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TRITIUM 720

1 - Design Concept and Background

Tritium was designed as a contestant to the Norske Flerskrog Sailklubb "INTERNATIONAL MULTIHULL DESIGN COMPETITION 2002". For the competition Design Brief see the last page.

I found the design brief a very tough one: the boat had to be fast, but at the same time provide cruising accommodation - AND be very cheap. Accommodation requires volumes, volumes require size, and size costs. If we also want performance, than we need powerful rigs with large sail area, and the cost is bound to escalate.
To avoid getting into this vicious circle, I tried to stay clear of the 8 m limit, and fit the required accommodation in a boat of around 7 meters.
The general idea was to keep it as ***simple*** (and light) as possible, give it a bit more sail area than the average cruising boat, include some "modern" racing multihull features.
Finally, I wanted a modern aggressive look, with plumb bows, raked mast, roached mainsail etc.

2 - Main hull

I drew a "tulip" shaped hull like in most cruising trimarans, where the flare provides width above seating level, and the floor sinks into the narrow, immersed part.
The widest beam on deck is carried after so to have a nice large cockpit.

3 – Side floats

Each float has about 200% buoyancy, i.e. twice the displacement of the whole (loaded) boat.
They have relatively small rocker, to get a long waterline length as soon as the boat starts sitting on them.
The buoyancy is carried well forward to avoid tendency to diagonal capsize, at the same time keeping a fine entry to the bows.
The deck is round so that if the bow does get under, it can come up relatively easy without shipping a lot of water – a bit like in "wave piercing" designs.
A round deck is also easier to build if the floats are made in two halves with a centreline joint.

4 – Cross-Beams

Even though I thought a folding system could be highly desirable, its complexity would add a lot to the cost of the boat.
The cross-beams are round tubes, mainly unidirectional glass with carbon fiber added in the most heavily loaded areas. The beams can be laminated over aluminium pipes or commercial PVC pipes used as a mould. The boat can be disassembled by undoing a few bolts.

Both beams are sitting on moulded recesses on the floats, and they are bolted through to the underlying bulkheads. At the main hull, they fit inside a moulded “sleeve” which runs through the whole breadth of the hull.
The mast step is above the forward cross beam sleeve, and a partial bulkhead fills the space between the two to support the compression loads from the mast.

5 - Rig

Two options are proposed for the mast, a traditional fixed mast and a rotating wing-section mast. In both cases the spar is in aluminium and a single set of diamond spreaders is fitted for lateral rigidity. The spar length is 9.9 metres.
The mainsail is heavily roached to maximise sail area with a relatively short rig, and because the top could twist to de-power the boat in gusty conditions.
The headsail has a small overlap.
A Gennaker can be set on an articulated bowsprit.

6 - Rudders

I put two rudders on the outriggers rather than a single central rudder. This is meant to be a sports boat and it has to be able to sail with the main hull lifted without loosing control.
In addition, having no rudder on the main hull transom makes for a very convenient central position of the outboard engine.
The two tillers are linked to cars sliding on tracks fitted to the after cross-beams. The two tiller cars are connected by a tube, offset forward of the cross beam, so that the boat could be helmed from the cockpit or from any position on the trampoline. One or two tiller extensions could be fitted.
The rudders are transom-hung for simplicity, have an elliptical plan form and are compensated. They are fitted with a tilting mechanism.

7 - Daggerboard

In this case I chose to have a single board on the main hull. I see it a bit like a safety feature: if the main hull lifts too far off the water, it may be good if the daggerboard starts losing grip so that the boat can “slide” downwind, rather than having a daggerboard on the leeward hull trying to trip the boat over.

8 - Interiors

The interiors are very simple. A “U” shaped platform goes from the bow to aft of the daggerboard well, splits in two leaving a small floor area and extends after of the companionway and under the cockpit seats, up to the after crossbeam.
The two main berths use the after part of this platform.

On the port side of the daggerboard case, a shelf integrates a simple galley, sink and a two-burners stove. On the starboard side, a hinged portion of the platform hides the chemical WC.
As an alternative, the WC could be located forward of the daggerboard well.
The forward part of the platform provides two more, smaller, bunks.
A folding table can be used inside or for cockpit dining, and be stored out of the way when sailing.

