MODEL AIRPLANE NEWS

January 1963—35 cents

EXCLUSIVE M.A.N. PHOTO 1962 NATIONAL CHAMP, ED KAZMIRSKI AND HIS TAURUS 1962's OUTSTANDING WINNER IN RADIO CONTROL—DOMINATED MIDWEST CONTESTS AND THE DETROIT INVITATIONAL.

NOW!

The Taurus

KAZMIRSKI'S

GREAT NEW

CHAMPION!

PLANS & STORY

SEE PAGE 11

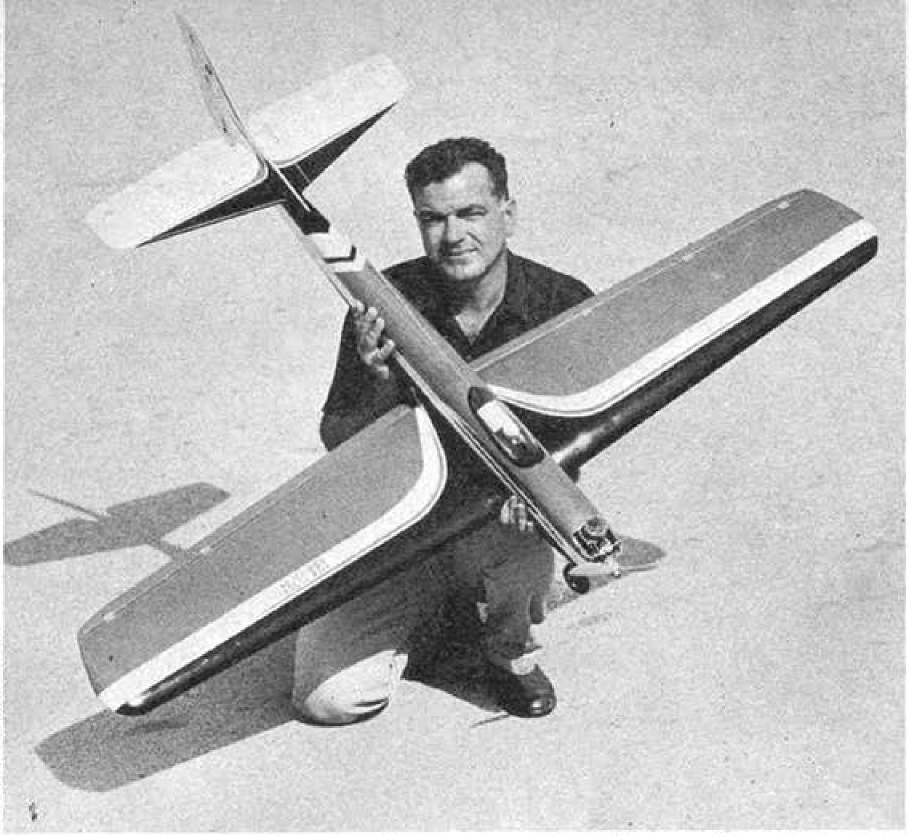


PHOTO BY GENE HOOKER

A bit older maybe, but still the same old Kaz as we all know him—note his usual fine finish.

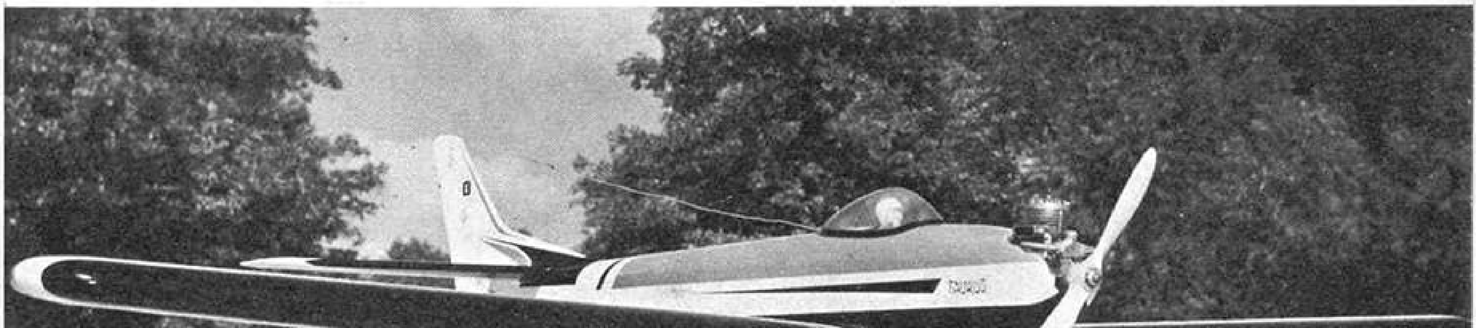
Veco .45 up front has special intake restrictor designed for slower flight with lighter plane

