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Cyrano II

Modelers in general are a stubborn lot. Being told that something can't be done has often been just the impetus to break out the drawing board and T-square. Our author decided to prove that a flying wing could indeed win a National Contest P-30 event. ■ Barnaby Wainfan

"OF COURSE you can make a flying wing model fly, but it will never be competitive with conventional models." This statement has appeared in various forms in several model magazines over the years, and I can't begin to count the number of times I have heard it in conversation. As a lover of unconventional configurations I felt this was a prejudice which should not be allowed to go unchallenged.

The flying wing has several inherent advantages over the conventional layout and should, all other things being equal, be superior in performance. I decided that the way to kill this prejudice was to develop a competitive flying wing model and win the Nats with it. This was a tall order, to say the least.

It took four years and a series of 10 experimental models to finally arrive at a tailless P-30 design which I felt was competitive. The Cyrano II is the model, and it was victorious in Open P-30 at the 1984 Reno Nats. The Cyrano was the only tailless model entered in P-30, and as far as I know it was also the only pusher model entered.

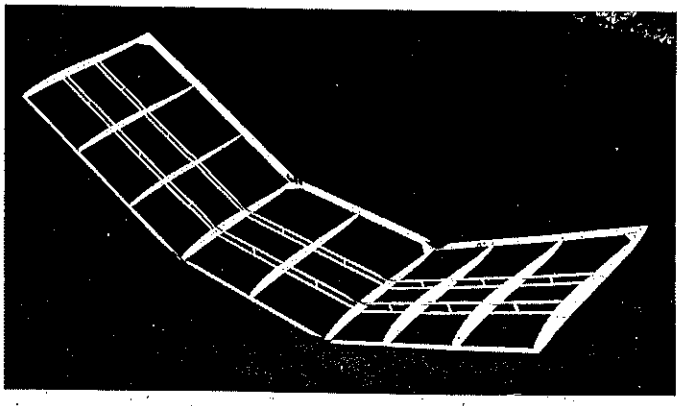
Design philosophy. The tailless configuration has several attractive features which recommend it for a rubber model. The first of these is that by eliminating the tail surfaces, much of the work of building the model is eliminated. There are simply fewer parts to make. The Cyrano wing has only nine ribs, and there is only one flying surface to cover. A tailless model should also be more efficient aerodynamically since it is not dragging tail surfaces through the air. The elimination of the tail will make the model lighter and allow it to have a larger wing area for a given total model weight. The Cyrano II has 240 sq. in. of wing area, which is huge for a P-30.

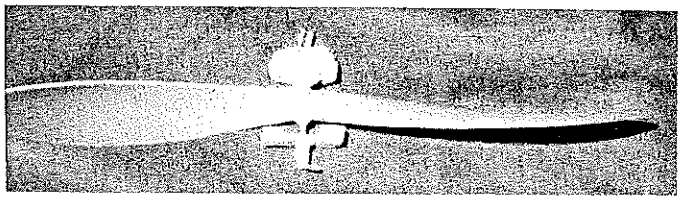
The history of tailless models shows that they can be very good performers, but they tend to suffer from several difficulties. The worst of these are a tendency to loop under power, difficult trimming, and poor or nonexistent stall recovery. All of these problems other than power looping can be traced to the use of conventional airfoils combined with wing sweep and twist to provide stability and trim in most flying wing models. A swept flying wing is very sensitive to the amount of washout in the wing tips. Small changes in wing twist will cause large changes in either the turn or pitch trim of the model. This makes it very difficult to get this type of model to be consistent, as humidity and temperature changes affect the covering and the warps on the model.

The sweep makes it difficult to adjust turn without also affecting pitch. A change in the twist of one wing tip intended to change the turn of the model will also change the lift on the wing tip and affect the pitch trim. This cross-coupling of roll and pitch trim makes it difficult to achieve good trim.

