A Safety Testing & Research Centre

Step into our TestSafe Time Machine and revisit some of the amazing things that we have done over the years.

Exploding Myths of Boat Building - 1991

Les Golder, Senior Technical Officer, TestSafe Australia

BANG! An explosion rips through the peace and quite of Londonderry on the western outskirts of Sydney. Water sprays high in the air from a pit in the ground and in just 1.5 microseconds a sleek, racing yacht is formed to launch a new value-added industry for Australia!

The explosion is an application of energy in what is called "High Energy Rate Forming" or HERF. It has been used spasmodically around the world since the 1960's to form compound curves economically in exotic metals for complex objects including missile nose cones.

The explosion taking place in the mould at TestSafe.

HERF had not been used for boat building until Don Richardson became interested in the process. Don is a Sydney engineer who spent eight years in the United Sates developing international expansion opportunities for food processing companies.
On his return to Australia, he began looking for a unique business opportunity that would create a value-added industry to build exports and help reduce the trade deficit.

He looked for a product and a material that would be credible as being of high quality because it came from Australia. "This is vital to the success of any export marketing campaign" he says.

"We decided upon an aluminium yacht because Ben Lexcen and the America's Cup gave Australia a world wide name for yacht design and aluminium is an Australian material."

"Australia is the world's biggest producer of bauxite and alumina and the fourth biggest aluminium producer."

"If we build a yacht from aluminium we can export it for $40,000 a tonne!".

Don says aluminium has many inherent advantages for boat building. "*It does not suffer from corrosion like steel, does not rot like wood and does not suffer from osmosis or sun deterioration like fibreglass*."

"*Aluminium is durable, light and virtually maintenance free. It is strong enough to survive collisions which is important when you consider the 60,000 shipping containers that are washed off ships each year in the northern hemisphere alone*."
"*These are recreational fishing or work boats, slab sided, easy and economical to build. Bigger, more complex shapes require skilled tradesmen to build frames and then carefully shape the covering aluminium sheets. This is a one-off process that is really only suitable for expensive, custom-built craft*."

A steel frame was used to hold the aluminium sheets in position in the mould during welding

"*Once a mould has been made, relatively unskilled workers can economically build boats on a repetitive, production line basis. Traditional one-off aluminium construction methods cannot compete!*"

Working at the New South Wales Government Department, TestSafe Australia at Londonderry and assisted by a research grant awarded to them by the Australian Government Department of Industry, Technology and Commerce, they developed a HERF process using a unique breathing mould system, which has now been patented, around the world.

The Penrith Engineering Company constructed the female mould from 20mm x 20mm alloy steel bars. The mould is concreted into a pit with a breathing gap left around the sides.

Comalco 5mm marine grade aluminium sheets were laid into the mould from side to side, roughly formed into the shape of the mould and welded together.

Dick Van Gaalen of Comalco provided technical assistance for the welding.

False flat bow and stern sections were welded to the ends of the steel because HERF cannot form a point or a corner.

The aluminium shape was filled with water and an explosive charge costing just $35 was detonated in the water.

The charge was shaped and placed to deliver the required force to the differing widths and shapes of the boat structure.

The water transmitted the energy against the aluminium which behaves like plastic under the sudden impact and flows out against the mould. The air between the aluminium and the mould is expelled through slots between the bars which make up the mould surface.

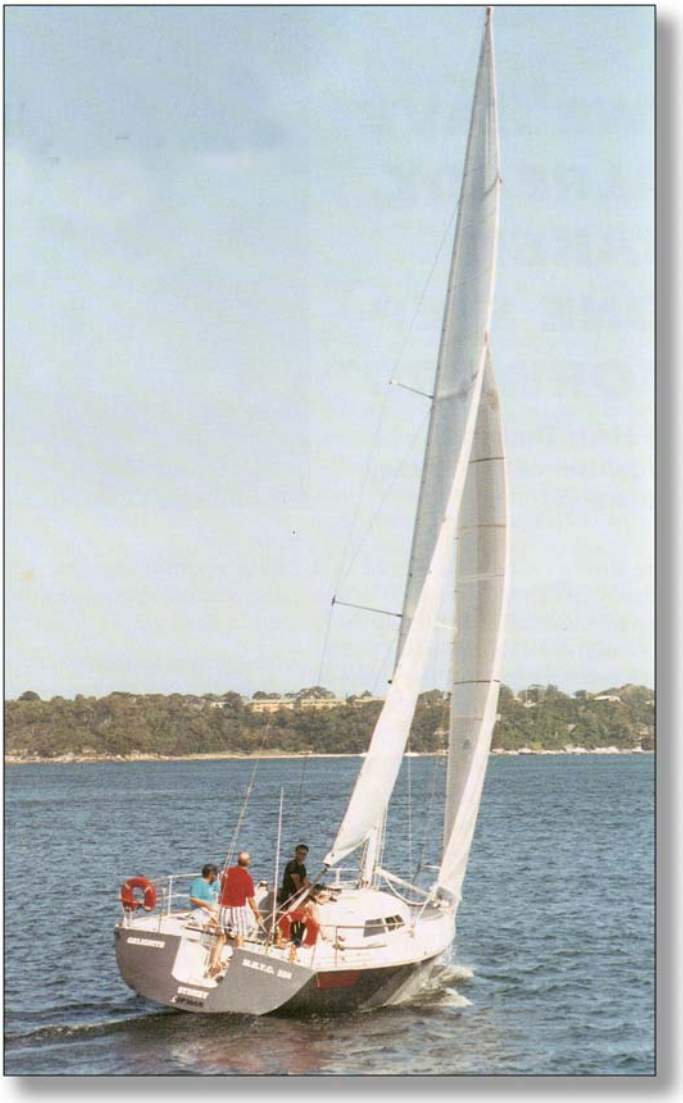
Welding in frames would have resulted in distortion of the smooth aluminium hull so the top-hat section longitudinal stringers were 'glued' in a with a 3M Scotch VHB (very high bond) 4950 Acrylic Foam adhesive tape which was designed for the aerospace industry.

The tape forms a very strong metal-to metal bond which is an impermeable seal. It is resistant to diesel fuel, solvents, sea water and extreme temperatures. It also acts as a shock absorber between the hull and internal structure which reduces the transmission of stresses and results in a quieter boat.

Only seven vertical frames were used and these were welded to the stringers. The interior has been left fairly bare so that the construction details can be shown to potential customers and people interested in the technology.

An attractive cruiser/racer layout has been designed for production boats and this can easily be varied according to each customer's requirements.

He says that the application of the HERF system has achieved the aims of the project. "*I wanted a repetitive process that would allow us to economically produce attractive, round bilge boats that can compete against the fibreglass models that now dominate the production pleasure boat market.*"



'Gelignite' the finished product sailing the waters of Sydney