TAURUS

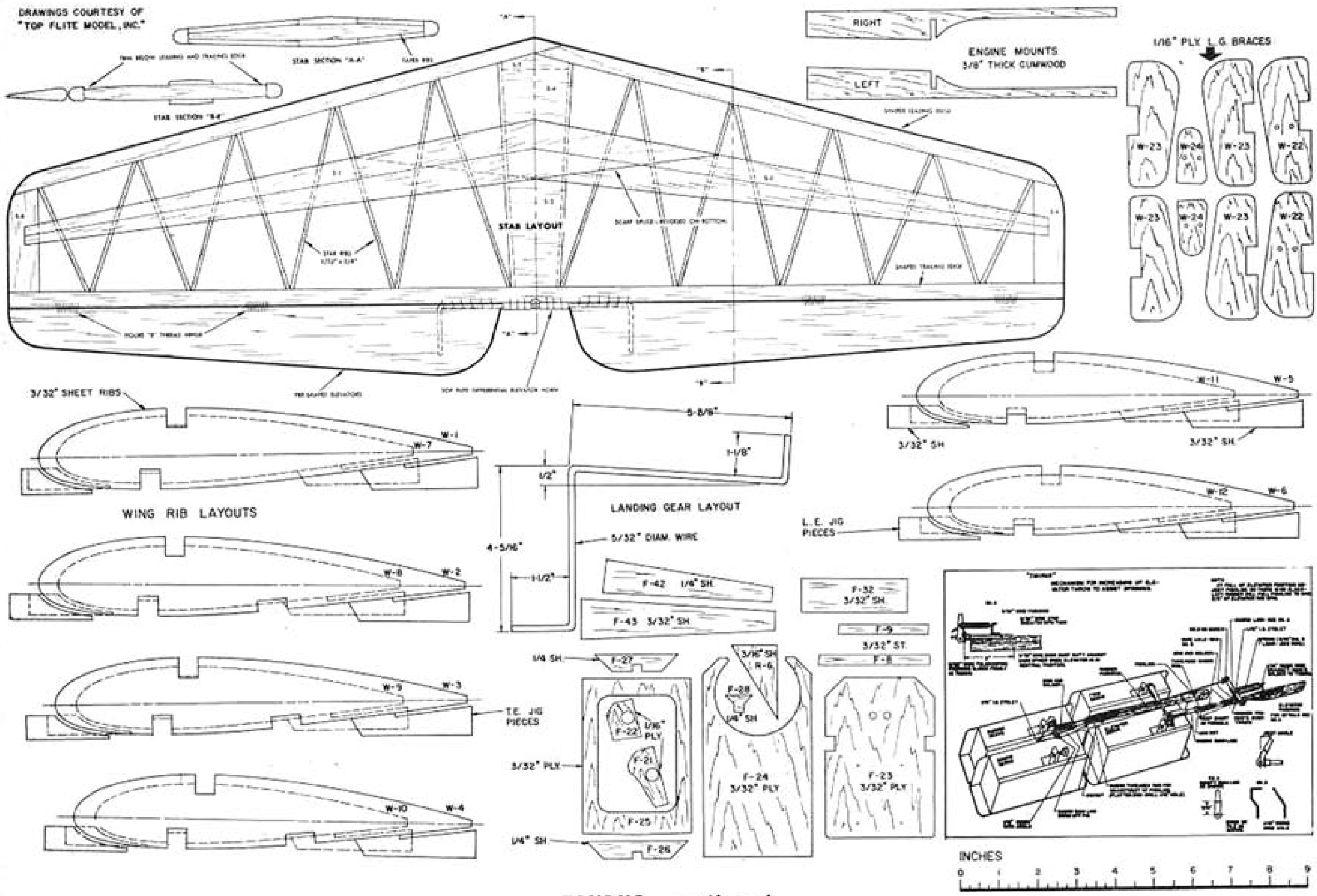
BY ED KAZMIRSKI

IN JUNE '60 M.A.N. IT WAS STATED THAT OUR AUTHOR'S 'ORION' WAS THE BEST MULTI OFFERED TO DATE—IT WAS! NOW WE GO ONE STEP FURTHER AND STATE HIS TAURUS IS THE BEST, BY BEST IS MEANT JUST THAT—A LOOK AT CONTEST RECORD SHOWS THAT THE MAN IN THE STREET IS DOING THE WINNING.

► In the last few years RC equipment manufacturers have made great strides in the development of RC gear. Radio and servo reliability is at an all-time high. Properly maintained, this equipment now allows the modeler to concentrate on the art of flying. During this time the RC model aircraft has also undergone considerable development, our objective was to come up with a plane that would perform the maneuvers more nearly perfect, but more important, would be easy to fly. It goes without saying that smoothness is all important. Our thinking was that if we could design a plane that would fly slower and still do clean maneuvers, we would have the