The poor stall characteristics of early tailless models can also be attributed to the use of large amounts of sweep. A swept

Left: Lynne Wainfan holds the Cyrano II while our author winds from stage right. The Cyrano is wound from the front while the tail block and prop remain in place. The holder carefully restrains the prop, and the removable nose and tail blocks make motor stuffing easy. Right: Our author launches the Cyrano at Mile Square Park in Fountain Valley, CA, site of the yearly Northrop Flying Wing Contest for which the model was originally developed. The model should be launched slightly nose up with the wings level. Both photos by Don Larsen. Others by author.

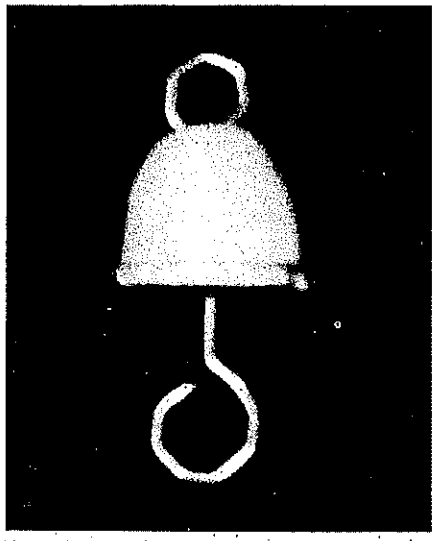




Left: The completed wing structure shows the simplicity of the design. One advantage of the flying wing is that there are fewer parts to make. The wing has only nine ribs, and there are no tail surfaces. The 1/16 sq. uprights between the spars help prevent spar buckling. Above: The freewheel mechanism. This gadget is necessary since the freewheel notch on the commercially-available prop is on the wrong side for a pusher installation. Note that in order to comply with the "unmodified prop" rule in P-30 competition the freewheel assembly is not actually glued to the prop.

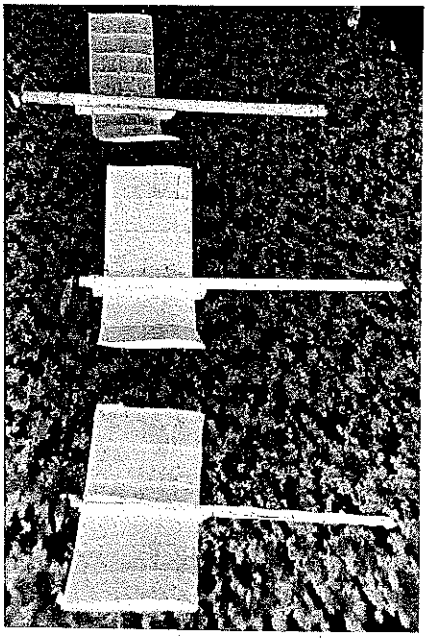
wing will tend to stall at the tips much more easily than an unswept one. This tip stalling tendency can cause the model to pitch up at the stall and make the stall very violent. Contrary to popular belief, the sweep does not fake the air into thinking that the wing tips are really a tail. The sweep does not increase the stability of the airplane, and it adds many problems to the trimming of the model. Several of my early test models had complex wing shapes designed to get some part of the wing to "act as a tail." None of them came close to performing as well as the simple straight wing plank, and some of them were completely untrimmable. You can't fool mother nature!

The unswept "flying plank" configuration of the Cyrano eliminates most of the problems caused by wing sweep. Since the wing is not swept, small amounts of wing twist will not affect the pitch trim of the model, although wing twist will affect the turn trim. The relatively low aspect ratio and constant chord give the model gentle stall characteristics when the center of gravity (CG) is in the right place. Like all tailless airplanes, the Cyrano is sensitive to CG position and will not tolerate a tail-heavy condition. The pitch trim of a plank-type airplane is controlled strictly by the airfoil and the position of the CG. The airfoil used on the Cyrano was designed especially for use on this type of model. Changes in the airfoil may seriously affect the flyability of the model, and they are not recommended.

