned rake for maneuverability and control of hull attitude. Rolla Propellers USA, 446 School Rd., Novato, CA 94945, tel. 415-892-0493. *Circle Reader Service Number 104.*



Mini-Environment Suit

The EEV Comfort Suit is now available from Technical Innovations, Inc. The disposable garment provides workers with protection from excessive temperatures as well as from dust, asbestos, fiberglass particles, and paint or liquid overspray. Made of lightweight Tyvek, coated with polyethylene, the suit uses compressed air from conventional sources. The control unit attached to the manifold on the back of the garment adjusts the temperature of the incoming air and circulates it throughout the suit. Technical Innovations, Inc., P.O. Box 129, Waterford, MI 48095, tel. 313-338-4011, fax 313-338-4016. *Circle Reader Service Number 105.*



Hose for Sprayables

Nyaflo high-pressure hose is available from the Polymer Corporation with either of two covers—nylon, which provides maximum resistance to most solvents, and polyurethane, which offers greater flexibility. The wireless, anti-static hose is said to be resistant to flex fatigue and abrasion. It is suitable for paints, solvents, fuels, and oils. Both types are constructed of seamless, thermoplastic inner tubing, bonded to layers of high-tensile, synthetic reinforcement. A static drain is located between the braid layers. Polymer Corporation, P.O. Box 422, Reading, PA 19603, tel. 215-320-6621, fax 215-320-6866. *Circle Reader Service Number 106.*

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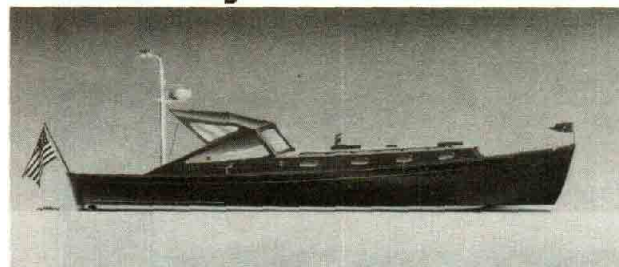
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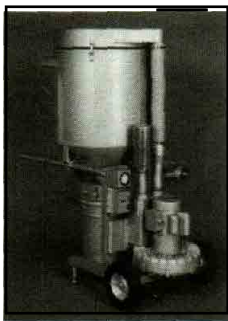
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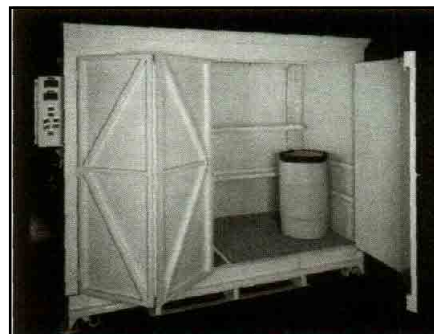
Acetone Replacement

Shipshape Resin Cleaner from GAP Chemicals Corporation enables fiberglass fabricators to replace acetone as a primary clean-up solvent. The GAP product complies with government regulations specifying lower VOC emission levels in the workplace. It can be used to remove polyester and urethane resin, as well as paint overspray. Evaporation loss is said to be 200 times slower than that of acetone. GAP provides a training program on handling, reclaiming, and reusing the product. Contact Joan Deiling at GAF Chemicals Corporation, 1361 Alps Rd., Wayne, IN 07470, tel. 201-628-3825. *Circle Reader Service Number 108.*

