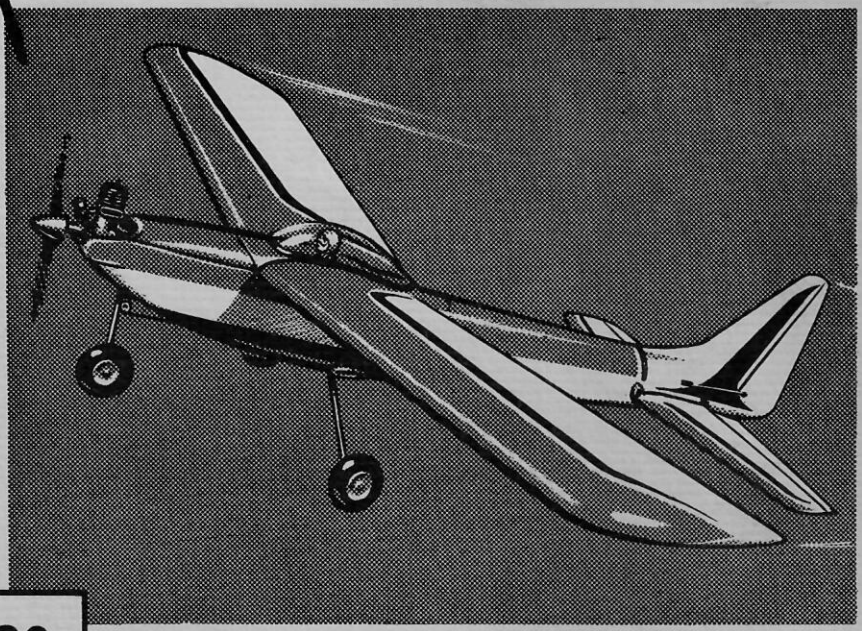
MULTI R/C FLYING

PRE-FLIGHT & OPERATION MANUAL



20c

by Ed Kazmirski

WORLD MULTI R/C CHAMPION

TOP FLITE MODELS, INC.

2635 S. Wabash Ave. • Chicago, Ill., U.S.A.

TOP FLITE

THE "ABC's" OF R/C

MULTI-CONTROL FLIGHT

The flight of model aircraft via multi-control radio as we know it in its present day form approaches so closely the flight of full scale aircraft that the layman, observing a multi-controlled model for the first time is thoroughly convinced that he is watching the performance of a full size airplane with a pilot seated at the controls. The thrills and pleasures derived from flying a multi-control R/C airplane from take-off, thru the many and varied types of maneuvers, to the prototype landing with the taxi-back, are hard to describe. One must experience them for himself.

To become adept at putting a multi ship through its paces the R/C novice should become acquainted with certain rules, procedures, and methods which the author has found both necessary and helpful.

This, then, is the purpose of this booklet. Read it carefully, abide by it, refer to it often and practice the rules, procedures, and methods as outlined herein and you will find yourself quickly mastering the art of multi flying and enjoying thoroughly one of the finest hobbies known today.

RELIABILITY & MAINTENANCE of the MULTI-CONTROL R/C AIRPLANE

Two of the prime requisites for successful multi flying are reliability and maintenance. These two go hand in hand and should be learned and and practiced by the R/C novice and expert alike before his model ever leaves the ground. What good is a well constructed and beautifully finished airplane loaded with complex radio gear if the prospective flyer doesn't bother to take the time to insure against trouble created by out-of-tune radio gear, poor wiring, bad solder points, defective switches and plugs, poorly mounted servos, and engines improperly mounted? The R/C novice will find that the most successful multi flyers are the individuals who always find time to check the reliability of their gear and maintain with reasonable regularity the entire aircraft from front to rear. To sum it up, the multi airplane will serve its owner faithfully only as long as as the modeler maintains his ship properly. So learn to check for reliability and practice maintenance at all times. **This is the secret of success.**

RELIABILITY

Reliability in a multi-ship can be defined as the proper functioning of all components time after time without a malfunction. The following sketches and descriptions indicate what steps to take to insure reliability in your model.

HINGES – One of the best types of hinges for the flying surfaces, such as the rudder and the elevators, is the figure eight stitch, using a heavy grade of button hole thread or carpet thread. Make sure you pull thread hinge up snug and coat the exposed thread with several coats of dope. Be sure that the surfaces do not bind through at least 60° of up and down or left and right travel.