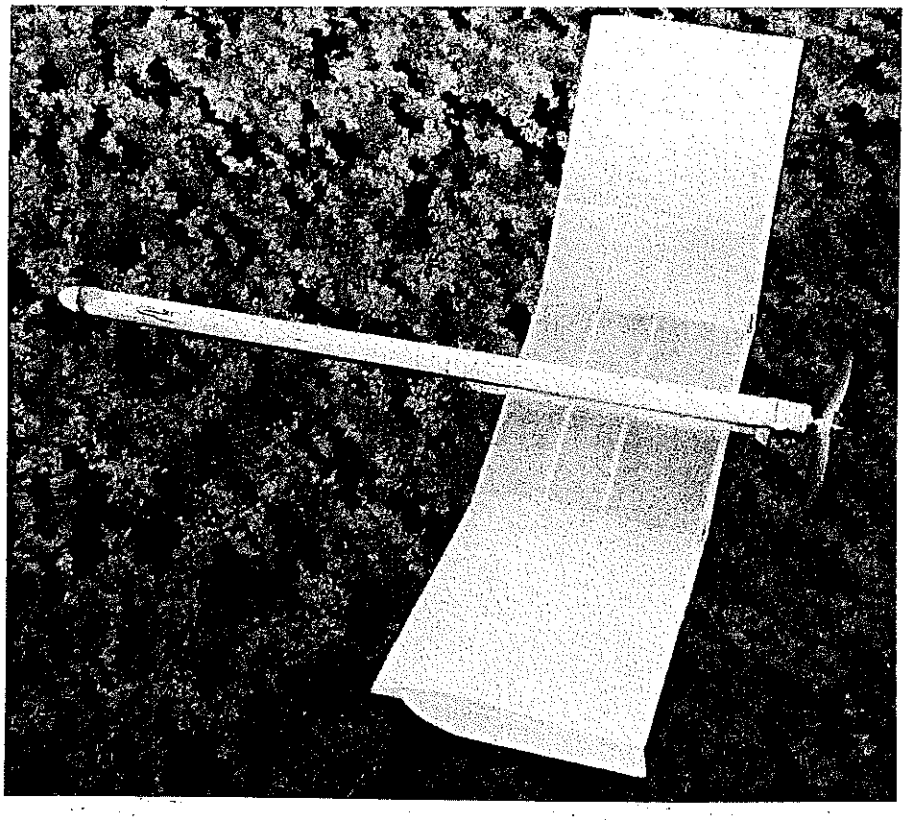


Nose block detail with the double-ended music wire hook. Wind by attaching the front loop of this hook to the winder. The ⅛-in. square crosspiece (see text) on the back of the block keys the block to the fuselage tube, and it takes the rubber torque loads.

