Round-The-Pole Flying

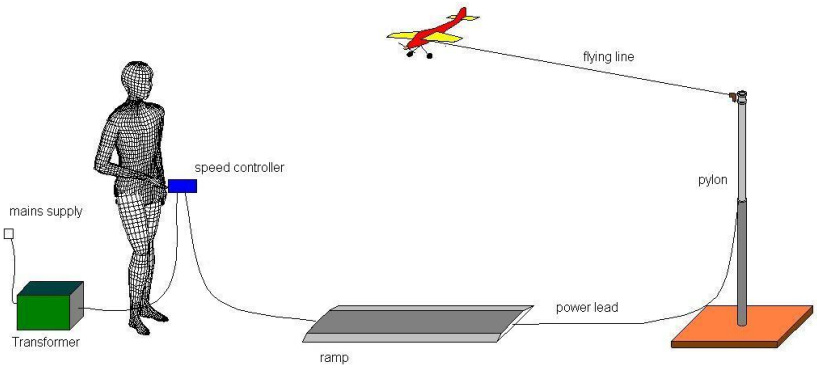
Charlie Newman with illustrations by Laurence Marks

RTP stands for Round-the-Pole. In this form of model flight, the model is tethered to a central pole or pylon, by lines. Originally, this form of model flight became popular in the UK during WW2, when free flight rubber-driven models were flown tethered around a broom handle. These days, models are powered by electric motors, which are supplied along the flying lines with an electric current. The pilot is situated outside the flying circle and has a throttle control. By this means, the model will take-off and climb if the throttle is sufficiently increased, and it will descend and land if the throttle is decreased. Unlike control-line flying, there is no elevator control: the model is effectively a tethered free flight machine, controlled by the throttle. The first electric RTP models were developed during WW2 and first displayed at the National Model Aircraft Exhibition, held at the Dorland Hall, London in 1946. A large Vickers Viking scale model was flown with home-made 18 volt AC motors and retract U/C, and it made quite a hit.

The power for the system generally comes from a mains transformer, which converts from 240volt AC power down to 18-48volt DC power. The speed-controller or throttle is fitted to the DC output side of the transformer so the voltages used by the models are extremely safe. The flying lines can be as short as 2.5 metres but generally it is better to operate on longer lines than these. We

typically use 4.5 metres or longer depending on where we are flying and thus the space available. RTP is normally flown indoors, though such models may be flown outdoors on calm days.

figure 1



This form of flying has limitations in that it is tethered but it also has a great deal to offer. It is particularly appropriate for young modellers as it is a lot cheaper than R/C or control-line, as well as being very safe. It can be highly effective educationally within a school or youth group, where many areas of knowledge may be learnt: design and technology, flight, mechanics, electricity and so on. In the past the club has used our system in conjunction with schools etc. to promote model flying to youngsters, as well as enjoying it in its own right as another way of flying model aircraft. Some members have built quite sophisticated RTP models rather than merely simple slab-sided basic profile models.

RTP MODELS

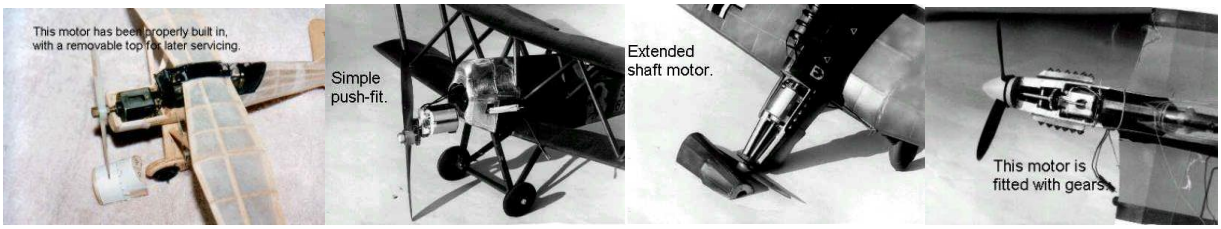
The RTP model has certain specific features. Firstly, it is equipped with a tether hook. This ideally needs to be fitted to coincide with the model's centre of gravity. It must be very securely fitted so that it cannot come apart during flight. It needs to be capable of being bent into a position and then holding that position during flight. 1/16inch brass rod from the K&S range of metals is ideal for all but the very largest models. Secondly, the elevators must be hinged as must the rudder. The best material for this is from an aluminium drinks can or for larger models the steel from a canned food lid.

