OPERATING INSTRUCTIONS FOR

SINGLE & TWIN-ENGINE RADIO CONTROL MODELS

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PRE-FLIGHT The first requirement for success is to set up your plane correctly. DO NOT ASSUME that errors in the set-up can be easily corrected in flight by radio control.

Examine the model carefully from front and rear to see that the wings and tail are absolutely true, with no sign of warp. Any warp that is detected should be removed by applying steam, hot water, heat lamp or thinner to the warped surface, while the surface is twisted in the opposite direction. The surface should be held or blocked until well set.

Make certain the vertical fin and rudder are pointing dead straight ahead. The wing should be square across the fuselage and centered. Using a tape measure, check the distance from the fuselage side to the wing tip. It should be the same on both sides. Next measure from the rear of the fuselage to the furthermost point on each wing tip. These distances should also be equal.

With the wing set in its true position, attach "split dowel" keys or mark several guide lines on the wing. The wing can then be easily checked for correct position on the fuselage before each flight. The stabilizer should be keyed and checked in the same way.

The center of gravity, or balance point, must be where it is shown on the plan. To check this, two persons should lift the model by the wing tips. Each person should use only one finger, moving it forward and back until the model balances. The position of the fingers indicates the balance point. A more sensitive check is to perch it on top of your left thumb and forefinger, using your right hand to control it. Move your fingers forward and back while you search for the point where it balances best. Do not be afraid to add whatever weight is necessary to make the model balance correctly. Usually, if weight is necessary, it must be added to the front, because models often turn out tail heavy. Try to keep the tail light, do not apply too much dope to it. The least weight is needed when added as far forward or back as possible.

Engine offset, or side thrust, is not always needed but depends on the design of the model. If accidentally present when not required, it may make the model difficult to control, and should therefore be eliminated before first flights. Measure from one propeller tip to the rear of the fuselage. Then turn the propeller one-half turn, and measure from the same tip to the same rear point. A difference of more than 1/16" should be corrected.

Before the beginning of each day's flying, make a range check of your equipment in accordance with the manufacturer's instructions. In general, you should have at least 500 ft. range on the ground. One way to do this is to have an assistant walk in one direction with the model, while you walk in the opposite direction with the transmitter. Signals should be sent every five or six seconds. No response should be missed until you are over 500 ft. apart. Only if the equipment works perfectly should any flights be attempted. Be careful not to use your transmitter when someone else on the field is flying or testing on the same frequency.

FLYING For first flights of airplanes not equipped with throttle control, limit the fuel so the engine will run no more than about 2 minutes. This lessens the chance of damage if the airplane is badly out of adjustment. With throttle control, the airplane may be landed at any time to make any adjustments necessary.

In flight control, most of the trouble comes from holding a signal too long. It is usually better to give a series of signals, each held only briefly.

A troublesome tendency is letting the model get downwind. New flyers should try to keep the model upwind at all times prior to the landing approach. It is more difficult to fly a model when it is downwind, and if a mistake is made the model will end up farther downwind, making it almost impossible to fly it back to the field.

If the ship tends to climb too much, raise the leading edge of the stabilizer slightly on successive flights until the climb is more moderate.

"Turn" in the airplane is corrected similarly. The ship is watched closely to see if it has turn in the glide, or with the engine throttled back to low speed. After landing, the rudder or aileron is re-set slightly for opposite turn each time until the ship has no built-in turn. Then, any remaining turn is caused by the engine, which is then re-set slightly to pull in the opposite direction.

RUDDER-ONLY OPERATION

Generally, for rudder-only flying, a single-channel radio and one of the popular types of escapement is used. A "compound" escapement, such as the Bonner Vari-Comp or Citizen-Ship SE2 gives right rudder when a single signal is sent (and held) by the transmitter, and left rudder when two quick signals are sent (the second pulse being held). The "SN" (self neutralizing) escapement gives right and left rudder alternately. Both types of escapement give "neutral" when a signal is not being transmitted.

When using the compound type, it is preferable to have the model set to make a very gentle natural left turn. Then as the model climbs away at the beginning of flight, turning very slightly to the left, a single signal held for an instant will swing the model slightly to the right. In this manner, alternately heading left and right, the model can climb safely to altitude before making any significant turn. The important thing here is that a single signal achieves positive right rudder. If, instead the model has a natural right turn, two pulses are needed for correction to left rudder. An inexperienced flyer may pulse improperly, winding up with right rudder instead of left, which may crash the plane.