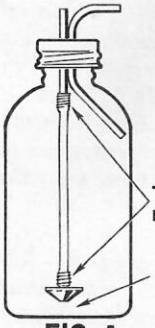


FIG. 1

MOTOR MOUNTS – USE MOTOR MOUNTS OF HARDWOOD, such as maple, basswood, gumwood, etc. DO NOT USE WOOD SCREWS to hold the engine down. Employ the largest size machine screw that will go through the engine mounting lug holes easily. Either flat washers with lock washers and nuts or individual locking nuts can be used under the mounts.

FUEL TANK – Many fuel problems occur when the center of the fuel tank is not in line with the needle valve body on the engine. Make sure they are on the same level. Use the largest size tubing possible between the tank and the needle valve body. Keep the length of the tubing as short as possible without kinking or placing a strain on the tubing that would result in the tubing working its way off the needle valve body or tank connections. Make sure that the weight on the end of the tubing in the tank does not touch the tank bottom when the tank is held upright. (Fig 1) Wrap thread around ends of tubing.

WHEELS – The wheels should be of the proper type and size for the airplane. The light weight pessary type with nylon hubs are about the best. Use collars with set screws for retaining the wheels on the landing gear wires. Wheels should not fit sloppily on the gear but should spin freely. Landing gear should be aligned so that the model tracks straight and true on a hard surface. Lubrication of the wheels will help prevent chatter which sometimes causes ground looping.

CEMENT SAFETYING – Whenever any components are held together by screws, lockwashers, and nuts, such as in the case of servo mounting screws, engine mountings, or landing gear hold down screws, the nuts should be coated with cement to prevent loosening. Go over the entire airplane and secure all such spots with cement.

WIRING – Use Bonner 19 strand R/C wire throughout – skin off only enough insulation to facilitate a good solder joint. Use only resin core solder and a pencil type soldering iron for soldering your connections. Sleeve all connections at connector plugs, switches, battery boxes, etc. (Fig 3) Don't forget to slip sleeving on wire before soldering. Tin the bare conductors and terminals before joining them. Apply heat and solder. Watch out for cold solder joints where the solder itself takes on a crystalized look. Reheat this type of joint.

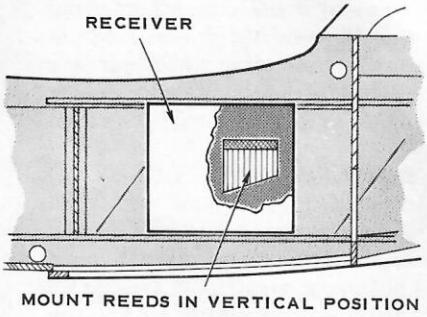


FIG. 2

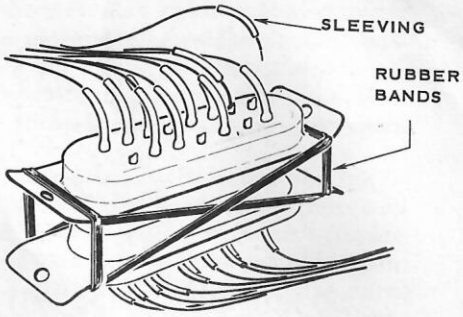


FIG. 3

RECEIVER – The receiver is highly susceptible to vibration from the engine and should be protected from shock by wrapping it completely in a layer of 1/4" or 1/2" foam rubber. Hold the foam rubber around the receiver with rubber bands. Place the receiver in the compartment of the airplane so that the reeds of the reed bank hang down as the sketch shows. (Fig 2) The reeds will be least affected by vibration when the receiver is in this position. The receiver should fit loosely in the compartment. Fill excess space with foam rubber.

SAFETYING – Connector plugs from receiver to servo should be safetied together by bending up end tabs slightly and then wrapping rubber bands criss-cross around the tabs. (Fig 3) These connector plugs should not be fastened down in any way, but should be allowed to wiggle freely within the fuselage. Make sure the leads to these plugs are long enough to allow free movement without placing strain on solder joints.

SERVOS – Servos should be mounted to servo boards with balsa or basswood strips at front and rear to prevent the shifting of servos fore and aft due to vibration. This can change the trim of the ship in the air. Tighten servo hold-down screws just enough to slightly compress rubber gromets on servos and to allow a little side to side motion at the top of the servo. New servos should be taken apart and all leads coated with Goo or Pliobond at solder joints. Also "Goo" down all components in transistor servos.