In addition to the above, the undercarriage needs to be fairly strong and the motor must be ventilated to some extent.

Contrary to common practice with RTP models, it is better to build them as light as possible. The lighter they are, the better they fly, especially if you are operating on very short lines or flying scale models or wish to fly aerobatics. A properly trimmed RTP should fly itself around the pole without trying to pull it over! Correctly trimmed and viewed from the centre of the flying circle, the flying lines should be just slack – if they are tight then the model is yawing out of the circle.

More or less any small model is suitable for RTP flying. Most of the small rubber scale kits available from VMC can be converted. The old Keil Kraft and Veron scale kits also available from VMC or as plans on Outer Zone have been used for years by the RTP fraternity. The Keil Kraft Nieuport 17, Sopwith Camel and SE5a all fly extremely well as RTP models as do the current VMC range such as the Sopwith Triplane using the 4556 Skylark motor form RTP Hut. For those looking fora more ambitious project RTP Hut are planning to release their Britten-Norman Islander profile model and the impressive Lockheed Hercules 4 engined transport aircraft as kits in the near future

With built –up structures such as these kits have, modification for RTP use would be to strengthen the undercarriage by increasing the wire size used, sheeting in the nose area and building in a mount for the motor etc. tether hook must be built into the model roughly at the point of the centre of gravity, the elevators must be hinged with stiff aluminium as must be the rudder. On large models, having trimmable ailerons is very useful, but unnecessary on models under 36 inch span.



Photos - The RTP Hut

When converting rubber kits it's worth remembering to allow some access to the motor for servicing and if the motor is mounted directly in the nose of the model the undercarriage may need to be moved forward to avoid nose overs. Some models will allow the use of extended motor shafts so the motor can be mounted further back

The Centre of Gravity (CG) is positioned much further forward than for a free flight on these small models positioning the CG about 1cm from the LE works well

Probably the most popular type of model, certainly for beginners, is the simple all-sheet profile model. The RTP Hut do quite a number of kits for these, as well as plans, and many designs have appeared in the modelling magazines over the years – see the Bibliography at the end of this section.


Photo - The RTP Hut

- MOTORS

With all regular RTP systems, the motors are 12 volt nominally rated. They are very cheap, even the most expensive costing no little more than about £11. This is not an expensive form of model flying! To be certain that you have got a suitable motor for RTP have a look at the RTP Hut who stock a range from small to large motors. However, when visiting model shows, if you see suitable-sized motors, the small motors are essentially scalextric slot car motors, going for little money as you invariably do, buy some and try them.

RTP Hut offer a range of motors divided into 3 sizes.The smallest 4550 Wren motor comes with a 75mmx 50mm prop and is suitable for models up to around 300mmm span.

Left to right 4550 Wren, 4551 Sparrow, 4554 Blackbird and 4556 Skylark (photos The RTP Hut)

The mid range 4551 Sparrow comes with the same size prop but the extra power can handle light models up to about 400mm span.

The larger 4554 Blackbird is very good direct drive with either a 125mm x 50mm 3 bladed or 112mm x 50mm 2 bladed prop fitted. It will fly up to a 700mm model well, especially if built light. Fitted with a 3:1 reduction gearbox and a Graupner grey plastic 6x4inch prop, it becomes very powerful and will fly scale models up to 36 inch/900mm span. The 4551 is also good with a similar reduction gearbox.

For the larger models RTP Hut have introduced a new motor, the 4556 Skylark which is capable of turning a larger 150mmx 100mm prop without the need for a gearbox and with a very low current draw . It comes with a 3 bladed 125mm x 50mm prop and can power most types of models up to about 700mm span

The KP Aero free flight electric units, including the KP ducted fan are also suitable for RTP use but be careful not to put too many volts through them – they are rated at about 4.5-6 volts only so some sort of voltage limiting BEC would be needed

The mounting of the motor is not critical – a simple force fit into a slot in the nose of the model will do , though it is a good idea to wrap a rubber band around it for security. The motor can be epoxied to a plate or slide into a balsa tube. Whatever method you use, try to arrange things so that air can pass over or through the motor. This will help to increase motor life, especially for direct drive installations.

