Kaon continues on page 40

The prototype used a rudder assembly salvaged from an old Robbe kit but you can easily make your own. The plans show how to make a suitable unit from sheet aluminium and steel rod. Experience with other models has shown that such 'homemade' rudders can be very tough indeed.

The rudder and throttle servos need a secure mounting in the rear compartment. The plans show a method of using balsa blocks glued to the bulkhead, sides and rear deck piece. It is very important that the servo bodies cannot move when in use otherwise erratic control will result. Simple direct wire links between the servos and tiller/throttle arms is the best idea. These wires must pass through the bulkhead and coaming - running them inside a length of silicone tube which is glued to the balsa allows a smooth action with some degree of water resistance.

There should be sufficient space left in the rear compartment for the receiver and its battery pack. These need packing in foam rubber/plastic to prevent them rattling about when sailing. The final part of this installation is the receiver aerial. The prototype used a vertical wire whip aerial bolted to the transom. Connection to the receiver aerial wire was via a short flying lead and plug which was soldered to washer fitted under the securing nut on the inside of the model. An alternative would be to use a vertical plastic tube and run the flexible receiver aerial up inside it, just like the R/C car people do! What must not be done is to coil the aerial wire up inside the R/C compartment as this results in a drastic loss of control range.

Hatch

The construction of the hatch to cover the engine and radio compartments can be made as soon as the basic hull structure is completed. It does however seem sensible to build it over the coaming after most of the internal fitments have been added. This can avoid embarrassments like the top of the engine sticking through the hatch.

A simple wedge shaped hatch was used on the prototype to give the model a semi-scale racer appearance. You could of course make any type of hatch provided it is a good fit but allows adequate ventilation of the engine compartment. This latter feature is vital if you want the engine to run consistently and deliver full power. The carburettor needs a steady supply of fresh air, so the hatch must not be totally sealed. Exhaust fumes can also build up and must be swept away from the engine. This would be no great problem except that you need the hatch to keep water from both engine and radio gear.

The hatch was built from sheet balsa and a secure fit was achieved by building it around the coaming. The two side pieces were placed either side of the coaming whilst two formers where glued and pinned between them to grip the front and rear sections of the coaming. A little care is needed to avoid sticking the hatch to the hull. After some thought I opted to make the hatch with a forwards facing opening along its front edge. To stop water reaching the engine a gap was left between the forward former and hatch top sheeting. A similar gap was left at the rear former as well as a rear facing opening in the 'cockpit' step. The idea was that when sailing the airflow around the model would produce a ram effect into the front opening combined with suction at the rear facing openings. This seems to have worked in practice with the insides remaining dry despite receiving plenty of fresh air.

The last thing to make is a cover for the radio compartment. I used a piece of clear plastic cut to sit on the top edges of the coaming and bulkhead. This was held down with strips of adhesive tape. Not exactly 100% waterproof but more than adequate for this model.

Propellers

A model such as this must have a propeller intended for use in a surface piercing mode. Conventional fully submerged propellers are unlikely to do anything but spin around and create lots of bubbles and noise with little thrust. It is not possible to specify a perfect propeller size that would suit all types of engine; some experimentation will be needed.

Metal propellers are usually recommended for the best performance. They are strong but rather expensive if you have to try several before finding the ideal type for your model. The small engines that this model is intended for can quite safely use plastic propellers. Perhaps the best to start with are the Graupner 2314 range of propellers which run from 30 to 52.5mm diameter in 2.5mm steps. The larger sizes are intended for geared electric motors so with an I/C motor you ought to start with a propeller around 35 to 40mm diameter.

Sailing

As with any new model it makes sense to carry out the initial sailing trials in reasonably calm conditions. Whilst a catamaran hull such as the Wasp is very stable, you cannot tell much about its handling and performance if the wind and waves are throwing it around.

Before setting out to the lake you must sort out the R/C operation. The rudder movement needs to be around 20 degrees either side of neutral. This can be achieved by adjusting the tiller/servo linkage or using adjustable rates if your transmitter is so equipped. The other servo must be capable of moving the throttle arm on the carburettor smoothly with no hint of sticking at any position. One thing to avoid is that the servo 'stalls' when you push the throttle stick to the full speed position. This is indicated by the servo emitting a buzz despite it not moving any further. If this happens then adjust the linkage or risk a short battery life and possibly damaged radio gear. I like to use a self-centring transmitter stick for the throttle with the neutral position corresponding to a fast safe 'tick-over' speed. Pushing the stick up increases the engine speed whilst pulling it all the way back will cause it to stop. Sailing an I/C powerboat with the ability to stop the engine on command has always seemed to be a sensible thing to do.

Anyone who can sail a fast electric model ought to find no problems with the Wasp. Once the correct propeller size is found for the engine then it should accelerate briskly to planing speed. As with most catamaran models it should run level and smooth with little tendency to heel under torque reaction. Rudder response is good in either direction and turns down to 2-3 metres can be made safely. Only very tight turns seem to cause any noticeable loss in speed and I have yet to 'spin' the model.

Conclusions

After all the worry and effort expended in the design of this model it proved to be something of an anticlimax when sailing. Switch on, start the engine and off it sails in a fast but reliable fashion, it could be an electric model but for the speed, duration and a little extra noise.

With respect to the subject of noise, the SC 12 engine has proven to be quite modest despite the simple exhaust arrangements. On many occasions its exhaust note was totally drowned by much larger, but not much faster models! The engine is also very frugal on fuel and it looks like my gallon can is going to last a long time.