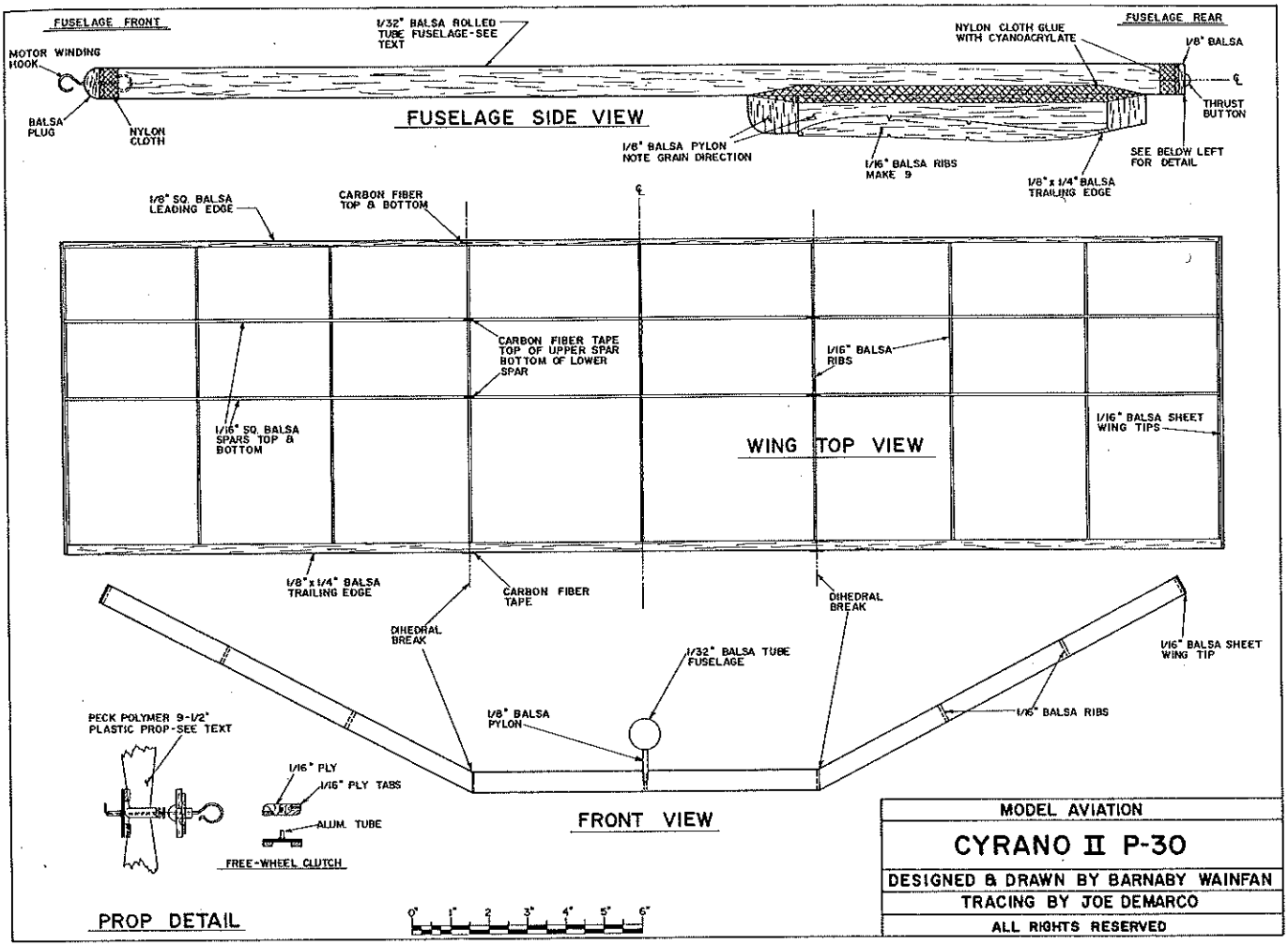
The power looping problem was solved by combining two design ideas. The low wing layout elevates the thrust line and gives the model built-in downthrust. On earlier flying wing models I noticed that the looping tendency only showed up in the power burst right after launch. Backing off on the power eliminated the looping tendency. In order to take advantage of this without sacrificing performance, I decided to make the Cyrano a cruise-climbing model rather than a burst climber. To accomplish this the Cyrano uses a long, thin motor carrying many more turns than the shorter, higher-torque motors used by conventional P-30 models. The rate of climb of the Cyrano is not as high as the burst climbers,



Three versions of the Cyrano concept. The small model is a 20-in.-span Hawthorne Class Indoor ship which was used to experiment with the basic configuration. The center model is the P-30 Cyrano II, and the larger model is a 300 sq. in. experimental Mulvihill ship based on the Cyrano concept.



Reno Nats Open P-30 winner. The end plates are 1/32 sheet balsa and were added as an experiment, but they generated no noticeable improvement in the stability or performance.



but the power run is longer. The Cyrano will gain as much altitude under power as the other models; it will simply take longer to get there. This is actually an advantage since it means that the time the airplane must achieve in the glide to make the max is lower.