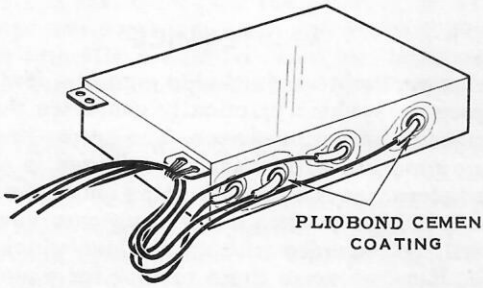


FIG. 4

BATTERY BOX – Form loops in the leads at the box as shown, (Fig 4) and tie them to lugs on the box with thread. Coat the sleeved leads at terminals with Pliobond cement. Make jumpers between terminals of box from solid soft copper wire and sleeve.

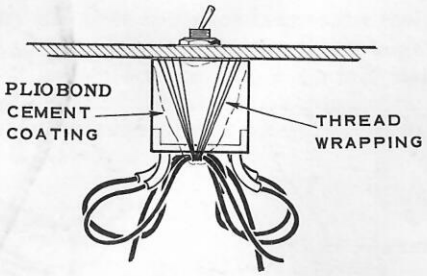


FIG. 5

DO NOT USE A SLIDE SWITCH in your plane. Use a good grade of toggle switch. (Fig 5)

WIRE JOINTS – Form a loop in the leads at the switch as shown in sketch (Fig 5) and tie leads back against switch with thread. Coat thread and leads with Pliobond cement.

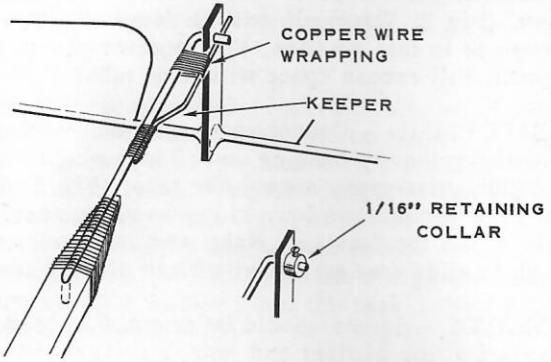


FIG. 6

KEEPERS – Keeper wires or small collars with set screws can be used at each end of all pushrods to prevent them from coming loose from servos or horns (Fig 6). Any undue strain placed on the pushrods during flight can cause the wire ends to jump out of place. Result – a mishap.

MAINTENANCE

Maintenance as applied to a multi-ship entails a few relatively simple but effective procedures which practically guarantee the R/C'er trouble free flying throughout the entire season. The proper time in which to go through these preventative maintenance procedures is after **every** flying session, or just before you contemplate going out to the field to do some flying. Spend a half hour or even more going over your plane at these times and you will be rewarded with an airplane which will perform for you at all times. Here are some items to look for when you are doing a maintenance check. Don't skip any of them at any time. This is important!

FLYING SURFACES – Check all thread type hinges for broken threads or sloppy hinge action. Replace the hinge immediately if you find such a condition. An elevator with weak or loose hinges could pull

loose in the air. Check to see that the elevator horn is not breaking loose at the silver soldered joint between the plate that takes the pushrod end and the music wire that goes out to the elevators. Replace the horn or re-solder with silver solder if such a condition is found. Are the elevators or rudder cracking or pulling apart at the hinges? If so, replace them.

ENGINE AND FUEL TANK – A clean engine will serve you faithfully for a long time. Take care of it. Clean off the head with thinner and a toothbrush if a coating of grime and oil has built up on the cylinder head. Check the backplate screws to see that they are not coming loose. Make sure the engine mounting screws are tight. Operate the engine servo and notice if the throttle barrel is hanging up someplace as it revolves. Tighten down head screws regularly. Make sure the needle valve locking screw is tight and the needle valve body is not bent or cracked. Above all, use clean filtered fuel only! Clean your engine immediately after a flying session and between flights. Keep it covered with a rag to prevent dirt and grime from entering the cylinder. When finished flying for the day, drain the fuel tank completely and check it for leaks. Look over the surgical tubing inside to make sure that it is not cracked or gummy. Replace the tubing if such a condition exists.

