Tips for Performance

Exploring rubber-power flying models the direct way, using a 49¢ ready-to-fly balsa job.

BILL HANNAN

ALTHOUGH RUBBER IS one of the oldest forms of model aircraft power, it remains one of the least understood. By employing a simple "flying laboratory" approach, much of the mystery can be eliminated. If deep theory and equations are your bag, look elsewhere! Here we shall try to prove that learning can be fun.

The first requirement is a simple, dependable aircraft. Several brands of ready-to-fly models are on the market, but a North Pacific Sleek Streek was chosen because it is widely available in hobby shops, supermarkets, and some drug stores. If this brand cannot be found, another may be used. Other slightly more complex aircraft, such as Delta Darts, are suitable also.

Any model's performance can be improved systematically. Tests and experience are best gained with ready-to-fly types.

The Sleek Streek is assembled according to package directions, with the following exceptions: (1) Two pieces of masking or clear tape are applied across the wing center section. This prevents the wing panels from popping out of the wing mount in case of a hard landing; (2) After being correctly aligned, the fin and stabilizer are glued into their slots. These changes are not intended to hop up the model, but are merely to make it more rugged and able to withstand the rigors of hard testing.

Equipment and Materials

In addition to the model itself, the following items will prove useful: stopwatch, mechanical winder, needle-nose pliers, wire cutters, 1/32" diameter music wire and sandpaper. Also needed are tape, glue, different sizes and types of rubber, different sizes and types of props, rubber lube, oil and thrust washers. It is not absolutely necessary to have all of the above items, but the more that are available, the more extensive can be the experiments. Briefly, the purpose of each item is as follows:

Stopwatch: To determine how changes affect a model's performance, a means of comparison is needed. Judging slight improvements by eye is difficult and at best inaccurate. Measuring the actual time in the air from launch until touchdown is a much better system. If a stopwatch is not available, a regular watch with a sweep second hand will do.

Winder: This is a basic tool for rubber-powered model flying, since winding by hand is a slow, tiresome task. Some modelers prefer to wind by hand and can offer good reasons for doing so, but they are in the minority. Winders can be purchased commercially, or they may be converted from hand drills, by attaching a suitable winding hook. If you construct your own, make certain that the hook is securely attached, so that it will not work loose under a strong pull. Winders differ in ratio; that is, for each turn of the hand crank, the hook will revolve a given number of times. The hand drill conversions usually have about a 4 to 1 ratio, while the small commerciallly-made units have a 16 to 1 ratio.

Needle-Nose Pliers, Wire Cutters: These tools are used to fashion propeller hooks, for use when propellers are changed.

Music Wire: One length will provide enough material for many prop hooks.

Sandpaper: Use to reduce the weight of the heavy blade, if a prop is found to be out of balance. It also may be used to smooth and lighten the entire model, if desired.

Tape: Use to reinforce the wings and for emergency repairs.

Glue: Use for assembly and repair purposes.

Rubber: Several sizes and types of rubber strand are manufactured. Try at least a small quantity of every available size. If the local hobby store does not stock different types, try a mail-order source. For longest lift, rubber should be stored in an air- and light-tight container.

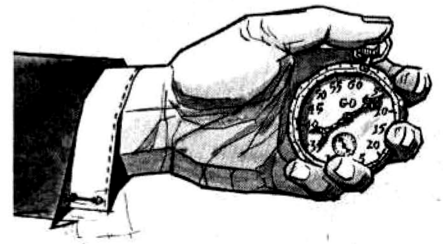
Propellers: The ready-to-fly model comes equipped with a prop, but, in addition, obtain one or more different types. For example, the North Pacific Skeeter, a smaller model than the Sleek Streek, features a scaled-down version of the same prop design, and the plastic nose piece can be directly interchanged with the larger one. Other brands of plastic or wooden props in the four- to six-in. diameter range should be obtained, if possible, for test purposes. Some props left over from small kits also would be suitable. The more types on hand, the more prop/rubber combinations can be tried.

Rubber Lube: A real must for rubber-powered models, rubber lube will allow any given motor to accept more turns and will extend its life. Commercially-prepared lubes are available at low cost, or castor oil may be used. Do not use common motor oils, which will attack rubber.