The total lack of vertical fins on the Cyrano looks strange, but it works. An early plank test model had winglet-type vertical fins on the wing tips. This model had a tendency to spiral in under power. To reduce the tendency to spiral, I started to cut down the size of the fins. By the time I got the model flying right, I had removed them entirely. I have flown the Cyrano with small end plates on the wing tips, but these seem to have little effect on either the stability or performance of the model.

Fuselage construction. The first part of the model to make is the rolled tube fuselage. While the fuselage tube is drying on the form, you can cut out the ribs and build the wing. Rolled tube fuselages may seem difficult to make at first, but they are actually much less work to build than conventional stick-and-tissue fuselages.

Start by cutting out a blank from medium-weight B-grain 1/32 balsa. The blank should be 28 in. long and just wide enough to wrap around your form once. The form for the Cyrano fuselage is an ordinary broomstick or mop handle. Be sure it is straight, or your fuselage will resemble a banana instead of part of an airplane. After the fuselage blank is cut, dope one side of it with full-strength clear dope. Do not dope both sides of the blank or it will refuse to curl around the form. Doping one side at this point serves two functions. First, the wood will tend to curl toward the doped side, making it easier to roll the tube. Second, since the doped side will be the inside of the finished tube the dope will help keep the tube from becoming saturated by rubber lube as the model ages.

After the dope is dry, soak the blank in warm water for at least a half hour. Remove the blank from the water and wrap it around

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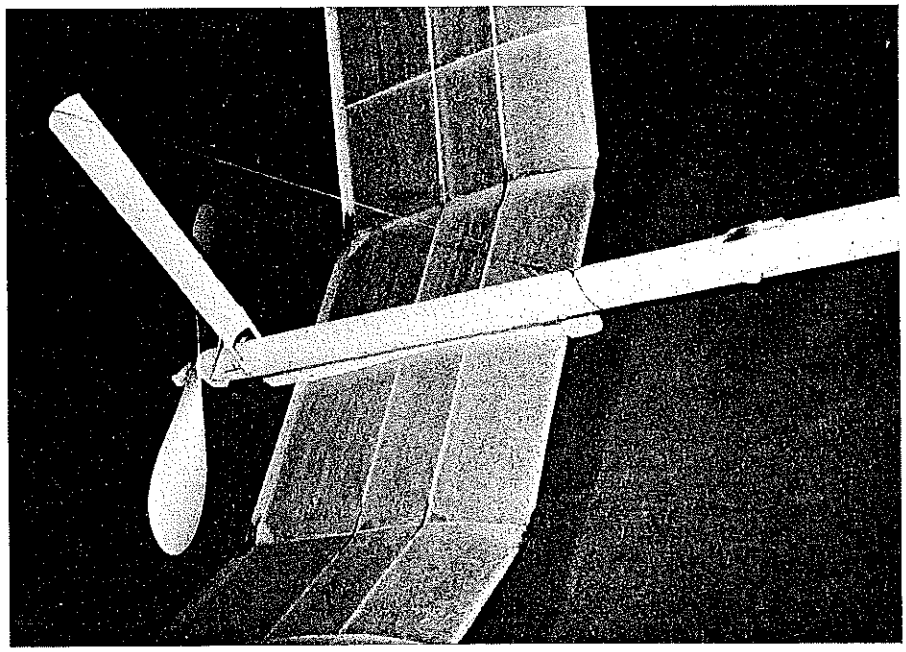

Pop-up paddle dethermalizer used on the latest Cyrano version produces an oscillating, stalling descent. Having no tail to pop up makes this a difficult model to DT adequately.

contained enough obvious errors that they were unable to improve their relative positions in the field. An apparent risk of the "macho" style of flying is that small errors are hard to disguise; it takes a virtually perfect pattern to be successful. Casale finished in 7th place, and Werwage was 10th.

Paul Walker decided to take a different tack. He was able to slow down his model and soften his pattern to more nearly approximate the style the judges apparently wanted to see. His subsequent flights also were scored higher, and he finished in a well-deserved 3rd place.