WHEELS AND LANDING GEAR – Regardless of whether you fly from a grass field or a hard surface the gear and wheels on your plane take a severe beating. Check these over well. Straighten any bent landing gear and re-align these for proper tracking. Any wheels with worn hubs or deflated tires should be replaced. Keep the hubs and axles lubricated with a few drops of light machine oil. Clean the axles, wheels and gear thoroughly. Make sure that all wheel keepers are snug and tight, but not so tight as to restrict the rotation of the wheels about the axles. If your plane has a steerable nose wheel, operate the steering servo and watch the nose gear as it swings from side to side. Be certain that it moves through its full travel without binding and that it returns to its proper position at all times. If it does not, look for a binding condition somewhere in the linkage and eliminate that cause. Tighten all screws used to hold landing gear mounting bearings.

CARE OF THE AIRCRAFT – Wipe down the airplane after each flying session with a mixture of detergent and water, or rubbing alcohol to remove all fuel and castor oil from the plane. This will keep your ship looking clean and new for a long time. Any cracked sheeting, gouges in nose blocks, or torn silk should be cared for before your next time out. Your plane will therefore look presentable at all time.

TRANSMITTER AND RECEIVER – The transmitter and receiver combination you use to control your airplane are the heart of the control system. They should be looked after and maintained in proper working condition with loving care. They are fairly expensive items, so a little time spent keeping them in order is well justified. If you have experienced a hard landing or a crack-up, check for loose or broken components in the receiver. Look for broken, frayed, or cut through leads and replace where necessary. Most latter-day receivers employ a printed circuit board. Give this a very close eyeballing for cracks or broken solder joints. Look over the relays if the receiver is of this type. Make sure contacts are not bent out of shape and that contact springs are in

proper position. See if the very fine wire that makes up the relay coil is all right. If it is broken, repair or replace the relay. Look over the reed bank to be certain that none of the reed fingers are bent out of shape. If the receiver case is bent up, straighten it out. If the receiver appears to have sustained extensive damage and does not operate properly, send it back to the manufacturer for repair. Don't try repairing a badly damaged receiver unless you know exactly what you are doing. Check to see that the receiver is in proper position and has not shifted in the compartment. Look over all the leads from receiver to plug. Are there any frayed wires or worn leads in evidence? Rectify this condition immediately. Check out the receiver and transmitter combination thoroughly on the bench. Are all reeds operating correctly and all tone pots in the transmitter on proper audio frequency? Return pots as necessary to bring operation up to par. How about the transmitter? Are any keys sticking or hard to operate? A bad key could cause a bit of grief out on the field. Lubricate the cams on the keys with a tiny bit of vaseline occasionally. Check the action of the collapsible antenna for binding. Extend the antenna and clean off all sections well. Straighten any bent antenna sections or replace the antenna. Check over internal wiring of the transmitter carefully for bad solder joints, frayed leads, and possible points of shorting of leads. Check batteries carefully. Turn on the transmitter and receiver and check voltage under load while operating controls. Above all, **be certain** that your transmitter and receiver batteries are up to par before any flying. Out at the field, range check and retune receiver and transmitter for optimum results before any flying is done. **Do this every time you go out.** Just because your equipment worked all right the last time doesn't mean it will continue to do so without a little touching up. The tuning may have drifted off slightly when you were flying the previous time and may be right on the verge of malfunction. Take the time. It costs only a few minutes and can save a valuable airplane – your airplane!

SERVOS AND PUSHRODS – Operate the servos on the bench. Is there any grinding or binding? Find out why, and correct these conditions. Are any of the servos slow in their travel? Could be that the motor brushes are getting dirty. Disassemble the servo, pull the brushes out of the motor and clean them along with the motor commutator. This should restore proper speed to the servo. Are any of the servo wires frayed or insulation on these wires cut or rubbed through? Replace the wire and find out what caused this condition and rectify it. Are the servo mounting screws loose? Tighten them properly, not too tight, and coat the nuts with cement. Check to see that the servos haven't shifted from their original positions. If they have, reposition them properly. How about the pushrods? Are the keeper wires or collars that safety the wire ends of the rods loose or missing? Tighten the set screws in the collars or resolder the keeper wires accordingly; then they will do their job well. How about the pushrod itself? Is the balsa cracked or weak anywhere along its entire length? Replace the balsa rod with a new one if you do find this condition. How about the music wire ends? Are they loose where they fit on the balsa pushrod? Re-bind the wire ends to the pushrod and coat with cement. Check to see that the pushrods travel freely through the fuselage without any contact that might cause binding or slow action of the elevator or rudder. If you are flying with ailerons the wire rods that run through the wing to the ailerons should be checked for drag or sloppiness by first running the aileron servo and pushing by hand the rod

from one end of it's travel to the other. Hold the ailerons and check for excessive play in the linkage. If present, find out why and where and and correct this fault.