The stability of this model suggests that larger engines up to 3 1/2cc could be used. Anything bigger would require the model to sealed up but its simple construction should make this an easy task. Another idea is electric power with one of the '700' size motors. If you try any such changes then let's hear about them.

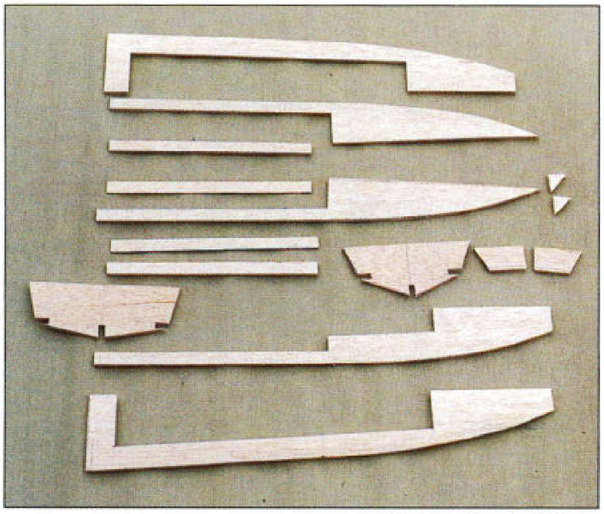
KAON

FREE PLAN 2

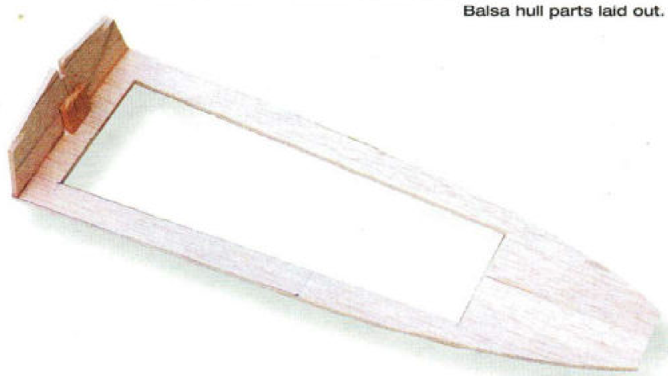
A Radio Controlled Fast Electric Model for Outdrives BY GLYNN GUEST

Desperation can often be the source of inspiration and this was the situation with this model. A new sailing season had started with a series of fast electric races planned at my local club. My original intention was to use the Proton (Model Boats December '91), a well used but predictable model. The installation of a stock motor had raised the speed by about 10 percent although it required the use of 1700SCR nicads to restore the duration to the original value.

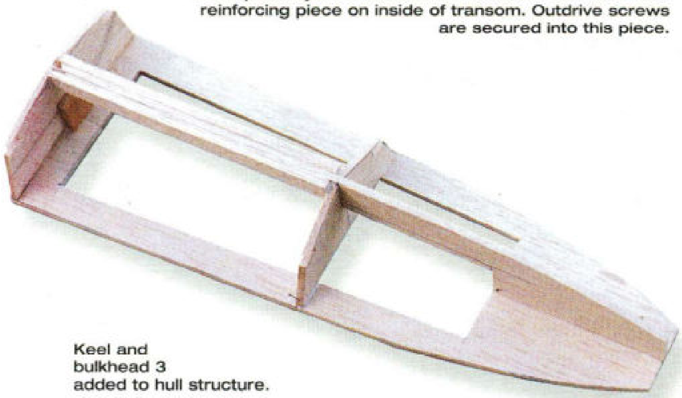
The first club race was entered with reasonable confidence that the model would not be outclassed. If I could avoid doing anything silly then a good result could be expected. It is worth pointing out that the club used a cumulative points system whereby the results from several races held throughout the year are used to determine the overall winner for the year. Thus,



Balsa hull parts laid out.



Deck pieces joined and transom added. Note hardwood reinforcing piece on inside of transom. Outdrive screws are secured into this piece.



Keel and bulkhead 3 added to hull structure.

consistent performance can usually beat a faster but less reliable boat, or more often than not a less reliable driver!

The only problem was that the first race was held on a windy day resulting in very choppy water. Individually most boats could have coped but under racing conditions numerous collisions and unexpected stops occurred. The Proton model gained quite a few dents and cuts but nothing that could not be repaired in the couple of weeks before the next race was due.

Calmer conditions in the next event ought to have produced better racing but it seemed like driving standards were if anything worse than the previous event. This resulted in the Proton being involved in a collision which removed the hatch and left the hull upside down in the middle of the lake. Some people are tempted to recover the model, then quickly dry everything and try to race in the next heat. I've always been more cautious and preferred to dismantle the radio gear immediately and abandon sailing. The gear is left to dry out for a couple of days, the airing cupboard is fine, being warm and dry but not too hot. After this the gear can be carefully rebuilt and tested. This might seem over cautious to those readers willing to spray water repellent and carry on sailing but I have yet to have any R/C outfit fail to work for anything other than flat batteries!

Examining the Proton hull revealed the bow sheeting to be badly holed. Numerous dents and cuts, from other model's propellers, could be seen all over the hull. Despite waterproofing, the cardboard-balsa hatch was falling apart. Individually none of the damaged areas were beyond repair but altogether they made me think about scrapping the model. With the next race only some four weeks away speed was important. Knowing how I can procrastinate at times, the only way to force me to build a new fast electric model was to destroy the old one.

Rather than just throwing the old model in the rubbish bin, the opportunity was taken to see just how strong these balsa hulls are. The overall strength was tested by inverting the hull on the garage floor then placing one foot squarely upon the hull. The pressure was increased until, much to my amazement, the hull was supporting my whole weight.