answer. We see many new designs but are they really different? To change the shape of the fuselage, stab, rudder or wing may give some slight advantage here or there, but we were looking for a design that was really different. After about two (*Continued on next page*)



Photographer was inspired with this photo, angle from beneath model coupled with background and clouds presents 'Taurus' at its very best.

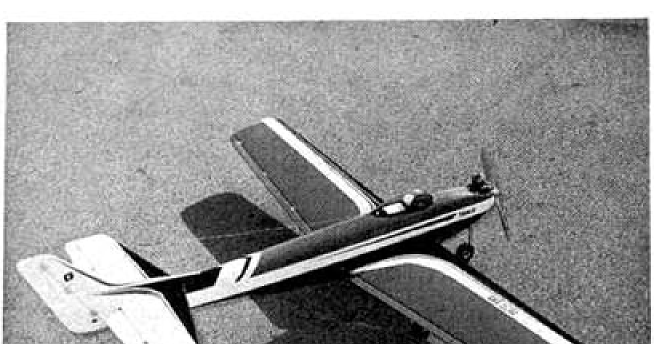


TAURUS—continued

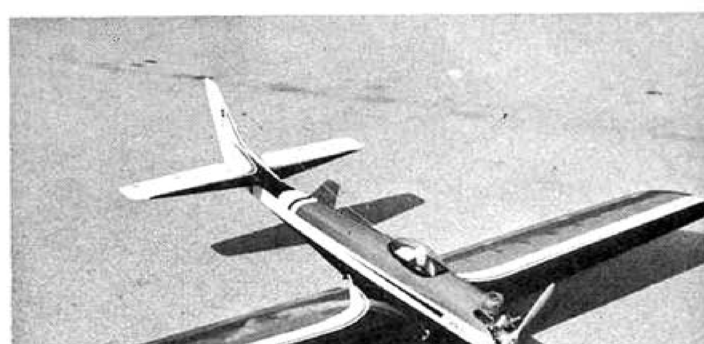
years of experimenting, (it added up to a lot of building and sweat) we evolved the design we now call the Taurus. What about the Taurus? What makes it different? Let's take a close look at its design.

First, we must remember that to win a contest or master RC flying it is a combination of 65% pilot and 35% airplane. A good pilot can take just about any design of ship and win contests with it. But what about the average flier? He needs a ship with some built-in advantages.