WIRING – Check all solder joints for cracked or broken leads, frayed wire, or worn insulation. Make sure all sleeving is properly in place over terminals of plugs, switches, and battery boxes. Look for points of contact between leads and other components which would cut or rub away the insulation or short out the lead. Are there any points of tension on any of the leads at plugs, switches, battery boxes, receivers, servos, etc? Remove these tension points by using longer lengths of wire, splicing in an additional piece where needed. Be sure to cover all spliced joints with sleeving and a coating of Pliobond cement.

TRIMMING

Some of the most interesting experiences we have had during our R/C activities were while we were "first flighting" models for other fellows. We found that two models, even of the same design, never flew the same, although the builders said they were built exactly to the plans. After some investigation we found the reason was an accumulation of slight differences during the building and setting up of the model.

The factors generally involved were weight, alignment, decalage, C. G. position, down and side thrust, leading edge radius, elevator settings, and "throw" of control surfaces. Any one, or combination of these elements, that varies from the recommended specifications can add up to one poor and difficult flying airplane. If we understand the function of each of these, we can better understand how to properly trim out our ship. We would go on record to say that about 75% of the R.C. models flying today are not properly trimmed out. In order to understand trimming, we will go over each of the above elements one by one.

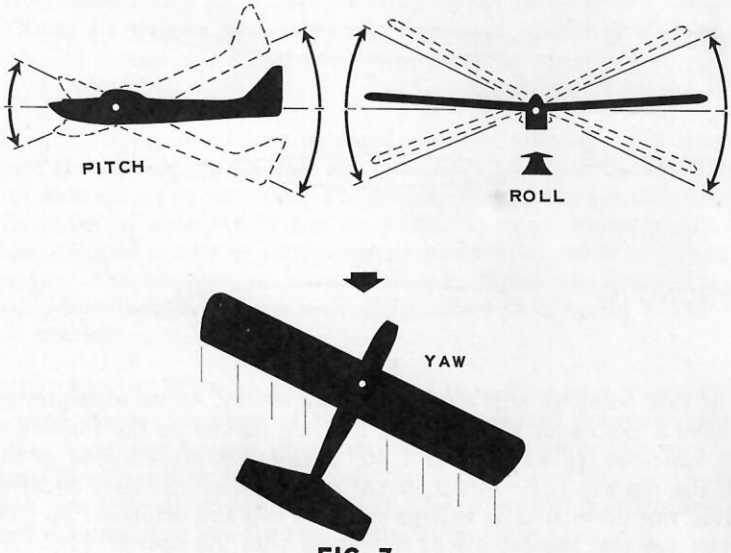


FIG. 7

First we must understand that all maneuvers are around three axes – pitch, roll, and yaw. (Fig 7) Trim is the "force set up" which determines the flight characteristics of the aircraft.

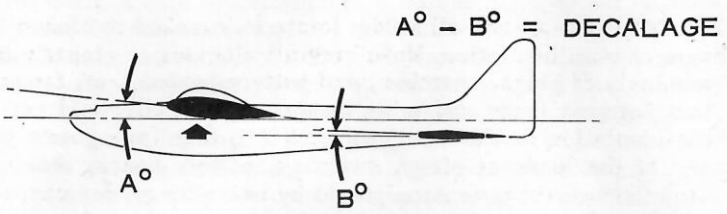


FIG. 8

The two most important elements of trim are C.G. position and decalage (Fig 8). The C.G. generally falls between 30% and 40% of the chord depending on the airfoil section. Until you know enough about it, it is best to stay within plus or minus 3/8" of what is shown on the plan. If C.G. is too far forward, the model will require more decalage, thus creating more drag and requiring more power. If the power is cut, the ship will dive for a real hot landing, and this is bad for any model. On the other hand, if the C.G. is too far back, the elevator becomes very sensitive. This makes the model difficult to fly, especially in rough air. If we have moved the C.G. back without changing the decalage, the model will climb on normal power. This we do not want so we must reduce the decalage when the C.G. is moved back. This should be done by shimming the wing or stab, preferably the stab. If the stab is fixed, the wing can be shimmed.

A model properly trimmed in pitch will fly level with no climb or dive under full power.

TAB EFFECT – All C.G. and decalage adjustments should be made with absolute "O" elevator. (Fig 9) This is very important. The reason for the "O" elevator setting is the tab effect.