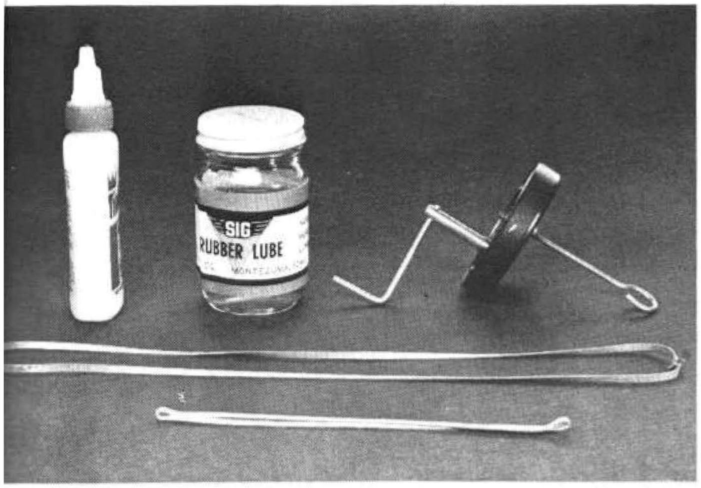
Oil: While motor oil cannot be used to lube rubber, do use it or sewing machine oil on the prop shaft bearing. A single drop is enough, since an excessive amount is apt to work its way down the shaft and onto the rubber.

Thrust Bearings: Some ready-to-fly models do not feature thrust bearings. After a time, the plastic prop hubs wear down and friction increases. To prevent this (or remedy it) tiny washers or sequins are placed between the prop and prop shaft bearing. Some experts instead use Teflon washers, which do not require lubrication.

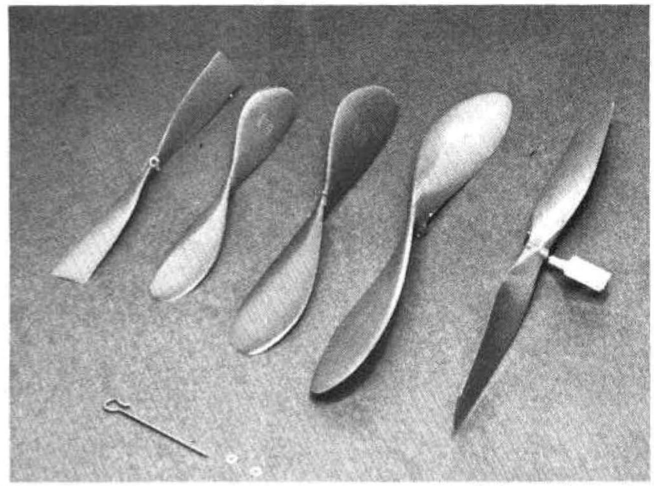
Notebook and Pencil or Pen: Any



Most important testing tool is the stopwatch. Checking relative performance is the goal.



Glue to attach flying surfaces permanently, commercial rubber lube, a commercial winder (or alter a hand drill), and a selection of rubber of different sizes are needed.



Changing props will significantly affect a model's performance. Smaller prop and motor might fly the plane longer than a big prop and strong motor. Some effects are surprising!

small notebook or tablet will serve to record test results for future reference. The simple form we used is illustrated, **but you may wish to design your own.**

Last, but not least, **find a willing assistant to help with the experiments.** If it can be another modeler, both will **benefit greatly and perhaps they can share the supplies.**

Testing Procedure

All tests should be performed under calm conditions, since wind can adversely affect flight performance and cause inconsistent results. Early mornings and late afternoons generally are the quietest times.

First flights should be performed according to the manufacturer's instructions, hand wound, and with the standard prop and rudder. Primarily, this is to be certain that the balance is correct. If necessary, shift the wing along the fuselage or, in the case of a model which does not have a movable wing, add clay ballast at either the nose or tail, as required. Check also for warps. Sometimes during shipment a panel will become twisted or bent. By breathing heavily on the affected part and bending it a little beyond the desired position, a warp can usually be corrected. Be aware, however, that it may return, especially if the temperature changes.

Once satisfied that the model is flying reasonably well, try timing a few flights. Our initial timed flights were performed using the manufacturer's recommended 170 turns, hand wound. Bear in mind that individual models will vary in performance ability, depending upon the weight of the balsa from which it was made, length of time the model has been on the dealer's shelf (which can affect rubber condition), etc. Caution: beware of false readings. A poor launch can handicap the model's true potential and, conversely, a thermal can boost duration. Neither presents a true picture of what the model is likely to do under average conditions. The number of flights per test is a matter of choice, but at least three or four are suggested.

If the model is equipped with a propeller free-wheeling device, as are Sleek Streeks and Delta Darts, conduct an instructive test by timing the model with the free-wheeler locked up, by means of tape or string. Note the effect on the glide.