Multi-engined aircraft are easy to do as RTP models. The motors may be wired in series or parallel – there are pros and cons either way.

With RTP models, there is generally no need for downthrust or side thrust. However, do look carefully at the plan, if it is actually for an RTP model, and set up the thrustline as instructed.

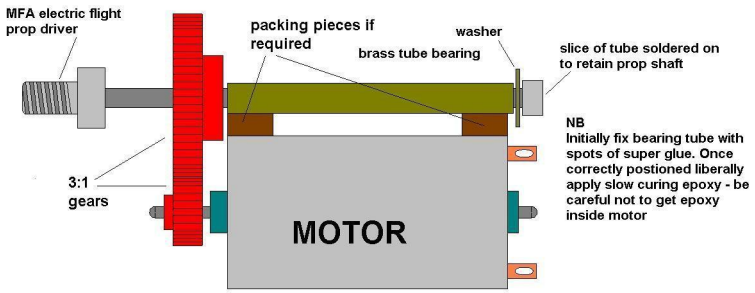
Finally, and most important, it is a good idea to lubricate the bearings at either end of a motor from time to time, especially if you are flying a lot. This Club flies all day at shows and we lubricate motors two or three times during the day. Just a single drop of light oil (Three-in-One) on each bearing is all that is needed.

- THE USE OF GEARBOXES

Gearboxes are used to allow us to turn larger propellers for a given size of motor. Electric motors are normally set up to be efficient and happiest at high RPM. However, they usually lack the torque required to turn big propellers at high RPM. Propellers generally are more efficient at lower RPM. So, if we fit gears to a motor so that the propeller is revolving at a substantially lower speed than the motor, then potentially we have the best of all worlds:- lots of thrust and a cool motor. With the average RTP motor, if it is to be geared, then a reduction of about 3:1 seems to be about right. At Oxford, we have used 3:1 gears a lot with great success. As there is no vibration with electric motors, these gear boxes can be quite basic and simple. We simply epoxy a brass tube to the motor can, sometimes with spacers to get the mesh of the gears correct. The prop shaft runs in the brass tube and the prop can either be attached to a commercial MFA electric flight aluminium prop driver or a brass bush from a rubber model may be used.

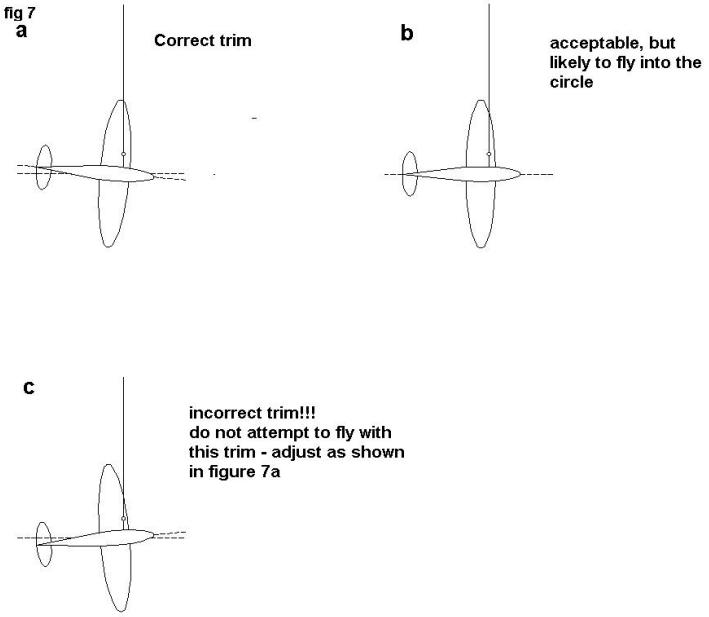
Recent advances do mean that similar qualities of high torque and low current draw can now be found in the direct drive 4556 Skylark motor for the larger models. For smaller scale models where this motor is too large a gearbox would be the way to go. RTP Hut do offer kits for geared drive conversion

There is no need to get involved with gears when starting out with RTP, but for ultimate performance, they are very useful.