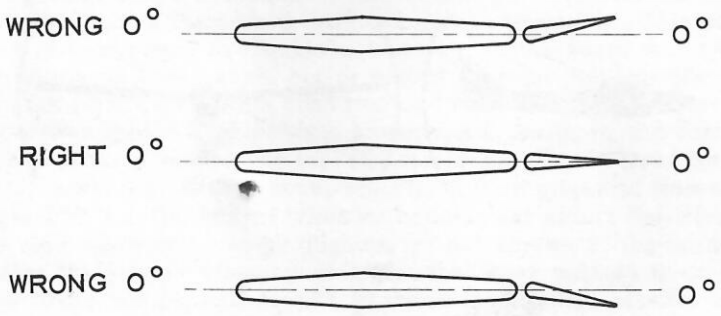


FIG. 9

At this point we will explain the tab effect. As an example, suppose we have a tab about 1" wide and 2" long placed on the trailing edge of wing near the tip with about a 10° deflection. At a speed of about 15 MPH the tab has little effect, but if we speed up to about 40 MPH as in a dive, the tab will have enough force to roll the airplane. So from this we can see that the tab effect increases with the speed.

Slightly up or down elevator acts as a tab and will change the pitch attitude of the airplane at different air speeds. For this reason all climb or dive tendencies should be corrected by changing the decalage. (Fig 9) Care should be taken not to introduce up or down elevator while shimming the stab. Check elevator to be sure that it is at absolute zero. C.G. and decalage are a compromise that can only be reached by experimentation. Make only slight adjustments at a time and check for flight improvement. A further word on C. G. position – spins are easier with a rearward C.G., outside loops are also better. Inside loops get a little tight, but again it's all a compromise.

WARPS – Wing, stab, and fin warps act as the tab effect and cannot be compensated for by opposite aileron or rudder at all airspeeds. It is most important to build these surfaces true.

LEADING EDGE RADIUS – Through experience we found that although the wing was dead true with no warps some ships would not groove through the loops. It was found that the leading edge radius varied from tip to tip. This caused yaw and roll. The correction is to sand the leading edge with a formed block.

DOWN AND SIDE THRUST – Down and side thrust work like this: Let's take down thrust first. At full out aircraft speed down thrust effect is nil, but in the case where the model pulls up steeply and slows down with the engine reving full, the down thrust becomes very effective tending to level the model to a smooth recovery.

This effect can be noted when a rudder only ship with a lot of down thrust is hand launched. As the speed is low, the down thrust pulls the model into a shallow dive until the aircraft speed picks up, then the down thrust becomes less effective and the model goes into a normal climb out. A few degrees of down thrust also helps with a nice long flat take off and climb out. Much has been written about all of the power loss from down and side thrust. Actually power loss figures out at less than 1% per 1^{o} of down or side thrust. With most modern R.C. jobs being overpowered a loss of a small percent of power is no problem.

So far as side thrust is concerned it works somewhat the same way as down thrust only in the roll and yaw axes of the airplane. The purpose of side thrust is to counteract torque. We can design an airplane to use no down or side thrust but we suffer in some areas of our flight program. With the loss of only a small percent of power we gain some advantage. Adjustments of down and side thrust are not critical, so generally speaking if you are reasonably close to the plan no adjustment will be needed.

THROW OF CONTROL SURFACES – It is very important to experiment with various degrees of throw on the control surfaces. Start out with just a medium amount of control and work up and down for the best results. The less the amount of deflection you can use the better off you are. Smoothness is very important. Over controlling is quite common so fly high until you get the feel of the ship.