Second place went to the Chinese modeler, Zang Xian Dong, who also flew a very smooth, rather large pattern. It was another good job of giving the judges what they wanted.

For the first time in history, the Jim Walker Team Championship Trophy will be engraved with the name of a nation other than the U.S.A. Our team members reacted in the typical way: on the trip home all they could talk about was how to get the trophy back. New model designs were discussed with a very keen eye to the middle-of-the-road approach!

CLWC Combat/Perkins

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bat definitely rewards those with the maturity to understand that a cut in the last 10 seconds of a match counts as much as one in the first 10 seconds.

Who do you think were the most disciplined in applying this maturity? The Soviets, of course! This event seems perfectly suited to the stoic yet fiercely proud persona that seems to be typically Soviet. Take some solid equipment, add a little flying skill (honed at a state-sponsored school), some luck, and voila!—World Champions.

The champion this time was a young 19-year-old named Nickolay Necheuhin. He was quiet, polite, and very disciplined! His one lapse of concentration occurred when he forgot to wear a safety helmet as pitman for Oleg Doroshenko. That was about the only mistake these well-schooled Soviets made. As a team they didn't lose a match until the missing helmet in the fifth round. That's 14 winning flights to one loss! Awesome!

Also awesome were Schon of Denmark (3rd), Jones of England (4th), and Ingvar of Sweden (5th). These three were on par with the Soviet team in terms of skill, and they all advanced through their matches with little fanfare. But for a bit more luck, either of these top five could have been the World Champion.

While modelers in the other three World Championships tend to display uniformity and emphasize progress through evolution, Combat fliers are much less constrained by convention and seem almost anxious to be revolutionary with their equipment. The hardware seen on the Combat field was as diverse as it always is. Foam, balsa, and foam/balsa hybrid models in all manner of configuration and size were powered by a variety of engine makes. It is tempting to believe almost anything will work. Just when you think huge foam Rudner-type models are the answer, the comparatively tiny flying wing style by Pavlov of Bulgaria changes your mind.

Neat hardware "tricks" abound as each modeler tries to find an advantage. The Soviets displayed a slick on-board, cam-operated fuel line pinching device that can't be lost in the heat of battle like a hemostat. Detachable metal engine mounts are now quite common as more modelers learn they are simple to make and allow adjustment to nose moment and balance of the model while producing a more reliable engine run. Oleg Doroshenko's models sported external control systems that seemed crude until the purpose was understood. If a midair collision were to destroy the inboard wing (which would end the flight most of the time), a simple relocation of the plug-in tip guide to the intact outboard wing would allow Oleg's model to be relaunched for all-important air time. It is a simple, brilliant idea that probably will be widely copied.

Cyrano II/Wainfan

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your form. The best way to do this is to work from one end and carefully mould the wood to the form with your hands. As you work down the tube, you must wrap something around it to hold it to the broomstick while it dries. Do not use rubberbands, since these leave deep grooves in the wood. I have found that the best thing to use is a lady's nylon stocking. Such stockings are elastic and porous, so they hold the wood against the form well and still allow it to dry in a reasonable amount of time. Wrap the stocking around the balsa and broomstick in Ace bandage style as you work down the tube. When you are finished, the balsa should be entirely covered by the wrapping.

Let the tube dry overnight. Once it is dry it can be unwrapped and removed from the broomstick. I use thick cyanoacrylate (CyA) glue to adhere the edges together and form the finished tube. As shown in the plans, the ends of the tube must be reinforced with cloth inside and out to handle the loads put on the ends. Do not cut the keying notches in the ends of the tube until after the nose and tail blocks have been made. The notches should be cut to match the ⅛-in.-sq. keys in the end blocks. These should fit tightly, since the torque of the wound rubber is carried by these keys.