9 - Deck

The deck layout is quite simple, with two winches on the top of the coachroof. The halyards can be led to the cockpit in the fixed-mast version.
One hatch is provided to ventilate the forward bunk area.
The cockpit was kept large enough to accommodate at least three persons on each side. The helmsman is meant to sit right forward of the crossbeam, while the mainsail trimmer can sit in the after part of the cockpit when he is not on the trampoline.
The cockpit is open on the transom, which makes a nice swimming platform. Under the after part of the cockpit floor is a large locker, where also the outboard can be stored.
A deployable bracket can be fitted to easily transfer the engine from the locker to the transom.

10 - Material and Construction

Tritium is made in sandwich of 80 Kg/m^3 PVC foam, 15 mm thick, with symmetrical skins in Glass bi-directional, 2 x 300 g/m^2 layers each skin, and vinyl ester or epoxy resin.
This layout exceeds the strength requirements from the American Bureau of Shipping. It could have been reduced, but I felt 600g/ m^2 for the skin was a minimum for impact protection.
The boat is intended to be built on a set of chipboard female form-frames. The frames can be flipped round to make both sides.
The foam could be laid in transverse or diagonal planks over longitudinal battens, spaced 100/300mm depending on local curvature. Or it could be laid in longitudinal planks over closely spaced form frames (and no battens), like in wood strip-planking construction.
Variants of these two basic methods are widely used in foam-cored amateur (and professional) boatbuilding.
15 mm thickness for the core seems a good size, it should be easy to bend around radiuses without being too floppy and require very tight mould batten spacing.
In addition, with a relatively thick core, the hull shell itself provides most of the reserve buoyancy required by the design brief, and only a small amount of additional foam is required.
The framing arrangement consists of an assortment of bulkheads, partial bulkheads and web frames.

Statutes for 2002 International Multihull Design Competition, issued 26/10/2001 by Norway's Multihull Association (NFS)

1) General Goals:

To promote the creation of a small or mid-sized sailing multihull which offers very high sailing performance and a little cruising comfort, on a modest budget.
A new design to fill the gap between the classic beach-cat (i.e. Hobie 16, Tornado) and most current cruising designs, which for many sailors can be too expensive and complicated to build - or not sporty enough!

General guidelines:

• The winning design should be unusually fast-sailing and visually attractive.
• The winning design should feature a minimal accommodation, enough to provide shelter, onboard vacationing (see below) and some privacy when in harbor for 2-4 people.
• The winning design should be possible to self-build for between 10,000 and 16,000 US$, ready-to-sail.

2) Specific requirements and limitations:

a) Dimensions :

1) The design shall feature two or more hulls.
2) It is recommended that Length Overall, not counting bowsprit or rudders, is not to exceed 8 meters unless very unusual design criteria (i.e. with Proas) apply.
3) The maximum length of any single mast profile is not to exceed 12 meters.

b) Construction :

The design shall be adequately robust to permit sailing along rocky coastlines, and include a positive buoyancy of 400 kg in the event of the hulls being flooded.

c) Facilities on board :

1) Bunks: The design shall include a minimum of two separate covered bunks, each with the following minimum dimensions:

200 cm. in length, 60 cm width over 2/3 the length, 40 cm over the remaining 1/3.
free space of 80 cm above 1/2 the bunks' length
free space of 40 cm above the remaining 1/2 of length.

2) Seating: The design shall allow four people to sit at a table, fully sheltered and enclosed from wind and rain. The enclosure, seats and table do not have to be fixed or functional while the boat is sailing. Each seating space must have the following minimum dimensions:

width of seat, 60 cm
35 cm from floor to seat level
100 cm from seat level to roof

Additionally, when the boat is underway, the design should allow good shelter from wind and rain for at least two people, either at the steering position or with visibility to it.
3) Galley facility: The design shall include an area for preparing food and cooking which is functional while the boat is underway.
4) Toilet facility: The design shall include space for a toilet with holding tank (e.g. 'portapotti') which is functional while the boat is underway.
5) Engine: The design shall allow for a suitably powerful engine, positioned in such a manner that the engine is protected from water damage and immediately operable in case of emergency while sailing.