Next came the impact tests, a posh name for hitting the hull with a hammer. With the hull held in one hand, hammer blows of increasing strength were applied to the hull. The bottom and side sheeting proved remarkably tough. Dents and small cracks could be produced with modest blows but actually making a hole required a relatively enormous impact, and then it had to be well away from any internal structure.

Destroying the hull in this fashion did serve its purpose since it showed just how strong these balsa hulls can be. This might answer those people who consider balsa to be unsuitable for everyday sailing, let alone the rough and tumble of racing. In fact even after all this abuse the hull structure still required a vigorous assault by jumping on it before it was flat enough to fit in the rubbish bin.

New design

Having proved that there was little wrong with the strength of the basic structure used in the Proton model, thoughts turned to the new design. My first idea was to increase the size a little, the reason being that the new motor and nicad pack had increased the performance to the point where the Proton design, whilst not unstable, had become rather 'twitchy' in its rudder response. This could result in the model spinning in tight turns, never dangerous but a great loss of time when racing. An enlarged design was drawn up but I then began to worry about getting into a vicious circle. This is where the larger model demands more power to maintain performance which increases the weight, which calls for more power, and so on ...

This all lead me back to keeping the hull length the same as the previous model, about 46cm (18ins), but looking at ways to improve the design. The Proton hull had been deliberately made as simple as possible since it was an early venture into surface piercing outdrives. A narrower hull form had shown performance benefits, Neutron Model Boats December '92, but could reduce stability. After a few sketches it seemed best to leave the transom width more or less as in the Proton design but taper the hull sections towards the bows. For both stability and appearance the hull depth was reduced, the critical factor being to keep the transom just large enough for the Graupner Hydrospeed outdrive unit.

Whilst the basic construction of the hull was unchanged, a couple of improvements were made. The original hatch and deck coaming were made from card, excellent material being strong, light and very cheap. For everyday sailing card was more than adequate but suffered in the rough and tumble of racing. Damage could easily allow water to penetrate and soften the card. After the Proton model's last race the hatch was literally falling into pieces. The new model was going to have coaming strips from 1.5mm 1/16in) plywood and an all balsa hatch.

Whilst the new and old designs were obviously related, the final result was a more sleeker and hopefully faster model. Now that these small fast electrics are travelling at speeds where air resistance can be significant, the overall shape of the model ought to be important. Any readers with experience or information about air flow around models might like to expand on this topic. I for one would welcome any ideas which reduce drag and thereby increase the speed and/or duration of our models.

Building materials

Having sung the praises of balsa construction it would be prudent to make some comment on the need to select the correct grades of wood. Balsa can be obtained in a tremendous range of qualities but these are based upon the combinations of density, strength, stiffness and grain pattern. Luckily for us most of the stock supplied to a model shop will avoid the worse combinations of these properties.

My selection procedure is based on picking out medium grades of balsa. The low density sheets can be prone to local damage whilst the 'rock hard' grades offer you only problems in cutting and building. Perhaps of more importance is the grain pattern and a nice uniform appearance is something to look for. Uneven grain patterns, perhaps with artistic swirls, can indicate problems with uniformity. It is also worth checking that the sheets are cut true and square with a smooth surface finish.

The basic structure of this model is made from 5mm (3/16in) thick sheets. With prudent cutting two sheets of 75mm (3in) balsa can just supply all the parts but it might be safer to buy an extra sheet just in case. The hull sheeting and hatch use 3mm (1/8in) thick balsa and three 75 mm wide sheets will be needed.

The spray strips along the hull chines are made from 4mm square wood. Do not be tempted to 'strengthen' the model by using very hard and difficult to bend grades of wood. Obechi or spruce are fine for this part since they tend to absorb and localise any damage. A small piece of hardwood is needed for internal reinforcement of the transom. The exact size depends upon your equipment installation. Likewise the spacer strips along the keel depend on the prop shaft tube used. The Graupner unit needs 1.5mm (1/16in) spacers.

All the wood joints were made with rapid setting PVA wood adhesive. This bonds well to balsa and gives you enough time to align joints. It is reasonably good at gap filling but .s of course no substitute for making the joints correctly in the first place. The absence of smell and the ease at which accidents can be cleaned up make this adhesive acceptable to my wife, an important point if I want dinner!

Below: Keel built up with drive unit slotted in place but not yet glued.

Hull construction

As is my normal practice these instructions will be given in numerical sequence. Please read them carefully, especially if you plan to built the model in a different order. It is very easy to miss out some small but vital stage and find serious problems at a later point. Also note that the hull structure is built upside down for convenience and accuracy.

1) Cut out the hull parts from 5mm (3/16 inch) balsa. Take care to cut the edges sharp and square to produce good joints for gluing.

2) The fit of the parts can be checked by assembling the hull structure 'dry' and using pins to hold pieces together. Adjustments to the size and shape of parts is much easier now compared to when everything is covered with glue.

3) The two deck pieces are glued together. They must be kept flat whilst the glue dries.

4) The transom can be stuck to the deck using pins to keep it perpendicular. The small hardwood reinforcing strip can also be stuck in place provided you are happy with its size and position. Remember that the Outdrive securing screws must fasten into this strip.

5) The keel must be cut to match the drive system tube. The keel also needs a notch to accommodate the gear housing. The end of the tube must extend slightly beyond the keel/transom so as to correctly align with the outdrive steering bracket. Take time to get this correct and if you make a mistake scrap the keel and cut another one out rather than risk a poor structure.

6) The Graupner Hydrospeed unit also required spacers about 1.5mm (1/16in) adding on each side of the central keel piece. This was to accommodate the drive shaft tube. The keel doubler pieces are then added to each side.