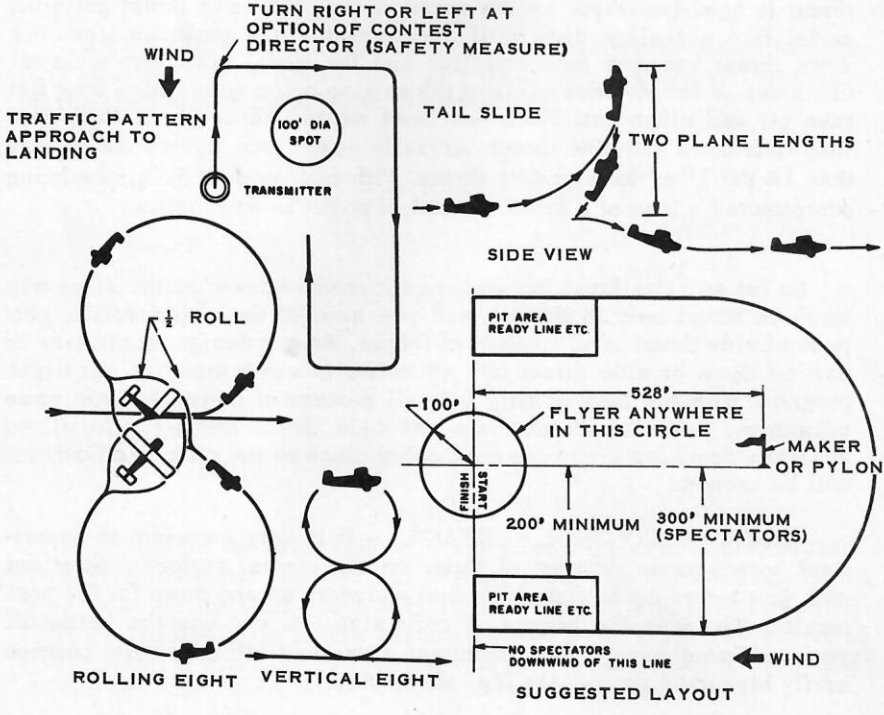
FIN LINE UP – Fins not properly lined up with the center line of the fuselage account for a large number of trim problems. A good way to check this is with a thread running around the fin to a pin stuck in the center of the forward part of the fuselage. All this adds up to accurate building and the added time pays off in a smooth flying airplane. Perfection in trim can only come from experimentation and experience, but after getting into it you will find it interesting and rewarding.

We hope we have passed on to you some helpful ideas gathered from our own experiences. If you follow along these lines we can assure you that R/C flying will be a great pleasure.

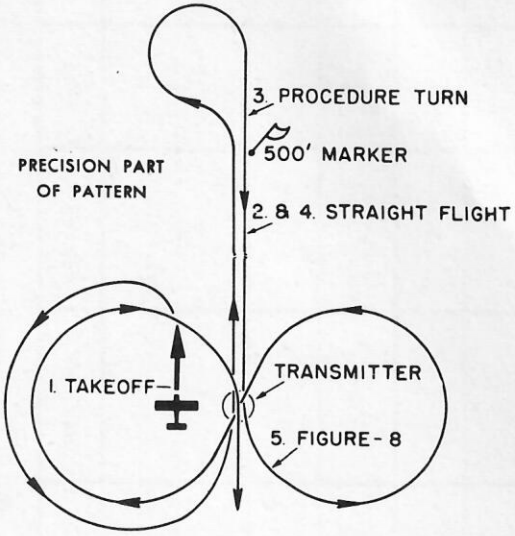
Ed Kazmirski

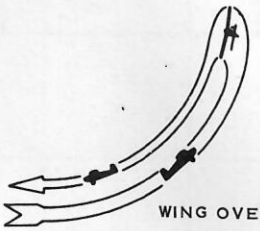
TOP FLITE

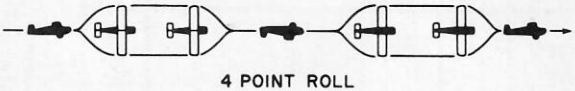
AMA RADIO CONTROL MANEUVERS

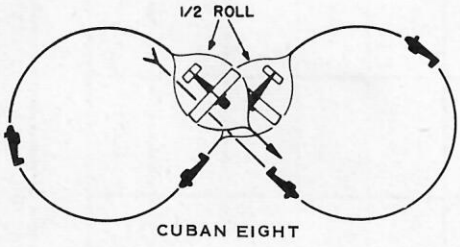


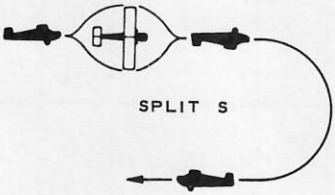
AMA RADIO CONTROL MANEUVERS

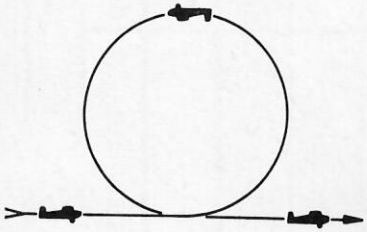


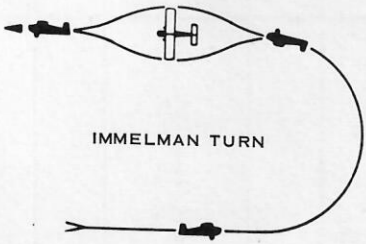












QUALITY AND PERFORMANCE
ARE NO ACCIDENT WITH TOP FLITE MODELS

Top Flite model airplanes must meet the most rigid standards before they are made available to the public. Every Top Flite model goes through a series of experimental design and performance tests. Production line models are constantly tested both in the engineering department and in the field for quality of materials, workmanship and manufacture, precision engineering and "fly-a-bility." It is, therefore, no accident that more Top Flite Models have won more Nationals and World Championships than any other models.