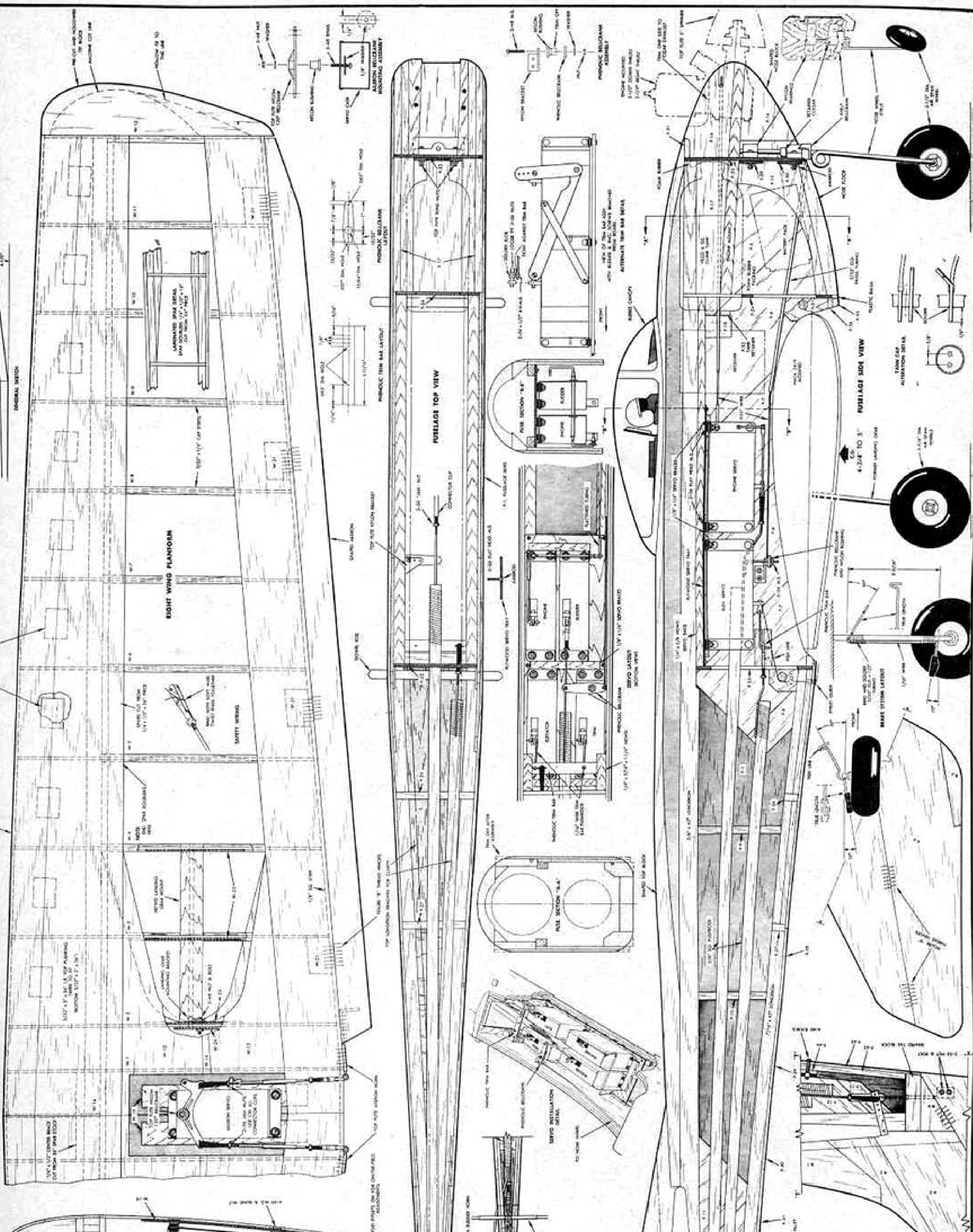
The big difference in the Taurus is the thick wing section. We use a modified NACA 2419. Let's consider the advantages of the thick wing section. A thick section has lots of lift and plenty of drag. We need both. Why do we want drag? If we had a ship that always flew at the same speed, the control response would always be the same. In a full scale airplane the pilot feels the pressure on the stick and by this feel he knows how much control to apply. In a model, we have to judge the speed and beep accordingly. If we double the speed of a model, the drag goes up four times; therefore the thick *(Continued on page 52)*



Three quarter rear view shows the long tail moment arm, plus the rakish fin and rudder—strip ailerons more effective than usual outboard type.