Wing. While the fuselage tube is drying, the wing can be built. The ribs are made from 1/16 balsa, and nine are required. The spars are 1/16 sq. Assembly of the wing is straightforward, but there is one very important detail. Looking at the plans you can see that the ⅛ x ¼-in. trailing edge is set onto the wing at an angle so that it is parallel with the bottom of the ribs. This is necessary to

preserve the reflex in the airfoil and trim the model. If this angle is changed, the effect will be very similar to changing the incidence of the stab on a conventional model. It is not easy to adjust the trailing edge once the wing is complete, so be careful to get this trailing edge angle right when the wing is assembled.

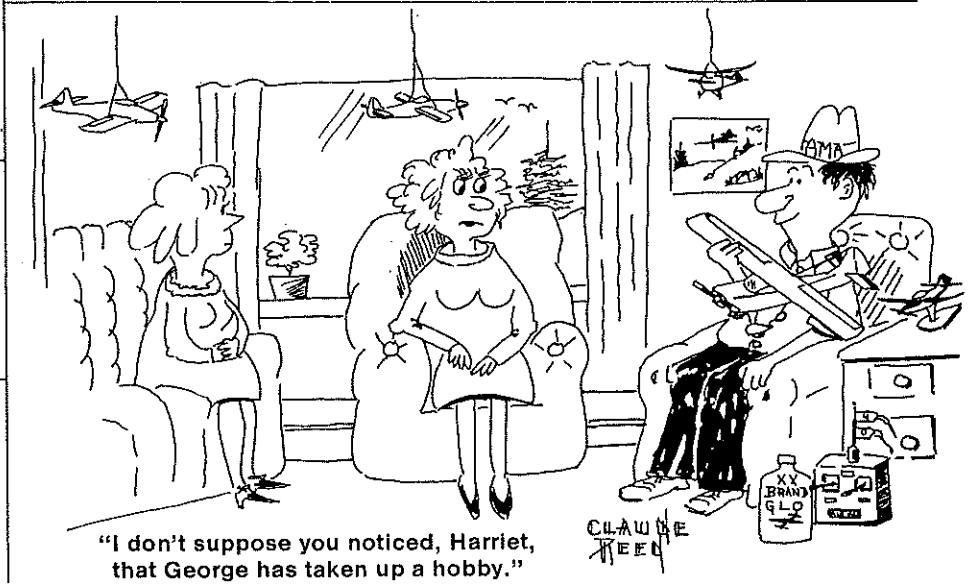
Cover the wing before assembling the model. The wing of my Cyrano is glued permanently to the fuselage and cannot be covered once it is in place. The wing should be covered with lightweight tissue. Shrink the tissue with rubbing alcohol rather than water. This gives a slower, more controlled shrinkage and reduces the chance of warps forming. I use two coats of thinned clear dope to finish the wing.

The pylon is made of ⅛-in. balsa and has three pieces. Note the grain direction shown in the plans. The grain of the central piece is oriented fore and aft while the grain of the end pieces is up and down. The upright pieces should be glued firmly to the leading and trailing edge spars of the wing when the model is assembled. The cloth reinforcement shown at the junction of the pylon and the fuselage is essential since it distributes the load over a large area of the tube wall. This system has proven to be quite strong in practice.

Nose and prop assemblies. The rubber motor of the Cyrnao is not attached to the fuselage by a conventional motor dowel. Instead, there is a music wire hook set into the nose block which has a winding loop on its opposite end. This wire must be glued very firmly to the nose block since it must bear the entire torque of the motor. I allow thin CyA glue to flow into the hole alongside the wire from both ends and then use an epoxy fillet at the nose between the block and the winding loop. The rubber is very easy to put into the model, since there is no motor dowel. You simply drop the motor through the tube and attach it to the hooks on the nose and tail blocks.

The construction of the nose and tail blocks is conventional except for the ⅛-in.-sq. keys which prevent the blocks from twisting relative to the fuselage under motor torque. The keys should be made of hard balsa. Be careful not to cut them off too short while trying to make them flush with the outside of the tube. It is better to have the keys stick out a little bit than to have them let go under full winds because they were sanded too short.