RADIO CONTROL

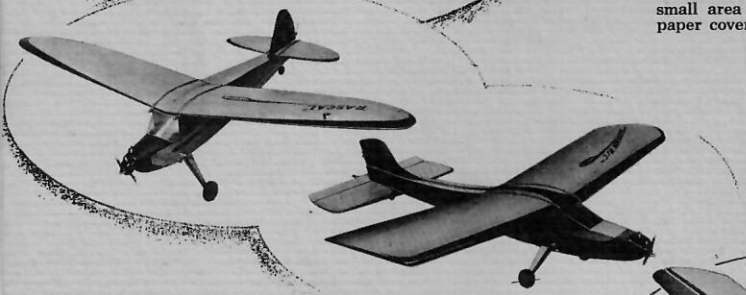
ORION

THE WORLD MULTI R/C CHAMPION designed by Ed Kamirski. The most complete and precise R/C kit ever made.

Wingspan: 68" Length: 47"
Wing area: 690 Sq. In. Engine: .45
Kit RC-1 List: $27.50

R/C COMPACTS—SINGLE CHANNEL

2 nights work puts either of these two models in the air. Both deliver top performance on .010 or .020 engines. Ideal for beginners and small area flying. All balsa construction, no paper covering necessary.

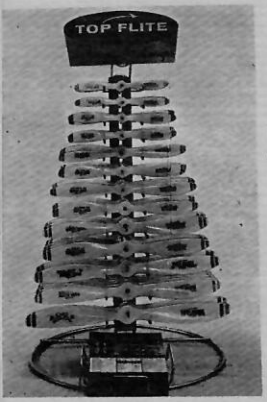


R/C RASCAL

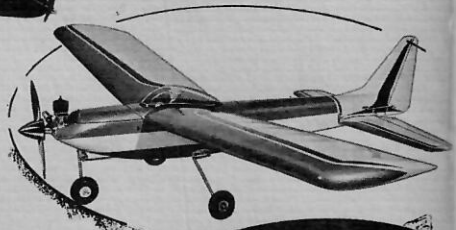
Wingspan: 27" Length 18½"
Wing area: 100 Sq. In. Kit RC-2
List: $2.95

R/C SCHOOLBOY

Designed by Ken Willard
Wingspan: 29" Length: 23½"
Wing area: 163 Sq. In. Kit RC-3
List: $3.50



NEW MULTI TRAINER "TAURI" designed by Ed Kazmirski
MULTI TRAINER — Kit No. RC-4
Single to 10 Channel
Length: 38¾" Span: 57"
Engines: .15 to .25 Fly wt.: 4 lbs.
Area: 530 sq. in. **$18.95**



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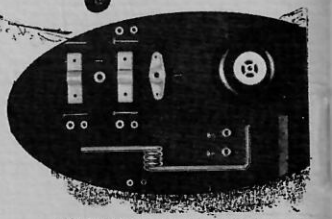
E–11*	Tail Wheel Bracket	E–24	Landing Gear Mounts
E–12*	Control Horn Assembly	E–25	Retaining Collars 1/16" dia.
E–13*	Aileron Bellcrank Assembly	E–26	Retaining Collars 1/8" dia.
E–14	Landing Gear Assembly	E–27	Retaining Collars 5/32" dia.
E–15	Engine Mount Assembly	E–28	Flexible Cable .015
E–16	Elevator Control Horn	E–29*	Mounting Bearings
E–17	Landing Gear Clamp Assembly	E–30	Springs
E–18	Hinge Thread	E–31*	Nose Wheel Control Bellcrank
E–19	Aircraft Pinking Tape 30"	E–32	"J" Bolts
E–20	Flexible Control Cable 24"	E–33	Blind Nut Mounting Set
E–21	Phenolic Horn Material	E–26A	Retaining Collars 3/32" dia.
E–22	Nose Gear Strut	E–33	Blind Nut Mounting Set

*NYLON



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