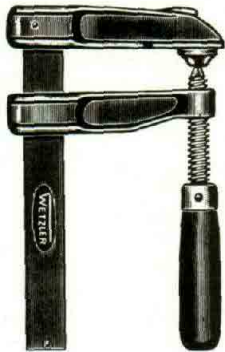


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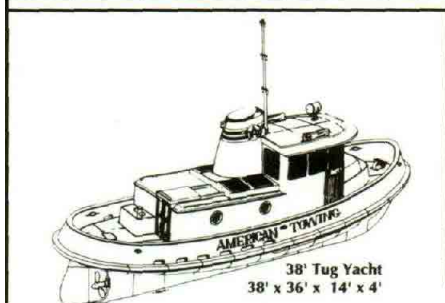
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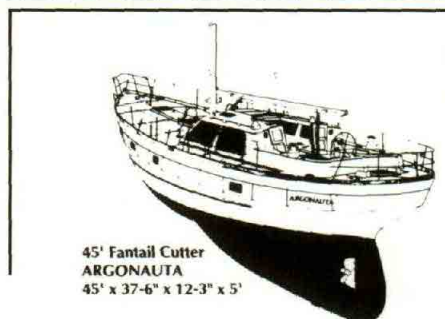
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FAIRING COMPOUND

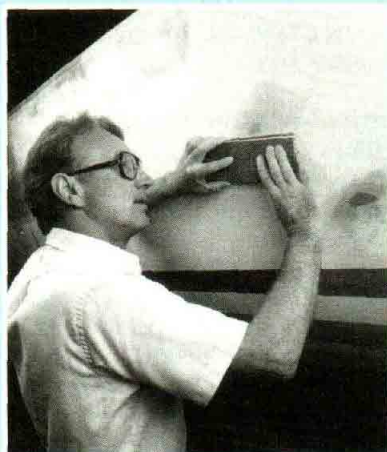
410 Microlight™ filler makes a tough job easy

"Sanding fillers is the worst job I can think of. It's miserable, tiring, and just no fun. That's why my brother Jan and I searched for a filler that would make the job easier. And we finally found it...new 410 Microlight™ filler. If we'd had 410 Microlight filler 20 years ago, I probably wouldn't have gray hair today."

— Meade Gougeon

EASIER TO SAND. 410 Microlight filler is the ideal low-density filler for creating a light, easily worked fairing compound. When mixed with WEST SYSTEM® Brand epoxy, this filler has a smooth, creamy texture. It trowels on easily, holds a featheredge well, and resists running or sagging on vertical surfaces. Microlight filler's physical properties make sanding about 30% easier than with microballoons.

LIGHTER. Because Microlight filler is less dense than microballoons, it's also lighter. You'll use about 30% less to create a non-sagging mixture. And Microlight filler is an ideal bonding adhesive for lightweight woods such as balsa.



LESS EXPENSIVE. Microlight filler requires less material — 3½ cups in 4 ounces of epoxy will yield 21 cubic inches of fairing compound. That makes it 30% less expensive to use than microballoons.

FASTER. Microlight particles are treated with a special coating that allows them to blend with epoxy quickly and easily, so you can mix a peanut butter-thick batch of fairing compound in next to no time. And because fairing compound utilizing Microlight filler tends to cure faster than compound utilizing a similar amount of microballoon-

based filler, you can apply multiple coats or sand the faired surface in much less time.

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The Aging of the Fleet

by Meade Gougeon

No one knows for sure how long fiberglass boats will last. Since the industry got its start little more than 30 years ago, we are just now beginning to see "old" fiberglass boats.

More than five million large, non-trailerable FRP vessels were built between 1960 and 1989. Today, we estimate that as many as a third of these are now moving into the "aged" category, with 10 years or more under their keels. Many boats of this vintage are now exhibiting chronic problems and will need serious structural upgrades if they are to see another 10 or 20 safe years on the water. The myth of eternal life for glass boats is just that: a myth.

The aging of the fleet is giving us an unprecedented window on the long-term, real-life characteristics of fiberglass boats. Studying this process will give us the ability to learn from past mistakes, allowing designers and builders to develop better, longer-lasting structures in the future.

Some of the original fiberglass production boats—Bountys, Mercers, Albergs, and Bertrams—were built conservatively, with very heavy laminates. Mercers, for example, had solid laminates measuring 7" thick in places, and Bountys were more than 2" thick. For the most part, these boats seem to be handling the aging process quite well. However, there are very clearly some warning signs in vessels built more recently. Problems like cracking, delamination, and blistering indicate that newer boats may not have the long-term potential their builders and material suppliers (not to mention owners) had hoped for.

