VOSPER THORNYCROFT K.D.PERKASA

Built by Pete Dickinson

The 96ft Malaysian Fast Patrol Boat ***Perkasa*** was launched by Vosper Thornycroft in April 1966. One of a class of four, she was based on the private venture craft ***Ferocity***. Her Three Proteus gas turbines were capable of propelling the craft at 54 knots, with twin General Motors diesels on the wing shafts fitted for Cruising. The hull is made entirely of glued wooden construction with aluminium upper works.

The Model

This model was built in the mid-1980's, originally from a Precedent kit, which had a 49inch fibreglass hull with the remaining items cut from ply and balsa. Later additions improved the rather basic appearance of the superstructure including a radio controlled 40mm Bofors gun on the foredeck, a scratch built Bofors gun on the aft deck, torpedoes and a crew in the open bridge.

The Drive System

A single propeller and shaft was used on the model as it wasn't intended to be a perfect scale replica. However from the first trials it became clear that the model was insufficiently powered by the electric motor (a very expensive Marx 12 pole) originally purchased for the build.

After several changes of power unit I finished up with a Graupner SPEED 900 BB Torque 12 V (Left) which was originally run at 12volts. This gave the craft a much better performance and remained as the power unit until recently when it was replaced by a water cooled brushless motor made by Hobbywing (Right) and a 90Amp electronic speed controller, the original home built controller being retained to operate the sound effects. (See the following section)

The Electronics

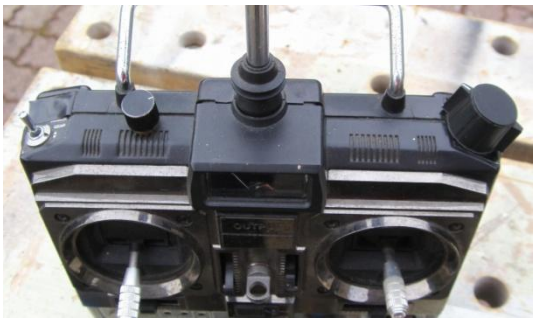
As an electronics engineer I began to modify the very basic control systems employed for the trials and eventually dedicated a 6 channel 40mHz Hitec Focus 6 transmitter to control all the added aspects of the craft.

In those days there were very little 'off the shelf' modules for model boat builders and so I designed and built the entire on board systems from scratch (apart from the receiver, a Futaba 6 channel). The electronics broke down into two separate systems linked via multi-way ribbon cables

The receiver, electronic switch control and speed controller, along with the rudder servo (and later two ancillary servos) were mounted in a waterproof box across the inside of the transom (The controller case). The sound generator, voltage regulator and amplifier were mounted in an identical sealed box, just forward and right angles to, the first unit, on the inboard starboard side of the hull.

I fitted a waterproof 10W 4ohm 60mm Mylar cone speaker in the superstructure and connected all the electronics to the control systems via multi-way (9 way 'D' connectors) plugs and sockets.

With the motor, drawing some 30amps while running and subsequently around twice that at stall, the speed controller was augmented by two matched 60amp FET's bolted to a large heat sink forward of the motor mounting (reducing the length of heavy cable needed between the battery, FET's and motor). Despite this precaution several paired FET's failed in use and I was later to prove that this was due to the threshold voltage from the speed controller which was not switching the FET's hard on quickly enough, the slope of the waveform creating excessive dissipation at the gate junction. A small modification to the link between the speed controller and power FET's, introducing a buffer I/C which upped the gate drive from 4.8 volts to 12 Volts, cleared the problem and after that no further problems were encountered.

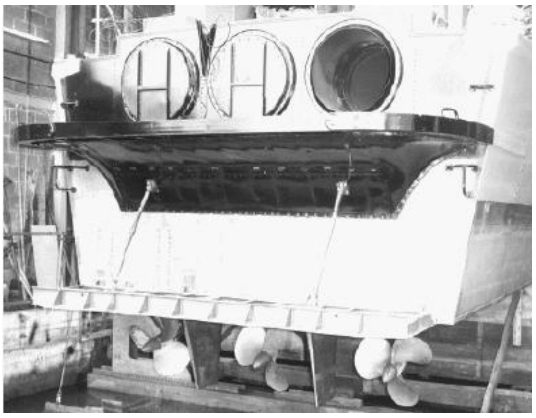


With the need to easily control the various devices on board, the modification to the transmitter was to harvest one of the channels and replace it with a rotary switch fitted on the right at top of the case. (See Left) This switch contained a series of carefully chosen resistor values, with the intention of having a servo in the hull to decode the position of the switch. However with my enthusiasm for electronics I built a fully electronic digital control with an 8 channel data decoder. Another switch (undercarriage) on the top left of the transmitter was changed for a non locking (centre off) one and that channel decoded into three separate outputs. (On-No function-Off)

The control board in the boat was set up to respond to the rotary switch position, and then the operation of the three way toggle switch gave me the ability to set high, low or not alter a set of 8 buffers, biased by resistors from their input to their output forming a simple latch whose output operated the various electronic devices.