Kaz feels that the 19% wing section permits the pilot to fly the Taurus completely through the maneuvers and to execute them even more cleanly.



FULL SIZE PLANS AVAILABLE. SEE PAGE 57

Taurus

(*Continued from page 12*)

wing and its drag tend to fly the model at a more constant speed. The advantage is that we have more feel in the ship; making it much easier to fly.

The lift characteristics of the 19% section at low speeds is a big help in landings. We can now bring the ship in slowly over the spot and there is no tendency for the tip to stall with the thick tip section. If you slow it down too much, it just sinks. Assuming, of course, the wing is true.

Another advantage of the 19% section is that it is not sensitive to slight elevator beeps, making the ship very smooth in pitch. Consider this: if we put a flat plate in a wind tunnel and change the angle of attack ½°, we get quite a change in lift; put a round tube in the same wind tunnel, rotate it 360°, and we have no change. The thick section is a lot more like the round tube. It gives us a nice soft response.

Still another advantage of the thick section is its strength due to the fact that the spars are spaced so far apart. A 19% section has approximately two and one-half times the beam strength of a 12% section; therefore, square outside loops are no problem. We have followed Hal DeBolt's lead and have gone to strip ailerons. This cuts the wing building time approximately in half. We now have a much truer wing because we no longer have aileron cutouts. The aileron linkage setup was designed so that the throw and differential can be changed by simple adjustments. Also, each aileron may be adjusted up or down independently of the other. With a strip aileron wing the outboard portion of the wing is lighter; thus it has less inertia. This makes roll maneuvers such as Cuban eights, Immelmanns, four point rolls, etc., much easier to do.

Another point of interest about the thick wing is that it is a natural for a low wing airplane. If the speed increases only slightly, the lower drag tends to hold down the nose and gives the ship good pitch grooving characteristics, dependent, of course, on whether the ship is properly trimmed, a subject we will discuss later. One thing we have found is that the ship had to be designed around the wing section, most important is plenty of stab area along with a change in the force setup.

Considerable work has been performed on the fuselage of the airplane. After much experimenting with moment arms, we ended with a short nose moment arm and a long tail moment arm. We have found that a clean fuselage is a must, as any drag in this area absorbs engine power quite rapidly. It is interesting to note that on full scale airplanes, the best aerobatics have extremely short nose moment arms and long, light tail cones. With this combination we find we have a better rough air airplane. During a flight we burn off about five to six ounces of fuel. This amounts to about six ounces of weight taken out of the nose during the flight. With a long nose moment the fuel tank is generally quite far forward. After the fuel is burned off, this makes quite a change in the CG position, changing the feel of the elevator. With a short nose moment this is much less noticeable, again giving a more constant control response for a better flying ship.

Long tail cones make an airplane extremely smooth in pitch and give good pitch control at low speeds. Fuel tank position on an aerobatic ship is very important in order to get a good fuel feed through all maneuvers. By careful experimentation we arrived at the position shown on the plans. With the proper needle valve setting the engine goes slightly rich with a nose down attitude preventing speed build-up. As the nose is pulled up, the engine leans out for maximum power where we need it. This tank position partly dictated the shape of the nose. We have eliminated the hatch, giving us a structurally stronger front end. The fuel tank now plugs in and is sealed with a ¼" thick sponge rubber gasket at the F 1 bulk head. The big advantage of this system is that it keeps the inside of the ship dry and free of fuel. This gives greater reliability to the switches, radio and servos.