"Improved," lighter-weight designs are the ones that appear to be having difficulties—a disturbing trend when one considers that today's builders are working ever closer to the edge of FRP's capability. The combination of this tendency toward lighter laminate schedules and increased life-cycle stresses (faster boats with high-performance power plants) may yield some shocking results eight or ten years along the time line, despite recent improvements in base materials.

Our laboratory testing has shown us that conventional fiberglass laminates lose their ability to withstand the cumulative effects of fatigue damage much faster than steel, aluminum, carbon fiber, or wood laminates. Nonetheless,

these data also indicate that a glass laminate with an original tensile strength of 35,000 psi may not fail for up to ten million cycles at about 7,000 psi, or only 20% of its initial strength. That's the equivalent of perhaps 10 years of life for most boats. In other words, if a laminate truly possessed this 7,000-psi capability, it would probably handle the loads to which most boats are subjected.

But, laboratory testing doesn't take into account either the marine environment in which boats operate [Editor's note: see p. 26] or the moisture that will, inevitably, work

its way into the laminate. The latter is an important consideration, since recent research indicates that moisture within the laminate plays a significant role in fatigue degradation.

Just how badly moisture affects overall FRP life span is not clear. From the limited data we have seen, it appears likely that moisture problems reduce a dry laminate's fatigue strength by 25%. In fact, the degradation could be significantly worse, depending on a large number of material and manufacturing variables that may affect specific situations.

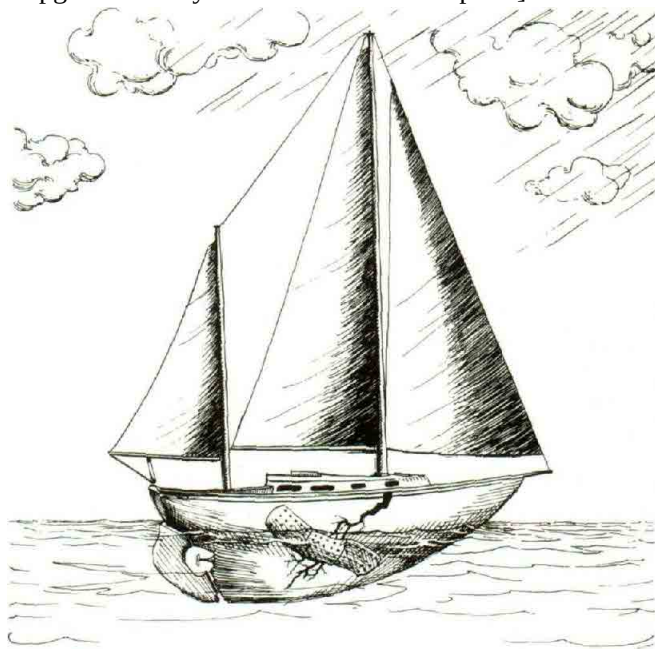
The marine industry has been rather lax in controlling quality during layup (particularly in eliminating aeration within the laminate matrix)

and, subsequently, during cure. In our view, this can greatly magnify the inherent potential for problems due to moisture. Until testing better quantifies the process of laminate degradation from moisture and/or fatigue—and until builders actively improve manufacturing procedures and quality control—designers need to be more conservative.

This is especially true for those who are pushing the outer limits of material and structural capabilities. These designers should make a point of allowing for the long-term moisture factor in laminate degradation, particularly if part of their goal is to develop boats with reasonable life span.

About the author: Meade Gougeon is president of Gougeon Brothers, Inc., a Bay City, Michigan, firm that manufactures WEST SYSTEM epoxy and has pioneered advanced-composite engineering and technology. 

We invite both comments on "Parting Shot" and contributions to the column. Write to: Executive Editor, Professional BoatBuilder, Box 78, Brooklin, ME 04616.



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