7) With everything pinned/clamped together on the keel, you need to make a final check on alignment. Note that the doublers end 5mm (3/16 inch) before the end of the keel and the step against which the third bulkhead fits.

8) I do not recommend gluing the drive system into the keel until you have finished the hull construction

9) Bulkhead 3 and the keel can be glued to deck and transom checking that all parts are square and true before securing with pins.

10) The chine pieces and bulkheads 1 and 2 are then glued into the structure.

11) A good tip is to run a small bead of glue along all the accessible joints then smooth it in with a scrap of wood or the ever useful fingertip! This simple act can dramatically reinforce the hull structure.

12) The chine pieces are deliberately overlong so that the excess can be cut then sanded smooth with the transom.

13) The edges of the deck, chines and keel need sanding to match the correct hull sections. A sanding block is the only sensible way to do this.

Hull sheeting

The hull sides and bottom are covered with 3mm (1/8in) balsa sheet. For stiffness and strength this sheeting must be applied with the wood grain running transversely.

In order to provide a reserve of buoyancy the enclosed spaces between bulkheads 1 and 2 and also bulkhead 3 and the bows were filled with expanded polystyrene before sheeting the hull sides. Cutting this material can be a messy job but I found that one of those large craft knives with the retractable 'snap-off' blades was ideal. With a new blade the EP was cut into slightly larger blocks than would fit into the spaces. By carefully drawing the extended blade along the edges of the hull structure, the excess EP was cut away, see Figure 1.

1) The hull sides are sheeted first starting at the transom and working forwards. It is also best to alternate from side to side when sticking the sheets in place as this minimises the risk of distorting the hull. The pieces ought to be slightly oversize.

2) Only when the glue is completely dry can the excess sheeting be trimmed away. I find that removing the bulk of the excess with a sharp knife then finishing with the sanding block is the easiest way to do this.

3) The hull bottom is sheeted in much the same fashion as the sides. The major difference is that the sheets must form a butt joint where they meet over the keel. Do not worry if this joint is not very neat as it can be filled later.

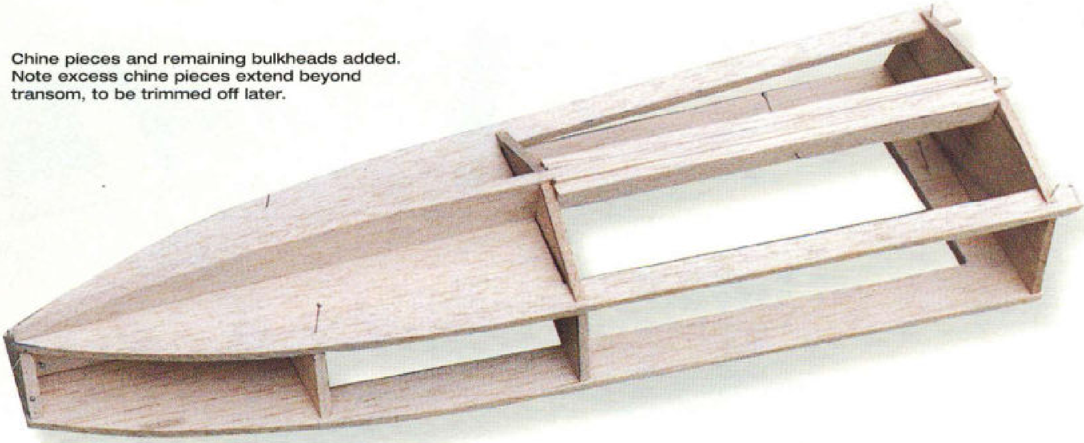
4) When dry the bottom sheets can be trimmed and sanded smooth.

5) The bow block is built up from balsa laminations. A tougher block can be made if the grain of each lamination is perpendicular to the previous one. Oversize pieces of balsa should be used to allow for trimming to the final shape.

6) When dry the whole external surface of the hull must be sanded smooth. Any 'steps' between adjacent sheets must be removed. A sanding block is essential to prevent the creation of an uneven surface.

7) Any gaps between the sheeting must be filled. Large gaps need a strip of balsa gluing into them then sanding smooth when dry. Small cracks could be sealed with glue alone.

Unless you are a very neat builder, there is certain to be a 'Vee' shaped gap along the keel