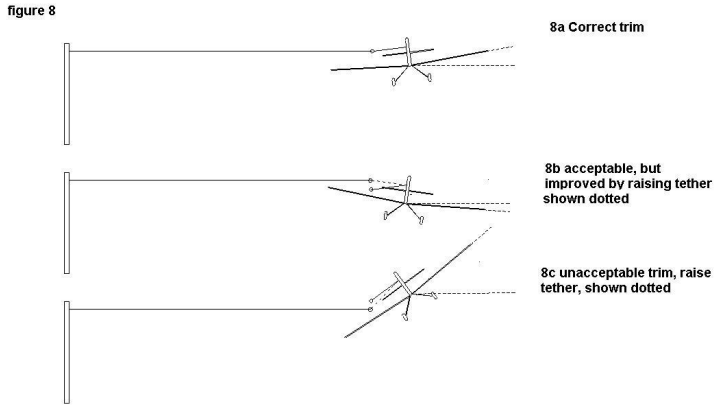
- TRIMMING RTP MODELS

Like all types of model, the RTP model flies best when it is properly set up, or trimmed. The centre of gravity (CG) should be somewhere between the leading edge of the wing and about 25% of the wing chord (chord equals the width of the wing as it joins the fuselage). Now hang the model from a line by its tether hook and see hang it hangs. The wings should ideally be in line with the line, viewed from the front. The nose should be hanging down slightly, viewed from the side. If not, bend the brass wire tether accordingly: back to lower the nose, forward to raise the nose, down to lower the inboard wing, and up to lower the starboard wing.



With the rudder set to 10 degrees right, and the elevators at neutral, gently try to fly the model. Slowly apply increasing amounts of power. If at full power the model remains on the ground, stop it and bend the elevators up a little. Keep doing this until it takes off. If it is reluctant to climb, increase the up-elevator some more. If it stalls, reduce it. Correctly trimmed, it should fly at the

same height as the pole, smoothly on about 2/3 power, and slightly banked towards the pole. If the flying lines are very tight, reduce the rudder setting or move the tether forward a little. If the model is flying nicely but is banked away from the pole, then raise the tether slightly.



It should be noted that some individual models prefer a tether point on the wing, though most are fine with a fuselage tether. With some large models, a small amount of weight in the starboard wingtip can be helpful – similar to control-line practice.

- FLYING RTP MODELS

Before flying your model, attach it to the lines and walk it or taxi it around the circle to check that the outer wing will not strike the walls or any other obstructions. If flying in a public space or where there are children, make sure that it is not possible for somebody to walk into the flying area. Also check the ceiling for suspended lighting etc – we have had models flying on 30 foot lines fly right over the top of the pylon: RTP models can fly high.

All RTP models are generally flown from a take-off rather than hand-launched, which is possible but difficult. To take off, position the model so that the lines are taught, with the model pointing slightly out of the circle. Apply fairly high power with the speed controller immediately and allow the model to accelerate, which will take a few seconds for an average model. Once the model leaves the ground, with most models, you can throttle back a little. Unless you are flying aerobatics, generally small smooth changes of throttle makes the model fly best.

Once flying, the model may climb on one side of the circle and descend on the other. This is caused either by an air current or draught in the room, or by excessive use of the throttle. Either way, should the climbing/diving become severe, the model should be throttled back a little as it is climbing. After a couple of circuits, it will stabilise in horizontal flight again. If you do not take corrective action, the model will hit the ground hard with probable damage.
Landing the model depends somewhat on what type of speed controller you are using. If it is a Scalextric style unit, then fine control at low speeds may be difficult and the model will tend to land rather hard and fast. If using an electronic controller, then the model may be flown accurately all the way down to the ground by gently reducing power until just before the model touches. At this point sharply throttle back. With practice, very smooth landings can be achieved.