With no quality sound modules available at the time I scratch built a Diesel engine sound generator which gave a good representation of a marine Diesel. (It even brought a comment form an observer that 'the number five injector needed changing'.) Adding to this I fitted a bought-in recordable sound chip (PT80) and recorded on it the sound of my Diesel car starting. This precedes the sound of the Diesel sound effect when the 'engines' are started up.

I then had the idea to introduce a further scratch built gas turbine sound generator which was composed of a simple CMOS oscillator driving through several stages of inverters. These were tapped at different points along the chain and taken to three separate piezo transducers mounted inside three black plastic 35mm film canisters inserted across the transom. Each piezo transducer had a different fundamental frequency which gave the resultant sound a very distinctive 'turbine whine'.



The full size craft had removable covers over the three gas turbine air intakes mounted across the transom (See Right) and to ensure the sound of the turbines was clear and audible, I mounted a servo in the controller case, alongside the rudder servo, and this was used to open the covers when the turbines were in use and close them when the Diesel was engaged, or the craft was idle.

The controller was also arranged to switch on and off these sound effects, whose frequency was directly proportional to the motor speed via a separate output from the home made electronic speed controller, variably illuminating a small LES 6Volt bulb on the sound generator board. This bulb was arranged to illuminate two LDR's which controlled the frequency of the separate oscillators generating the Diesel and Gas turbine sounds.

I could now place the craft in the water, start the Diesel and manoeuvre slowly out to clear water before stopping the Diesel and engaging the gas turbine sound. The effect was slightly marred by the fact that the model would go at the same speed whichever sound effect was in operation.

So around this time I decided to increase the power supply from a single 12volt 7Ah gel cell to two, supplying the motor with 24 volts which enhanced the craft's speed to such an extent that, despite the increased weight of the extra battery, the bow would lift unrealistically far from the surface of the water. In

the few photographs I had of the original craft, there was one showing the stern which showed that the Perkasa was fitted with a hull bottom extension, (See photo above) apparently hydraulically controlled from the bridge, to trim the boat at speed. A second ancillary servo was fitted in the controller case to adjust this fin while moving and this proved a great success enabling me to trim the boat at speed until she sat properly on the water, planing correctly and thereby increasing the top speed of the craft as it no longer absorbed energy keeping the bow artificially high. (This was achieved by using the 'trim' control channel already fitted to the transmitter.)

To generate a more realistic response the 'Diesel' manoeuvring was run off the single 12 volt cell but when using the 'gas turbine' an auxiliary heavy duty relay switched in the second cell providing the motor with 24 volts.

The remaining switch positions were used to run the radar, navigation lights, searchlight and lastly a barrel flash and gun retort from the foredeck-mounted 40mm Bofors gun, which also used a spare channel to enable it to rotate.

The History of the model

Although originally built as a Malaysian Navy vessel I eventually decided to rename the model to 'Valient' and attributed her to the Royal Brunei Navy. Whether that navy ever had any Perkasa class fast patrol boats I never knew but it did deflect some criticism from some of the more pedantic modellers who seemed to delight in pointing out discrepancies with the correctness of the finish.

Sadly after many years of operation 'Valient' began to look as tired as her full sized craft probably was and so underwent a Spartan refit. I also took the opportunity to upgrade her power plant and with the drop in prices of brushless motors and ESC's bought a large water cooled 90 Amp combination (See 'Drive System') which promises to deliver even greater performance, although I had to abandon the selection of battery voltages as the 4 cell 5Ah Li-Po sits alone in the now seemingly deserted hull, because changing voltages would cause problems with the Li-Po cell threshold voltage protection sensors built into the ESC resulting in possible damage to these rather volatile (explosive!) power supplies.

Still looking like a real working vessel (slightly dilapidated), she does show signs of her age but as a fun model she is still amongst my most prized.

As they always performed faultlessly the various diagrams of the scratch built electronics have long since been lost, but if you would like to chat in more detail about the method of design please feel free to ask me.

Pete Dickinson.

AWL (**A**ir **L**and **W**ater model club)