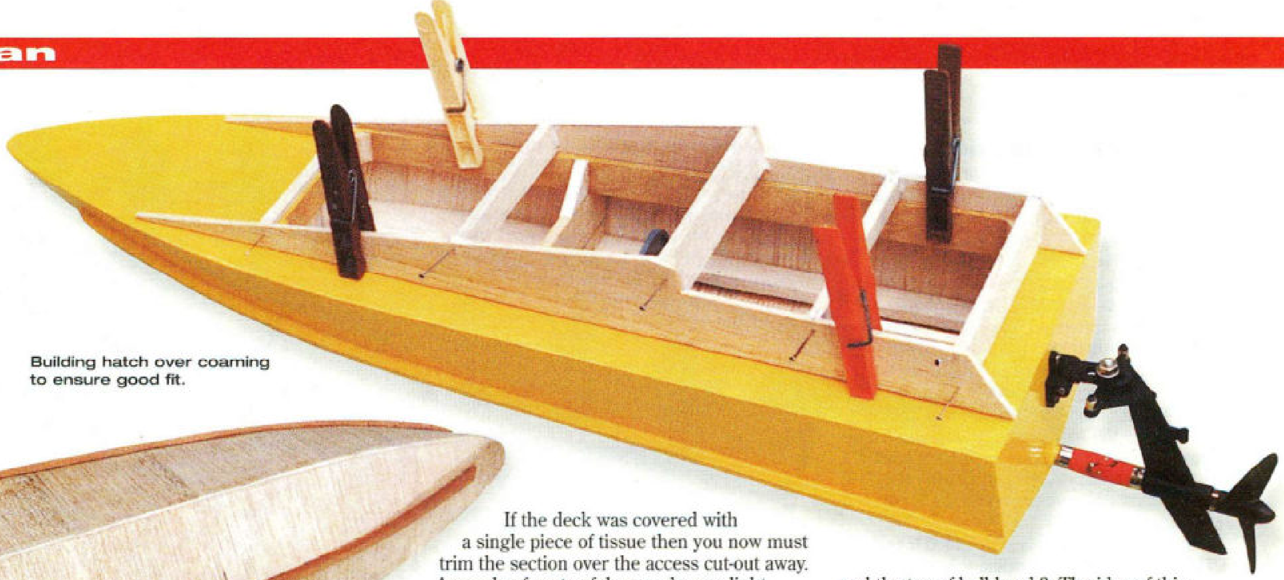


Chine pieces and remaining bulkheads added. Note excess chine pieces extend beyond transom, to be trimmed off later.

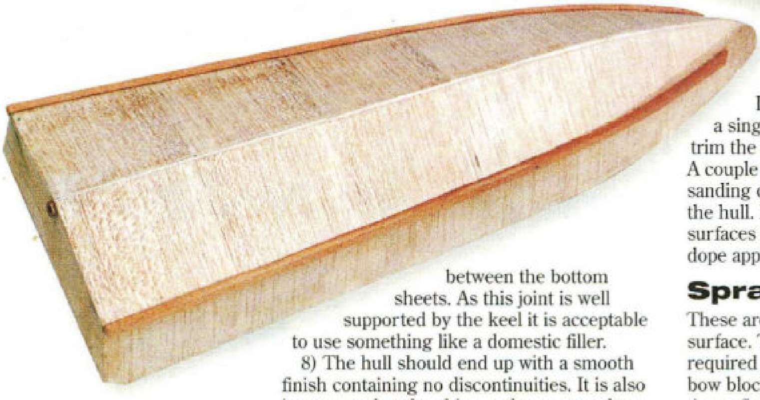
Sheeting sides of hull framework. Note buoyancy foam fettled into bow compartment prior to sheeting.

Hull sides sheeting completed, excess trimmed and sanded away. Note buoyancy foam in hull bottom from bulkhead 3 to bows.

Bottom sheets glued and pinned onto hull frame.



Building hatch over coaming to ensure good fit.



Bottom sheets trimmed and sanded to shape. Bow block added and shaped. Spray strips added to hull.

between the bottom sheets. As this joint is well supported by the keel it is acceptable to use something like a domestic filler.

8) The hull should end up with a smooth finish containing no discontinuities. It is also important that the chine and transom edges are sharp. Keep holding the hull up and checking from every angle.

Surface sealing

One of the reasons why some people do not like balsa is the potential for producing a poor paint finish. True, if you just like to slap a single coat of paint on to your models then balsa is not the material for you. But, given a little effort a tough and smooth finish can be produced on balsa.

A light but very strong finish can be made by sticking light weight model aircraft tissue onto the balsa with cellulose dope. The first step is to apply a couple of thinned dope (50:50 dope-thinner mixture) onto the external hull surfaces. Lightly sanding after each coat removes any surface 'fuzz' as well as penetrating and strengthening the balsa.

The hull is now treated as six separate panels, i.e., the deck, two side, two bottom and the transom. For each panel a slightly oversized piece of tissue is cut. The tissue is laid over the panel and unthinned dope brushed through it to bond to the balsa. The best technique seems to be to start in the centre of a panel and work outwards with the brush. If creases appear then the tissue can be lifted up and relaid with firm brushing. Any excess at the edges could be simply cut away but I prefer to overlap adjacent panels at the corners. The sequence in which you cover the hull is not critical. I usually start with the transom, then the bottom pieces followed by the deck and finally the two side pieces.

If the deck was covered with a single piece of tissue then you now must trim the section over the access cut-out away. A couple of coats of dope and some light sanding ought to result in a smooth finish to the hull. If any wrinkles appear in the bottom surfaces then they must be sanded away and dope applied to restore a smooth finish.

Spray rails

These are best added after sealing the hull surface. Two 4mm square wood strips are required running from the transom to the bow block. If you have used a dope and tissue finish then I strongly recommend using balsa cement to stick these strips to the hull. The solvent in the cement allows it to bond with the dope.

Numerous pins and elastic bands are needed to hold the strips to the hull whilst the glue sets. If the wood is reluctant to take the desired shape then you could try soaking the strips in warm water. This ought to soften the wood and allow you to bend it more easily. Holding the wet strips against the hull with pins and bands but not glue!, will produce the desired curve. When the wood is dry it can be glued to the hull. Another option would be to make the spray strips from two laminations of thinner wood applied separately.

With the strips stuck to the hull any gaps can be filled before sealing with dope. Take care to do a good job on these spray strips. They not only aid the model's performance but also protect it from damage.

Hatch and coaming

The coaming strips were cut from 1.5mm (1/16in) plywood, being about 15mm (3/8in) wide. They were cut to be a snug fit within the deck access cut-out. It is important that the coaming is perpendicular to the deck or the hatch will be a poor fit. Rather than try to use pins whilst the glue dried I wedged scraps of balsa across the opening.

A little extra reinforcement was given to the coaming by gluing small triangular fillets into the internal corners. A small triangular wedge was also glued between the coamings and the top of bulkhead 3. The idea of this reinforcement was to ensure that the coaming would not readily part company from the deck in the event of an accident.