The prop drive dog is necessary because of the "unmodified propeller" rule. Since there are no commercially-available plastic pusher props, this rule poses a bit of a problem. The propeller is a standard Peck-Polymers item. It must be installed backwards with the freewheel notch on the tail block side against the bearing. The drive dog is made of 1/16 plywood. The tube is



"I don't suppose you noticed, Harriet, that George has taken up a hobby."

either aluminum or brass. It must be epoxied in place; the freewheel notch can be cut with a file or razor saw. The drive dog slips over the back of the propeller and engages the blades. It is not glued to the propeller and thus complies with the "unmodified prop" rule.

Trimming and flying. The Cyrano is an easy model to trim, but the trimming technique is a little unusual. Work on the glide first. If the mythical tall grass is available, use it to test glide over. If not, then use the softest substitute possible. The only adjustment available to trim the glide in pitch is the CG. Since there is no tail, you cannot change incidence. The advantage of this is that tail warps or incidence cannot change and ruin the trim of the model. The glide is adjusted by adding clay to the nose if the model stalls and to the tail if it glides too nose-down. Turn can be set with a small rudder tab on the trailing edge of the pylon. If this is not sufficient, a small drag tab at a wing tip can also be used.

The Cyrano flies a left-left pattern. Do not attempt to fly it to the right; it will spiral in every time. Set the power turn by adjusting the thrust line. I have found that a small amount of left thrust is usually required to get a good tight stall-free climb. To get left thrust, either place a shim under the right side of the tail block or sand away a little of the left side of the fuselage where the tail block rests on it. A small amount of downthrust may be necessary to control power stalling.

The Cyrano is wound by hooking onto the wire loop in the nose with the winder while the holder restrains the model and the propeller. Make absolutely sure that the freewheel notch has engaged the propeller shaft before you start winding or your holder will be treated to a shaft run his fingers will never forget. Start text flights at low power and work up slowly to maximum winds.

The motor for the Cyrano is one 10-gram loop of ¼-in. FAI rubber. It is important to weigh your motors when flying Cyrano. Changing the motor weight will change the pitch trim of the airplane, and as I said before, tailless models are quite sensitive to CG shifts.

Cyrano is an easy model to build, and it has contest-winning performance. It is worth building one just to watch the expressions of disbelief on people's faces as it cruises overhead. Flying wings *are* competitive. Try one.

RC-1/Lanzo-Winter

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tem by rewinding an electromagnet from a Ford cut-out relay. I used it as a combination relay and rudder operator. I placed an extended arm on the clapper and linked it to the rudder by two control strings. This control gave a right turn against torque when actuated and a left turn with no signal. There was no neutral.

When the equipment was mounted in the plane and the engine was running, the range was very short—less than 100 ft. The problem was in the model's ignition coil, which was acting as a transmitter and swamping the signal from the ground-based transmitter. Too bad glow plug engines were not available.

I would say that the RC-1 should not have been considered a successful RC model in 1934 and 1935, but it was a tremendous success as a Free Flight model that could carry the additional weight of a receiver—a quality contemporary models still aim for. I flew the RC-1 at a local flying field but never entered it in any large contests. It was retired after a bad crackup. (It should be noted that the radio equipment is shown more as a nostalgic project than as a useful RC setup.)

How the coherer system works. When the key of the transmitter is pressed down, the sparking coil is energized and sends out a continuous series of sparks across the spark gap. The resulting undamped electromagnetic waves are imposed across the tuning coil and condenser. The tuned frequency waves are then sent out over the air waves by the antenna.

The antenna mounted in the model receives the transmitted radio waves which are then impressed on the tuning coil and condenser and also on the two end caps of the coherer. The coherer tube is loosely filled with about a 50-50 mixture of iron and silver filings. When the frequency signal is impressed on the iron filings, they become magnetized and stick together. This action also squeezes the dispersed silver filings together and decreases the resistance across the tube ends, causing electrical current to flow through the actuator.

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