We formerly used a positive setup for the wing and stab on other ships. That is, the wing and stab were mounted at a positive angle in relation to the center line of the fuselage. Since the Taurus was designed around a trike gear setup, we have gone to the "O" "O" setup. The stab and wing are now mounted "O" to the fuse center line. The reason for this is that on a trike gear setup we want our wing to be negative when the ship is sitting on the ground. This makes for very easy landings. The principle involved is that as the ship touches down on the main wheels, it rocks down onto the nose wheel. At this point the wing goes negative, pushing the ship down on the runway and holds it there preventing bounce. With the "O" "O" setup the tail cone does not have to be tipped up too high to make the wing negative to the ground, giving the ship a more normal appearance while sitting on the ground.

We use a slight amount of down and side thrust. Much has been written about the power-robbing down and side thrust. The simple truth is that the power loss is nil (less than 1% per 1°). As it is we have more power than we need. We can design a ship that uses no down or side thrust, but this dictates the fin area and force setup; thus the ship suffers in other areas of performance. Actually, down and side thrust are very effective at low air speeds with full power such as during take offs or when adding power on a slow approach. At full out air speeds slight amounts of down and side thrusts have little effect. The amounts used are a compromise for the best overall performance.

The above is a rundown of what we feel are some of the more desirable features of the Taurus. I don't want to give the impression that this airplane solves all the problems or that a rank novice would find it a pushover to fly. However, we do feel that it is a ship with some new ideas and concepts that further the art of radio control flying.

BUILDING

We will not go into too much construction detail, as most modelers building this type of ship will have had some building experience.

Accurate building is a must in any model as well as a flat working surface. A little extra time spent to make sure everything is true is profitable. The Taurus is designed around the use of light balsa. Five pound stock can be used throughout the ship except for the spars and the first three inboard ribs on each wing panel. These ribs take the main landing gear loads and should be medium balsa, about six to seven pounds stock. The fuse top block and wing sheeting should be four pound stock. The strip ailerons, elevators, fin and rudder should be made of quarter grain stock to prevent warping—this is important. You will note the leading edge is formed of sheet balsa. We use this type of construction for two reasons. First, we have found that on some ships, although the wing was true, the leading edge radius varied from tip to tip, and the ship could not be trimmed out properly until this was corrected. With this type of construction the leading edge radius is formed by the ribs and must come out true. Second, this type of construction is extremely light. After the leading edge is installed only a light finish sanding is required.

At first some people felt this type of leading edge dents quite easily. Experience has shown this is not true. At the time of this writing a number of ships using this type of leading edge have had a full year of flying with no problems due to leading edge damage.

Since this construction is a little different, we will give a rundown on how we go about it. Most important is the proper selection of balsa for the leading edge. We use what we call bending stock. This is about four pound balsa with very few grain marks showing. Sheets should be three inches wide. Edges should be trimmed so they are straight. We put a line down the center of the sheet with a ball point pen, run the sheet under hot water for a few minutes, wipe off surface water, and wrap it around a ¾" wooden dowel, using the ball point pen line to center the sheet on the dowel. The sheet and dowel may now be placed between two strips of wood to hold the sheet around the dowel. It should remain there until nearly dry, usually about three quarters of an hour. The leading edge can now be attached to the wing, again using the pen line to center the sheet to the chord line of the ribs. The bottom spar should be blocked up 3/32" to allow space for the leading edge sheet on the bottom side of the ribs. Pins are used to hold the top of the leading edge in place while the glue is drying. Balsa wood wedges hold the bottom in place. Conventional leading edge construction may be used, but be certain that you end up with a big fat radius.

While building the wing, do everything possible to keep it true and accurate. Extreme caution should be used while sheeting the bottom of the wing as a twist could still be introduced at this point. With a strip aileron wing, the wing can be covered and color doped before being attached. The front end of the fuse should be well rounded to keep it clean.

While sanding the stab, take care to see that it is kept symmetrical. This is important to keep the model in trim. All construction on the fuse aft of the wing trailing edge should be kept as light as possible for better performance. You will note that the elevator horn is angled forward. This gives more down elevator than up so our inside and outside loops are of equal size.