- Different Types of RTP Model Flying

The above explains the basics of RTP flying. Now let us look at other aspects of RTP. With a single head pylon, a model can be used to fly loops and wingovers. This is done on at least 20 foot lines, with a pylon about 3 feet high. For 20 foot lines, you need a room that is 27 feet high. The model needs to be high-powered and light. It must be trimmed to fly with up-elevator, level with the top of the pylon at about half throttle. If the model is powerful enough, instant application of full throttle will cause it to fly straight up into a loop. Less powerful models must be climbed high, the throttle temporarily cut to drop the nose and then full power applied. It requires very careful use of the throttle to smoothly pull out from the loop. The Barnstormer biplane listed in the Magazine Bibliography below is good for aerobatics.

Single models may also be used to fly Limbo. Have a pylon outside the circle with a 36 inch length of 1/8th inch square balsa projecting into the circle. It needs to be mounted so that if the model hits it, the balsa swings out of the way. Owing to the stability of RTP models, just going under the limbo pole is easy. To make things much more difficult, RTP Limbo is flown alternately under and over the pole on successive laps!

Balloon-bursting is another popular activity. Again, a pylon is needed on the edge of the circle, though this time the pole projecting into the circle needs to be made of 3/8inch square spruce. At the end, epoxy a clothes peg so that the jaws of the peg stick out beyond the end of the spruce. The pole needs to be about 6 feet off the ground and must be capable of being swung out of

the circle either if a model hits it or to place balloons on the peg. Move the balloon pylon so that the outer wingtip of the model can strike the balloon but not the pole. A pin or spike is fixed to the outer wingtip leading edge of the model. You can run timed competitions to see who can burst the balloon quickest from a standing start, though we at Oxford use Balloon-bursting as the focal point when flying with young children. It is also a good fund-raiser at fetes or model shows. We have raised a good deal of money for charity this way as well as making our system self-financing.

The next variety of RTP flight is Carrier Deck. The model is equipped with an arrester hook. Either on a dummy carrier deck or simply on the floor, arrester wires are laid out, raised above and across the landing surface on small blocks (1/2 inch), with weights attached to each end. The idea is to make an arrested landing with model. In the same way as control-line Carrier Deck models, you can see how fast or slow the model will fly, and the hook may be fixed or lowerable by timer or using the motor torque to release it (the motor being mounted on bearings, with a light spring holding it in place – high power will cause it to rotate on its own axis and with a suitable linkage, lower the hook). An electronic controller really is a must for this form of flying.

With a twin-head pylon, two models may be flown together. This opens up other possibilities. The first of these is Racing. As the models must take off and land in a co-ordinated way to avoid line tangles (the lower model takes off second but lands first), the lap count should begin once both model are airborne. If both are being flown on one transformer, things get interesting because as one model is given more power, it will suck power away from its competitor and vice versa. If possible use two separate power supplies, one for each model. If the lines get crossed, this is not a major problem and it is often possible to untangle them in flight with some co-ordinated piloting.

The other type of dual flying is Combat. Here two all-sheet models are fitted with tissue streamers. The idea is to cut your opponent's streamer with your prop. Suitable streamers may be easily made by slicing rolls of soft toilet tissue with a band saw. Streamers about 4 feet long by 1/2inch wide are ideal. With this form of flying, it is definitely more fun to use a single power supply for both models – the increased use of the speed controllers makes things more equal. This is great fun, but have some super glue handy to repair the models, and you will also need a good supply of spare propellers.

Airmark Cassutt Special OD by Charlie Jeffreys

EQUIPMENT REQUIRED TO FLY RTP

- POWER SUPPLY

To fly electric models, you must have an electrical supply. RTP models do not carry their own batteries, merely an electric motor. This is supplied with electricity along the metal(copper) flying lines. Power is normally taken from a mains 240volt AC supply, which is then converted through a transformer to a variable low voltage DC supply, usually from about 18 volts up to about 50. This means that the supply used by the models is absolutely safe. The reason for the variable output is simply to take account of the variation in length of flying lines from one venue to another: the longer the lines, the more the electrical resistance of the lines and therefore more volts must be passed along them to give the same voltage at the model, ie 12 volts in most cases.

The only retail supplier of RTP models, RTP Hut can supply a range of transformers, from a basic model up to one with variable voltage output fitted with an ammeter. This latter feature is extremely useful as with the model flying in the air, the pilot can tell what current it is drawing and thus can avoid burning the motor out. In addition, this feature also allows the RTP system to be used for experimental work, such as comparing the efficiency of propellers or gearboxes when using the same motor.