To ensure a good fit the hatch was built over the coaming but taking care not to stick it in place! A simple but hopefully semi-scale type of hatch was designed. The two 3mm (1/8in) side pieces were held to the coaming with pegs while the 5mm (3/16in) cross pieces were glued in place.

When the glue had dried the pegs were removed but the hatch left on the model, the top of the hatch being covered with 3mm (1/8in) sheet balsa, the grain running transversely. Like the hull sheeting, these pieces were slightly over size to allow trimming when dry.

The hatch external surfaces were finished with dope and tissue just like the hull. The inner surfaces of the hatch and the coaming were just given a couple of coats of dope.

Drive system

At this point the motor mount and tube can be installed in the hull. The tube ought to slide into the keel snugly but the transom opening may need enlarging. The end of the tube must be about 1.5mm (1/16in) beyond the transom. Epoxy is the best adhesive to use due to the forces created when running these outdrives. A good tip is to roughen the tube and motor mount before applying the epoxy. When satisfied leave the model until the epoxy has set, handling it before then runs the risk of things moving out of alignment.

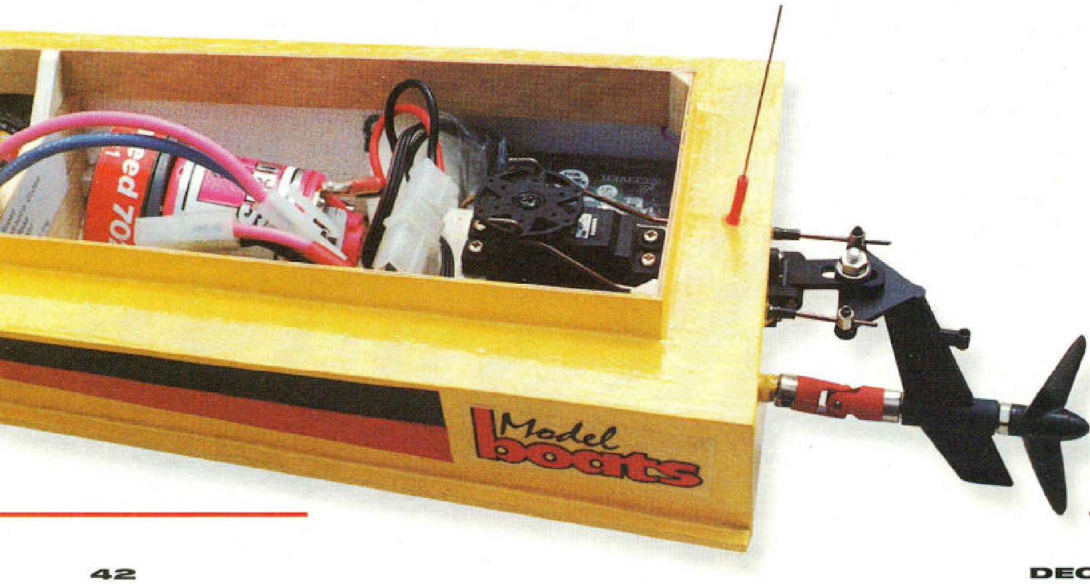
The outdrive unit can be fitted to the transom at this stage. The aim should be to get it square on the transom with free movement either way whilst the drive shaft turns effortlessly. It is worth taking some time over this part. A badly fitted outdrive will place extra loads on the motor and steering servo as well as losing speed and duration. Perhaps the best idea is to only use one fixing screw at first. When happy the other screws can be installed. Whatever you do do not try to run the motor at this moment. An unlubricated and unrestrained outdrive will simply try to self destruct!

Steering servo

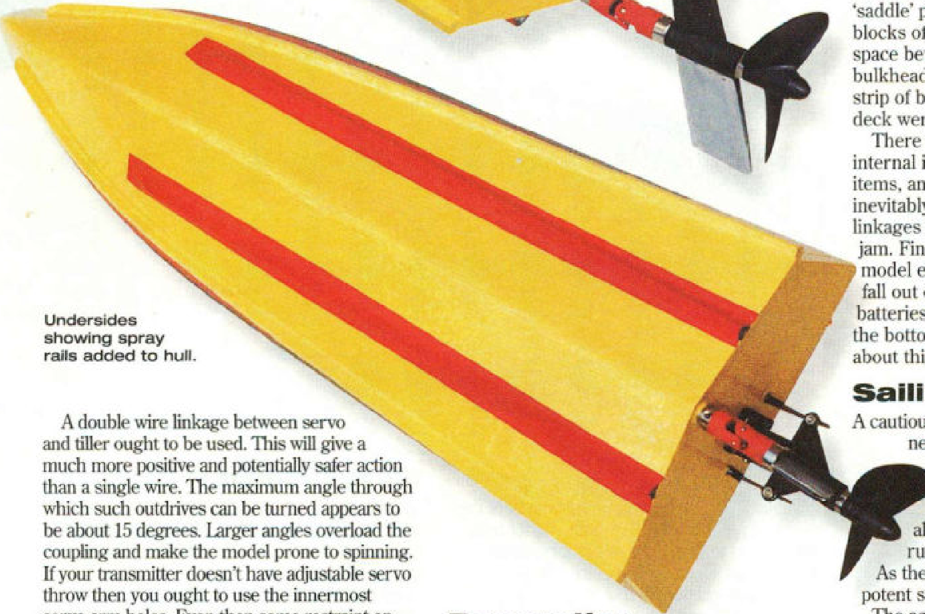
With the drive system fitted into the hull the steering servo can be installed. The servo must be on the centreline of the hull between the motor and transom. A little care is needed to ensure that the linkages to the steerable outdrive will be smooth whilst access to the servo is clear. Likewise the servo must not be mounted too far forward or it will foul the motor.