Next apply some rubber lube to the stock rubber band, and note how it alters the feel even while hand winding.

Winding

When using a mechanical winder, models are usually wound from the front. However, with simple stick models, we prefer to wind from the rear, since it is easier to remove and attach the rubber loop to the rear fuselage hook. The procedure is as follows: have a helper grasp the prop firmly, while you stretch the rubber loop to about three or four times its normal length with the winder. While cranking in the turns, walk slowly toward the model until a point near the rear hook location is reached. The safe number of turns will have to be learned by experience, and a few strands of rubber will be broken while a feel for it is developed. Charts which list the safe number of turns that can be used for different sizes of rubber have been published. The mathematically inclined may study one or more of the charts, but none is a substitute for experience. Rubber is inexpensive when compared to glow fuel or rocket motors, so don't be afraid to sacrifice a few strands in the interest of education!

It should be understood that individual batches of rubber differ in quality, regardless of brand, and results can be expected to vary. The big advantage of testing rubber on simple models is that a blown motor is unlikely to do much damage. By contrast, a fractured band in a scale job is almost bound to extract a few bits of structure and tissue in the process!

Another important point to remember: count the number of turns as they are put in, so that results can be duplicated. Usually only the turns of the winder's crank are counted, so don't bother computing how many actual turns are being put in. It is merely a matter of multiplication to find the actual number of turns for scientific comparison. Warning: a prime rule in rubber power model circles is never talk to a man while he is winding!

Any reference to breaking in rubber motors has been purposely omitted. It is another subject of conjecture and controversy. Suffice it to say that the properties of a motor change somewhat after it has been wound several times. This too becomes evident as you go along. After a stock motor or two has been used up, make new ones from rubber strand. With any given size of rubber, the power can be varied by altering the length of the loop. A short loop produces greater power, but it cannot hold as many turns as a longer loop. The knot should be securely tied before applying rubber lube, since it is difficult to tie a knot in slippery rubber.

Note that when changing rubber or loop sizes, the balance of the model may be affected, and suitable adjustments will be required. Also, greater amounts of power will usually alter much more than just the models' duration. A model, which is docile with low power, may turn into an unmanageable beast when more "zap" is applied. Thus ample practice in adjusting the model's flight sur-

DATE: OCT. 4, 1969 — CONDITIONS: CALM	FLIGHT NUMBER			
MODEL: NORTH PACIFIC "SLEEK STREEK"	1	2	3	4
COMMENTS: STOCK PROP, STOCK RUBBER	(TIME IN SECONDS)			
HAND WOUND, 170 TURNS	8.5	7.0	9.0	9.5
STOCK RUBBER, 240 TURNS, WINDER WOUND	12	11.5	N.G. (CRASH)	12.5
" " 320 TURNS " "	15	14.5	15.2	15.5
" " MOTOR FAILED AT 336 TURNS	—	—	—	—
TESTS CONCLUDED BECAUSE OF DARKNESS.				

TYPICAL PERFORMANCE CHART

(Continued on page 74)

BEWARE

The unsuspecting may be zonked by a decal

Begin installation of the completed rotor assembly by placing a plain washer over the 1/16" dia. rotor shaft, then add the rotor assembly. On top of that, sandwich a ball-bearing between two plain washers. Bind the tip of the shaft with fine wire and solder. The rotor blades should spin freely and be reasonably well-balanced. Balance the blades by inserting and gluing small bits of lead to the lighter blade tips.

Insert ⅛" hardwood dowels to the rear of the fuselage, and rubber-band the tail unit in place. Check alignment. The center of gravity position is shown on the plans and can be corrected by adding lead weight to the nose or tail.

My model was finished with one coat of black fuelproof dope and striped with yellow markings. Dummy cabin windows were striped with tape and doped a pale green.

Testing and Flying: After rechecking the alignment of flying surfaces and the center of gravity location, one important adjustment remains before test flying. Tilt the entire rotor assembly to the left (as viewed from the rear of model) by bending the rotor shaft, just below the rotor bushing, approximately 1/32" to 1/16" from the vertical. This slight bend in the rotor shaft is an effective control in flight. When the rotor shaft is bent to left, the results are similar to rudder control. Bending the shaft back has the same effect as incidence to a fixed-wing model.

Select a grassy area for testing. Lean out the needle valve to full power. To start the rotor blades rotating in the proper direction (counter-clockwise), turn them with a finger. An autogiro is never launched by throwing. Instead, with model facing the wind, walk until the rotor blades develop enough lift to fly the model out of the hand. Observe the first flight carefully.