There are other types of power supply. Searches of junk shops and army surplus stores can often yield suitable power supplies in the form of scrap transformers, theatrical variacs and the like. The Oxford Club uses both a Ballards transformer (actually an old Harry Butler unit, modified), and a power supply from a piece of medical equipment, this coming with a huge, smoothed variable resistance which allows us to set any output voltage we want. Several Club members have actually designed and built their own electronic power supplies. The final source of power is to use several car batteries in parallel, but this is not advised as it is clumsy and inflexible, and a proper transformer is easily obtained.

If using a mains transformer, always make sure that it is used with a suitable fuse.

- SPEED CONTROLLER OR THROTTLE

Having established a power supply, you must be able to control the voltage output to the model. A Speed Controller is fitted in the output to the model from the transformer. It can take one of two forms, both having the same function. The first is a converted Scalextric hand controller, available from RTP Hut, the second an electronic speed controller, also available from RTP Hut,

Controllers Left to right - Scalextric type, RTP Hut Pulse Width Modulation |(PWM)controller, Oxford Controller

The Scalextric style of controller is the most common and is the cheapest type. However, it has several major shortcomings. First, it gets very hot with use and thus uncomfortable in the hand. Secondly, because electrically it is simply a wire-wound variable resistor, it is working hardest at low throttle settings (hence the heat produced) and as a result tends to burn out at those settings. The result is that the controller does not work at all at the lower range of throttle settings – the motor in the model just stops. This is not ideal as it is exactly at this end of the speed range where control is needed most. Once this damage occurs, it is irreparable and the only answer is to replace the whole unit. When using this type of controller, under no circumstances use an unmodified Scalextric unit: RTP Hut alter them to take the increased load imposed on them by RTP flying though can still only be used with the smaller 4550 and 4551 motors

The Electronic Speed Controller is an altogether more sophisticated way of controlling an RTP model. The Pulse Width Modulation (PWM) controller offers better fine control and can cope with the higher current needed for the larger motors

Oxford has it's own design controller. In this unit, is an electronic circuit which contains a component known as a MOS-FET. In layman's terms this is an electronic switch. It switches ON/OFF continuously. By changing the proportions of ON time to OFF time, the motor in the model will run faster or slower. As this effect is known as an 'electronic fly-wheel' , the result is very smooth, precise control of the motor down to extremely low RPM, which is just what we need to fly an RTP model well. In addition, the Electronic Speed Controller operates without generating heat, and so it is comfortable to use in the hand. The Oxford MFC design also has the sophistication of a polarity reversal switch as well, this permitting the use or reverse thrust on landing and cutting out the need to reverse plugs on the flying circuit for a model that has been wired differently. The only care that must be exercised with a MOS-FET-controlled unit, is that when connected to the power supply it MUST be wired positive to positive, negative to negative, or the unit will be severely damaged or destroyed. The use of one-way only plugs is advised to avoid mistakes being made.

- POLE OR PYLON

Mounted in the centre of the flying circle, this needs to be between 600mm and 1200mm high, depending on the length of flying lines used. It must be mounted so that it does not move when the model is flying. With lightweight models on short lines, a 600mm square piece of MDF would be quite adequate. With larger models, on longer lines, a weighted base will be needed, In the

past we have used an old biscuit tin, filled with concrete with a tube set into the middle to take the pole. In the current set up we use the base from a swivelling office chair, occasionally ballasting this with a 20lb lead weight when flying large models (250 gram) on long lines (10 metres). In reality, this is an unnecessary precaution when flying properly trimmed models but as we have in the past flown at public events, with an audience close to the flying circle, it is a sensible precaution.