TRIM

There is no doubt in my mind that for successful RC flying one of the most important things is to know how to trim a model. A properly trimmed model is easy to fly because fewer commands have to be sent out. My feeling is that only about 25% of the multi ships flying today are trimmed the way they should be. It seems that if the model flies, that's good enough. But think how much extra pleasure you could get out of your flying when your model grooves through clean maneuvers with little effort on your part. Good trim is the difference between a dog and a thoroughbred.

We do not find much written about trimming a model. Perhaps this is because we are still learning new things about it. As compared to other phases of modelling, radio control is still new. The design and trim of a RC model is different.

What about trim? I will try to give a "Reader's Digest" version of trimming out a ship. A statement I hear quite often is, "I built it exactly as shown on the plans." This may be true, but it is very seldom that two airplanes fly alike. The reason for these differences is that little errors can creep in and change the characteristics of a ship. This goes for any design, including the shoulder wing. In order to simplify the subject of trim, we will break it down into elements. These are not necessarily listed in order of importance:

1. CG Position
2. Decalage
3. Down Thrust
4. Side Thrust
5. Throw of Control Surfaces
6. Alignment
7. Weight of Model
8. Rigidity of Control Surfaces

These elements are some of the tools we have to work with in trimming a ship. Let's put these tools to work. Let's assume we have finished our ship. Radio gear has been installed and checked so we are ready for our first flight. For our first flight a reasonably calm day is preferred. We take the ship off and fly it around to get the feel of the controls. Now we can get down to the business of trimming out our ship. The first thing we check is whether it flies straight and level. Let's assume, for example, that we have a left turn and a fair amount of climb. We now land the ship and start making adjustments. We should point out at this time that a multi ship should fly absolutely flat under full power and "O" elevator setting.

To correct climb many modellers start adding down elevator. This is not the proper approach. In aerodynamics we have what we call the tab effect. Since this effect can cause us a lot of trouble, we will explain what it is—suppose we put a trim tab about 3" long and 1" wide on our wing trailing edge and deflect it about 15°. At slow speeds, this tab will have little effect, but in a high speed dive, the tab will have enough effect to roll the airplane. So, as the speed of the model changes, the trim also changes. An elevator acts as a trim tab in pitch. For example, if we had a ship that flew absolutely level at full bore but had a slight amount of up elevator to do so, as we cut the power the ship would slow down. The slight up elevator would become less effective and give you a "hot landing" ship. This is the reason we want absolutely "O" elevator for flat flight. To correct our climb we go about it thusly: first, we must be sure our CG position is as the plans call for. We then shim down the leading edge of the wing about 1/16". We now try the ship again. After observing the results, we may have to shim more. We keep at this until we have flat flight with "O" elevator.

Differences in decalage are the result of weight differences from model to model. Some ships may require a negative decalage. This occurs when we have an ex-

(*Continued on page 56*)

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TAURUS

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Wing section NACA 2419 (mod.)
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Designed and flown by Ed Kazmirski, who also designed and flew the Orion to the 1960 World Multi R/C Championship. Ed and the Taurus will lead the U.S. team in the F.A.I. World Competition in 1963.

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June 9-10
Detroit, Mich., Les Fruh

June 16-17
Fort Wayne, Ind., Ed Kazmirski

August 18-19
Minneapolis, Minn. Maxey Hester

August 19
Grays Lake, Ill., Pete Mathis

August 25-26
Wyandotte, Mich., Bob George

August 26
Peoria, Ill., Bob Choronzuk

September 1-2
Kalamazoo, Mich., Ed Kazmirski
Also next 5 places

September 8-9
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Taurus

(*Continued from page* 54)

tremely light ship.