The plans show a simple balsa cradle to hold the servo. This can be built around the keel pieces to ensure strength and accuracy. I have never had any problems with the security of such mountings and in the event of a serious accident the screws through the servo lug would probably pull out and prevent further damage.

Original outdrive fin area which proved inadequate.



Enlarged fin made by epoxying aluminium to original fin.



Undersides showing spray rails added to hull.

A double wire linkage between servo and tiller ought to be used. This will give a much more positive and potentially safer action than a single wire. The maximum angle through which such outdrives can be turned appears to be about 15 degrees. Larger angles overload the coupling and make the model prone to spinning. If your transmitter doesn't have adjustable servo throw then you ought to use the innermost servo arm holes. Even then some restraint on using the rudder might be called for.

The two holes for the wire links in the transom will have to be slightly oversize to allow for angular movement when turning. In previous models this has lead to a small, but annoying, amount of water spray entering the hull. A simple answer is to fit pieces of plastic tubing, about 25mm (1in) into these holes. This alone reduces water entry but a spot of grease on the external end of the tubes before sailing makes them almost water tight.

Painting

It is best to remove the steerable outdrive unit from the hull before attempting to paint it. The function of paint on this model is threefold, firstly to protect the surface from damage whilst sailing. The second reason is to produce a smooth finish for the best performance. Lastly, the model needs to be clearly identifiable especially if you indulge in racing.

There is no one best way to achieve these ends. The traditional enamel paints can produce excellent finishes. Two-part epoxy paints have the potential to produce a very durable model. In my fast electric models I simply use Finningans Smoothrite paint. For those unfamiliar with this product it is a thick cellulose based paint which rapidly dries to give a hard smooth surface. It might be promoted for 101 jobs in and around the home but it also does a damn good job on my models. Being cellulose based it bonds well to the previous dope and tissue finish. A little practice might be needed but two coats can produce a gleaming hull. Surface damage is very easily painted over with this finish.

Decoration

It seems a good idea to give these models something of a semi-scale appearance This costs nothing in performance and adds greatly to spectator appeal. With the prototype a yellow base colour was used. This aids visibility and makes my model stand out from the usually anaemic kit models it races against. A little extra colour was added in the form of self-adhesive tape and transfers. The final touch was the driver's helmet made from a light plastic ball.

There is almost unlimited scope to personalise your model by changes to the hatch and colour schemes. A more forward driver position could be used along with two drivers if required. Exhaust pipes, made from light tubing could be added to the hatch. A rear mounted wing is another possibility.

Radio gear

The radio gear can be installed after refitting the drive system. The plans show a suggested layout but you might need or prefer something different. The hull is large enough to allow the position of internal items to be adjusted for the correct sailing trim.

A vertical wire whip aerial was used for the receiver, connection being made via a flying lead and small plug/socket. This method ensures good radio reception whilst keeping the aerial away from potential motor interference. The only precaution is to keep the total length of the wire whip and flying leads the same as the original receiver aerial.

To provide a little extra buoyancy in the event of accidents, the receiver and speed controller were fitted into blocks of expanded polystyrene. Final securing was with pieces of foam plastic. The prototype used a six cell 'saddle' pack, that is the cells were in two blocks of three. This would fit snugly into the space between the second and third bulkhead. Foam packing and a removable strip of balsa fitted transversely under the deck were used to keep the nicads in place.

There are several key points for a good internal installation. One is good access to all items, anything that is hard to reach will inevitably give you trouble. All wiring and linkages must be neat or things will foul and jam. Finally, if the worst occurs and the model ends up inverted, nothing must try to fall out of the model. I wonder how many batteries and bits of radio gear are lying at the bottom of lakes because somebody forgot about this last point?

Sailing trials

A cautious approach is always best with any new model so a standard 540 motor was used at first. The model accelerated onto the plane effortlessly and ran with a good speed. Turns were safe although too vigorous application of full rudder did result in the model spinning. As the model's handling was safe, a more potent stock motor was installed.

The acceleration was even more brisk but now the model displayed a slight 'porpoising' motion. The oscillation was quite mild and probably had little effect on the model's performance, but moving the rudder stick changed all that! Very gentle turns were safe but any more than a few degrees of outdrive movement resulted in the model entering a spin.

After some experimentation it was found possible to make tight turns by the sudden application of rudder and its almost immediate removal, not giving the model a chance to spin. With practice a reasonable right angled turn could be made but it did seem like a risky technique for racing. More consistent turns were achieved by slowing the model just before turning. Knowing how frantic things become in a race, I could not honestly rely on either method. So it was back home to ponder over the problem whilst remembering that the next races were only a few days away.

Modifications

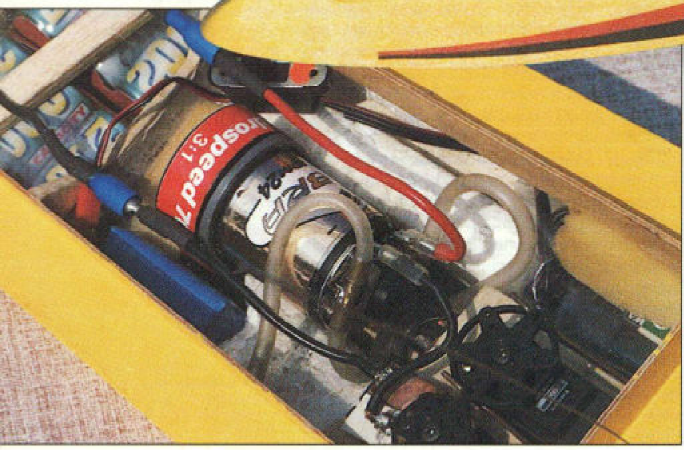
One idea was that the outdrive fin area beneath the prop shaft was too small. In the first trials the model was sailed in turns of reducing diameter. It was noted that just before

Enlarged fin area and spray rails.