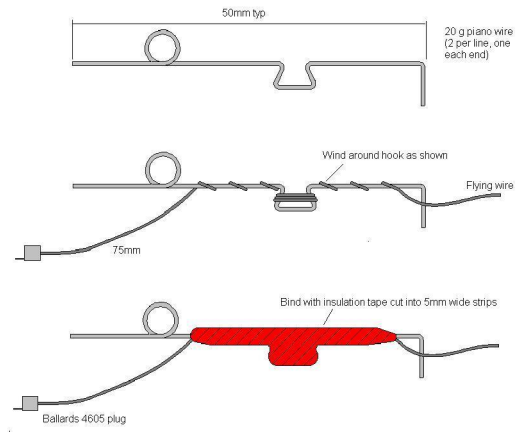
The RTP Hut offer complete poles for use with one or two models as well as a range of parts

- FLYING LINES

The flying lines need to be of fine (30 gauge), single strand copper wire, insulated with shellac. Reels of this material are available from RTP Hut. It is single strand and so two lengths will be required to make up a set of lines. A 4605 miniature plug needs to be fitted at either end, the shellac being scraped off with a scalpel blade so that the wire may be soldered to the plug. It is important to use short lengths of sleeving over each connection to prevent short circuits. In use these lines are very easy to tangle and damage if left straight off the reel. A good way to improve their strength and lengthen their life is to twist them together. The best way to do this is to cut a piece of wire a little more than twice the required line length. Double it, and hook the looped end over a fixed hook.
Attach the other two loose ends to a hand drill chuck. Take up the slack and start winding until you have approximately 8 turns per 25mm/1 inch throughout the length of the line. Detach from the hook and the drill and solder the two plugs at each end in the way. Make sure to cut the wires into two at the loop, however.

Now two wire hooks need to be bent from 20 gauge piano wire – do not use paper clips as has been advised in the past. Bend these hooks to the shape shown in the illustration and then bind and tape the flying lines to them

Figure 4



The function of these hooks is to take any possible strain from the model as the plugs alone will not remain connected otherwise. It is good practice to attach the hooks before connecting the plugs and vice versa when removing the lines. This reduces breaks in the fine copper wire. Examine the wires after each flying session or if they get badly tangled in a crash – replace them if the damage means that there is any likelihood of a short circuit.

Flying lines are best stored on reels. We use the card centres from rolls of 12mm masking tape, with discs of card glued to them to create flanges.

Oxford MFC does not use the wires described above. We have been using twin-core transformer wire since 1992. This consists of two thin copper wires each covered in shellac and then glued together with another coat of shellac to create the equivalent of very tiny bell-wire. It is much more durable than the usual single core wires and offers less drag when the model is flying. Unfortunately, this is an industrial product that is unavailable to model shops and is very expensive – we were lucky to be given a huge roll of it for free. But if you can find a source of it, do use it, as it is infinitely superior.

It is important to follow a sequence when connecting or disconnecting flying lines, in order to reduce the chances of breaking the wires. When connecting, always engage the tether hook first, and then the plug. When disconnecting, disconnect the plug first and then the tether hook.

(Pictures 14,15)

- POWER LEADS

The power leads are those that connect the speed controller and transformer to the pole. They need to be of reasonable length in order to permit varying lengths of flying lines to be used. Ours are about 10 metres long. As they will be laid on the floor and

trodden on, the best material is twin core 2mm flex. If the system has a double head, ie. it can fly two models at the same time, then you will need two leads. A suitable plug should be mounted at each end. Reversible plugs are OK for this part of the system as they will be downstream from the speed controller. If you do not have a polarity reversal switch built in to the system, this also allows you to change the polarity of the flying lines to suit any model very easily. If you are using double leads, it is a good idea to tape them together at regular intervals to create one item.

As the power lead links the power supply to the pole, the model will need to be able to take off over it. The easiest solution is simply to tape down a piece of card over the flex at the point where the model will have to cross it. At Oxford MFC, we have what we call a 'hot ramp'. This is a piece of laminate on to which lengths of low resistance copper strip have been glued. These are wired up to sockets at each end of the laminate. A sheet of thin rubber was then glued over the top of the copper. The power lead is divided into two parts so that the ramp may be plugged into it. As the ramp is only about 2.5mm thick, with very thin edges, the models can taxi over it without bouncing.