Now that we have our ship flying flat, we go to work on the amount of up and down trim to be used on our elevator. The ideal situation is that, when we take off with a full load of fuel and full up trim, the ship will have a very slight climb. Generally, this works out to be about 1/16" of up trim or less. After flying around a while to burn off some of the fuel, we roll the ship inverted, putting in full down trim. With full down trim the ship should climb a little while inverted. This is necessary so that, when we are doing our inverted eights, the ship will neither climb or dive. Work on this trim adjustment until it is exactly as stated. With the ship set up this way, you never have to hunt for proper amount of elevator trim. As the fuel tank empties, the elevator trim is more effective, but not enough to worry about. While we were doing all of this, we have watched the size of our loops as we want a nice medium size loop when we hold full elevator. Generally, about 5/16" of up elevator and a little more down for the outside loops works out best with the Taurus. We don't want to pulse the loops as they are not as clean that way. During these adjustments we also had to determine why our ship had a slight left turn. First, we check to see that our ailerons are at neutral. We adjust the proper aileron up or down until the ship grooves in straight flight.

Now that the ship is flying flat with no left or right turn, check the loops to see that they are true. If the wing is true and both ailerons are at neutral, the loops will be dead true.

Since strip ailerons are comparatively new, we might mention a few things about them. For one thing, it is sometimes difficult to tell when they are neutral. Some fellows like to fly both ailerons drooped slightly below neutral, claiming it improves their ouitside loops and acts as a flap on landing. Others like to position both ailerons slightly above neutral. This setup gives more effective differential for the rolls. At any rate, this is something each individual modeller has to "season to taste."

We can now work on our roll rate. The aileron throw is adjusted by sliding the nylon blocks up or down on the aileron horns. About 5/16" of up and ¼" of down is a good place to start. A heavy ship might require more throw. We want the ship to roll fairly slow but not so slow as to use up too much sky while doing the three rolls. If the roll rate is right, you can add up and down during the rolls and actually gain altitude while rolling, if desired. Also, with the proper amount of throw, you will have ample aileron response for landing in gusty air.

While checking out and adjusting a model for right or left turns sometimes a fin or rudder is at fault because of misalignment. For example, if we have a fin that is turning our ship to the left, roll the airplane inverted and the airplane will then turn to the right because the yaw is reversed when inverted. This is one way of telling whether it is yaw or roll that is turning our ship, as roll control is not reversed when inverted.

The down and side thrusts of the engine are fairly well set and should require no adjustments. We have previously discussed these effects and need not go into them here.

Aileron differential seldom requires any adjustment. The linkage shown on the plans will give the proper amount for true axial rolls with no yaw. Should more differential be required, it can be obtained by pivoting the aileron servo pushrods further forward on the nylon block attached to the aileron horn. Perhaps a short explanation of why differential is used may be in order at this point. When we deflect the ailerons, say for a right roll, the left or down aileron generates more drag than the right or up aileron, causing the ship to roll to the right but yaw slightly to the left. By giving more up to the right aileron, we add more drag to right wing panel, thus equaling the drag on both panels to give a true roll with no yaw.

Rigidity of the control surfaces is most important. We use ⅜" light balsa for elevator and rudder push rods for minimum deflection. During some maneuvers very high "G" loads are developed, enough to deflect the control surfaces and change the trim of the ship. We have encountered a number of cases where a rudder push rod linkage was flexible enough to apply rudder during loops. With this condition the loops were not true. After stiffening the push rod linkage the loops were right in the groove.

The Taurus was designed around the small relayless receivers. If you are still using a relay type receiver, the fuselage may have to be widened about ½". This can be accomplished by making formers F1, F2, F3 one-half inch wider. The motor mounts would be changed accordingly. Most of the fellows presently flying the Taurus are running their "45" engines full bore. I have bushed down my Veco Lee "45" to give me less power. This is done by bushing down the rotating throttle barrel from the original .280" bore to .250" bore. This gives added fuel draw and thus more power through maneuvers. With this restrictor we can fly a full contest flight on 4½ ounces of fuel. We still have more than enough power for the vertical eight and square loops.

We feel that if you build the Taurus reasonably true and properly trim, you will have a ship that will be a real pleasure to fly.