If the model turns sharply to the left after launching, add opposite rudder tab. If this does not remedy the problem, rebend the rotor shaft slightly from left to right or to a more vertical position. With ideal adjustments the model should fly in left-hand circles about 300 ft. in diameter, climbing slowly to 400 to 500 ft.

After the engine stops, the autogiro should descend slowly, with near zero forward speed. If a series of gentle stalls occurs upon descent, move the center of gravity forward by adding weight to the model's nose. Flight adjustments are not difficult to achieve. Keep in mind the following: (1) Power-bend the rotor shaft for proper climb and turns, using rudder tab for fine adjustments; (2) Descent-shift center of gravity position until the model descends nearly vertically.

Tips for Performance

(Continued from page 15)

faces is provided. The best rule here is: only one adjustment at a time. Then if an error has been made, it's much simpler to undo it!

After trying various types of power, begin experimenting with the props. In order to obtain smoother and more efficient performance, it is worthwhile to balance the props. As when changing rubber, switching props probably will bring about a change in the model's balance. You may wonder why smaller props are suggested, since virtually every article emphasizes the merits of large props. However, blanket recommendations of that kind must be tempered with moderation. Probably more rubber-powered scale models have self-destructed from being overpropped and/or overpowered than from any other single cause, with the possible exception of warps. Models, which may be marginally unstable, will often perform happily with a small prop, whereas a larger fan may render them completely unflyable. But try it and see.

A change of propeller also can alter

a model's entire flight pattern. Watch, in particular, its effect on turning radius, especially when the model is set up to fly in right-hand circles. Since a change in props often brings about a change in speed, be prepared for the effect of slight warps or maladjustments to be magnified.

Tardon

(Continued from page 31)

adding 1/16" plywood formers fore and aft.

Cut out the cockpit and finish the area under the canopy. After a pilot and instrument panel are installed, epoxy the canopy in place.

Finishing and Painting: The choice of finishing methods is varied. We began with a good sanding; two coats of Hobbypoxy clear; two coats of automotive primer, wet-sanded between coats; and the final finish of two coats of dope or acrylic lacquer. Rub and wax as desired.

Equipment Installation: When the finish has dried, hinge the control surfaces, making sure they all move freely. Add the landing gear and tail-wheel. Install a K&B 40 rear rotor with a 2¼" spinner.

Because of the long tail-moment, radio equipment must be placed as far forward as possible. Even so, it may be necessary to add lead to the nose. Tardon II weighed in at 4 lb. 12 oz. before balancing. After balancing, it checked out at 5 lb. 4 oz. It is more important that the plane balance at the CG than weigh in at 5 lb.

Control movement is quite important, since most RCers use too much. By following the recommended throws on the plan, no difficulties should arise. Remember that at higher speeds less throw is just as effective as a large throw at slow speeds.

Orbit Cobra

(Continued from page 39)

on a shelf. Below it, on one side, is an Eveready battery (#276) whose current consumption was measured at 60 ma. Although not rechargeable, this battery should last for two to three months of hard use. (A NiCad battery with charger is available at a slight extra cost.) Voltage between the antenna and battery terminal was measured at .8V. Signal amplitude on a CRT showed .67V from base line to peak. The battery is changed merely by removing the back cover (held by two screws) and slipping in a new one.

Throttle and gearshift levers are located on a separate board on the right side in a straightforward manner.

The receiver is the same size as all the others in Orbit's 1970 line, but it does have one significant innovation. All connectors are now much smaller so that the car-borne system can be installed easily, with minimum bulk.

The switch is the old reliable sliding type supplied with regular Orbit sets. The battery is square, which made it easier to install than the flat pack. The battery capacity is 500 ma. The receiver batteries, which are NiCads, can be charged as usual with the charger module supplied in the set. The power plugs are a new triangular polarized configuration.

Servos are based on the new 1970 PS-3D Mark III configuration. While the radio will operate the 1969 PS-3 type servos, older radio systems will not operate these new servos because of the pulse frame rate and configuration. The servos delivered four lb. thrust on the linear output but, when a rotary output is used, more speed (albeit with less thrust) is available. Speed, rather than force, is essential, especially for a car's throttle. We found the servo transit time of 0.6 sec. fairly adequate. Resolution was excellent and there was no hint of cross talk or mutual interference.

During a typical car race, the transmitter may be put on the ground (blacktop) and track temperature at times may reach 125 degrees. With mixed feelings we left the transmitter