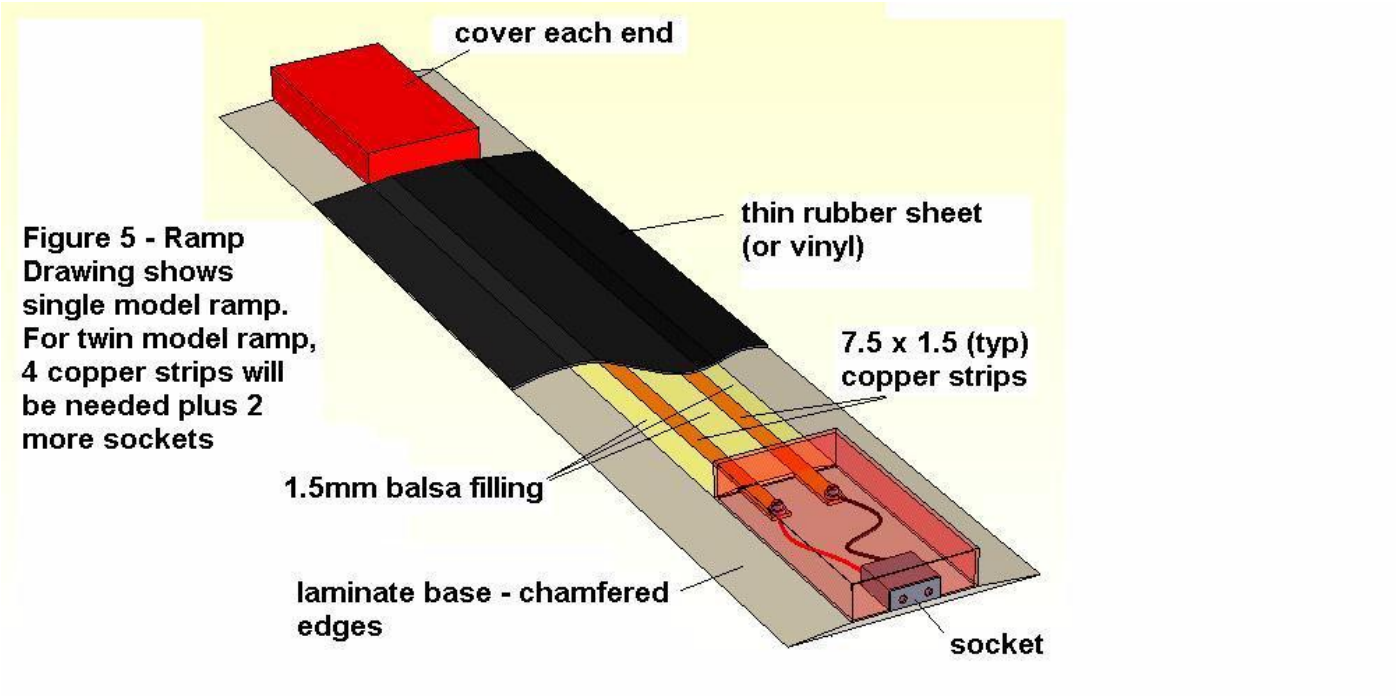


Figure 5 - Ramp Drawing shows single model ramp. For twin model ramp, 4 copper strips will be needed plus 2 more sockets

- BIBLIOGRAPHY OF RTP MAGAZINE ARTICLES

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Aeromodeller	December, 1977	RTP 4 – plans for four profile sport models
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Aeromodeller	April, 1979	Electric Round the Pole Flying, Part 4
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Aeromodeller	March, 1984	RTP article plus Eindekker profile model.
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Aeromodeller	December, 1984	Curtiss Helldiver kit review.
Aeromodeller	November.1985	Avro Triplane plan. Very detailed scale model.
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Aeromodeller	October,1992	Article on a Dutch 24 volt RTP system with elevator control
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Aeromodeller	June, 1994	Training in Tasmania. RTP pilot training
Aeromodeller	December, 1994	Gyrolec autogyro plan. Simple to build, wonderful flyer
Aeromodeller	March, 1995	Article on ducted fan scale models. Excellent
Aeromodeller	June, 1995	Sopwith Pup plan. Highly detailed scale model
Aeromodeller	September, 1995	RTP on the water. Australian flying boat models
Aeromodeller	Issue no. 729	Harrier plan
R/C Model Flyer	June, 2003	Small Talk RTP, good general overview, especially from educational aspect

Links - RTP Hut https://www.thertphut.co.uk

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