Original installation including an electronic speed controller.

Right: Underside showing spray rails and water cooling pick-up.

Below: Current installation which uses a water-cooled motor and simple servo operated on/off switch.

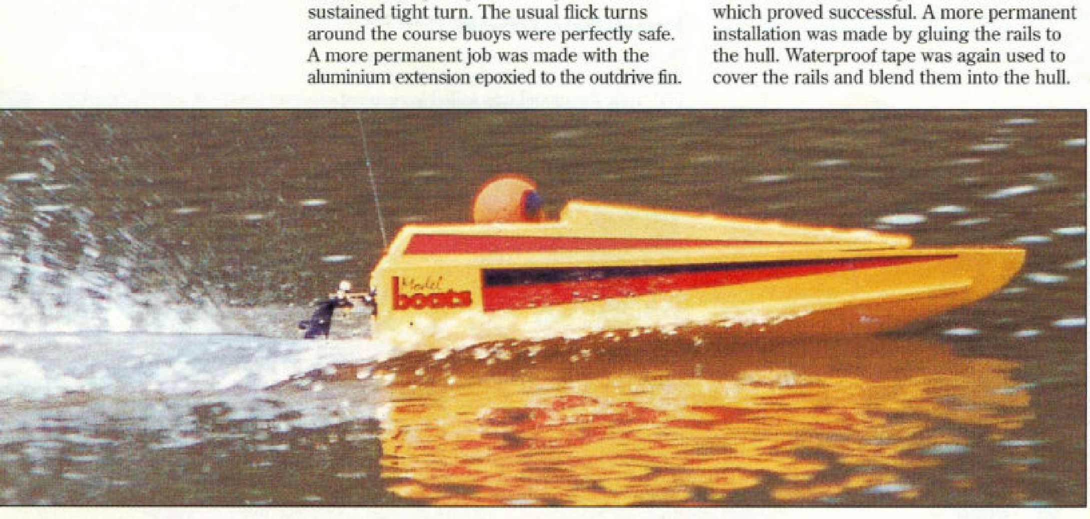


spinning occurred the rear of the model would 'twitch', suggesting that the fin was on the verge of letting the model go. A quick test was arranged with a fin extension made from a folded piece of thin aluminium sheet fixed to the outdrive with waterproof tape. All very 'Heath Robinson' but it worked with the model refusing to spin unless pushed into a sustained tight turn. The usual flick turns around the course buoys were perfectly safe. A more permanent job was made with the aluminium extension epoxied to the outdrive fin.

Further testing confirmed the benefit of the greater fin area in that very little rudder trim was needed to produce a straight running model at full speed. This has the obvious advantage of producing less drag leading to higher speeds and improved duration

The porpoising was still present and could have been removed by fitting two trim tabs or wedges to the hull. Both these methods would have added a little extra resistance so another idea was tried. Spray rails on the bottom of the hull are used to deflect the sideways flow of water downwards. This improves the model's performance by creating extra lift as well as cleaning up the high speed running. If the extra lift could be used to push the bows down slightly then the porpoising would be diminished.

As the positioning and size of spray rails is something of a black art, a temporary set of rails were used, these being made from some right angled plastic strip, sides about 5mm long, obtained from a local model shop. Two rails 300mm (12ins) long were fitted running from the transom forwards. The rails were parallel and 35mm (1 3/8ins) either side of the hull centreline. Waterproof tape could just about hold the rails in place for the trial runs which proved successful. A more permanent installation was made by gluing the rails to the hull. Waterproof tape was again used to cover the rails and blend them into the hull.



Conclusions

Was it all worth the effort? Most certainly yes! The first races with the new model showed a small but valuable increase in performance, there was little to choose between Kaon and the best kit based models in the club. Stability was much improved although in the excitement of racing I could still overdo things and occasionally get the model to spin.

The strength of the model was inadvertently tested a few times but only minor scratches resulted. The all balsa hatch proved very successful when a collision with another model rolled Kaon upside down. Upon opening up the model after recovery it was found that virtually no water had entered the hull. As the radio gear was still dry the model was thrown back into to the race with no problems.

After the first season of racing with Kaon, the club seemed to lose interest in fast electrics. I then moved to another club where a fast electric was probably considered to be something like a tug model which travels at more than walking pace. So, the Kaon has just been used for fun over the past couple of years. Even so, a few improvements have been made and the model currently runs with powerful stock motor using six RC 2000 nicads, driving a Graupner 52.5mm diameter prop (No. 2314/52.5) through 2:1 gears.

It soon became clear that things were getting a little too hot when I burnt my finger on the motor body after one fast run. It proved impossible to fit a water-cooling coil to the motor body due to the lack of space between the motor and the propeller shaft tube. I had to settle for just water cooling the motor brushes which involved soldering two lengths of brass tube to each brush holder. Water is picked up by an aluminium tube epoxied into the hull bottom. It is fed to the brush tubes via silicone tubing then discharged through a tube in the hull side. It has made a noticeable difference to the motor's temperature and hopefully will extend its life. So far no problems have appeared but I did take great care to avoid situations which would fill the model with water!