A steep climb is not desirable, as it makes the model hard to control. Too flat an angle also is not good, since with any turn the tendency then is to drop the nose sharply. The model should climb at a very moderate angle. The stabilizer can be adjusted to achieve this, raising the leading edge 1/32'' to 1/16'' to reduce climb, or raising the trailing edge if more climb is needed.

Be sure to check your escapement rubber band before each flight to see that it has at least 200-300 winds.

When a rudder-only plane is turned, it enters a bank, and then shortly after begins a banked dive. Use brief signals except when you want a dive.

A surprising variety of stunts, (loops, wing-overs, rolls, Immelmans, etc.), can be performed by the skillful rudder-only flyer. Initially, however, much practicing needs to be done to master the simple process of steering around in the sky, winding up with a landing close to the pilot.

SIX AND TEN-CHANNEL OPERATION

Six-channel equipment is popularly used to become familiar with simplified multi-channel work. Three servos are used: one each to move the rudder, elevator, and engine throttle. Ailerons may be used instead of rudder. They give more versatility, and allow more positive control of the plane. However, their installation, while not difficult, is more complicated than the rudder.

If you want to do much flying inverted, it is better to use ailerons so as to have positive lateral control.

Because of having elevator control, the multi-channel airplane does not need as much decalage as the rudder-only ship. Decalage is the difference between the angles of the wing and stabilizer.

Ten-channel equipment controls rudder, elevator, ailerons, engine, and elevator trim. This last control is a small in-flight adjustment which is used for trimming the airplane to fly flat despite different weight conditions as the fuel is burned. It may also be used according to need for certain maneuvers.

TWIN-ENGINE OPERATION

The latest exciting challenge made possible by R/C is the flying of multi-engine aircraft. All through the history of modeling it has been a generally unrealized dream. Now in the last several years R/C enables us to investigate and practice this phase of flying.

The most successful operation of twin-engine aircraft results naturally from the fullest number of controls. However, while ten channels or proportional controls are desirable, they definitely are not necessary in a well-designed aircraft. Six-channel operation can be very satisfactory, and for a skillful single-channel flyer, even rudder-only is entirely within reason. Generally speaking, most flyers should use six or ten channels. For six channels, rudder, elevator, and engine have been used quite successfully. However, the use of ailerons instead of rudder is even better.

The most important problem affecting twin-engine ships is caused by the fact that the engines are not on the center-line. This problem shows up on take-off unless both engines are tuned to produce about the same R.P.M. A variation of 500 R.P.M. from one engine to the other causes the ship to swerve towards the side with less power. A good tachometer is a real help in checking the R.P.M.

The question of offset thrust is often brought up. In general, however, it has not proven of much value.

In the air, variations in engine speed are less serious, and as long as both engines are delivering fairly well, the ship will behave pretty much in the manner of a single-engine airplane. If one engine delivers substantially less power than the other, the ship will, of course, be somewhat handicapped.

Watch out for peculiar vibration effects due to "vibration-phasing" of the two engines. Screws tend to loosen - connector plugs may separate. Check frequently. Fuel tanks should be "topped-off" before take-off. This requires tanks with 3 tubes. On take-off, gain excess ground speed and climb at a shallow angle, in case one engine cuts out.

The major difficulty, but not necessarily so bad, comes when one engine quits ahead of the other. Maintaining control is largely a matter of keeping the airspeed high enough. This takes practice and judgment.

Control will be lost temporarily if the nose is kept too high for too long. As speed is lost, the power of the control surfaces is drastically reduced. At the same time, the effect of the off-center thrust is increased. Ailerons are more effective than rudder in maintaining control. However, as the ship continues to slow down, at a certain point the live engine takes over and pulls its wing forward and up (because of dihedral). This causes the ship to make a sharp 180 degree turn, ending with a dive. Having thus regained speed, the ship is once again controllable.

This maneuver must be prevented from happening near the ground. If throttle control is available, the simplest answer is to reduce speed on the remaining engine immediately after the first engine quits. However, it is a good idea, of course, to acquire the piloting skill needed for successful one-engine-out operation. To do this, the ship should be kept up high at any time when failure of one engine may be expected. One can then practice flying, observing the ship closely; and if mistakes are made, there is plenty of altitude for recovery. The second engine will, of course, cut sooner or later, and the ship can be glided down and landed as usual.

Since the essential need is for speed to maintain adequate control, power is important. A pair of good .09s on good fuel is quite adequate for weight of 4 to 4-3/4 pounds. On a ship of this weight good .15s will provide sparkling twin-engine performance, and also do very well when just one engine is left.