



# STYX *Top aerobatic model from France*

By Pierre Marrot

## Editor's Note

This is the fourth and last in the series of World R/C championship designs which have been appearing in R.C.M.&E. over the past few months. Starting with Bruno Giezendanner's Bremen World R/C Champs winning Marabu, we went on to publish Wolfgang Matt's 6th place Super Star, Richard Brand's 8th placed Spitpanzer, and now from France we present Pierre Marrot's Styx.

In case you think that Styx is just another shoulder wing model, just take a closer look, because a great deal of 'think' has gone into this design. The wing, tail and engine thrust line for instance are almost on a common datum. Take a look at the wing section as it nears the tip - it looks strange, but is obviously there for a purpose. In all, it is quite a remarkable aeroplane, although we must admit, it helps to fly like Pierre Marrot!

**T**HE Styx came about because I wanted a model that would be a smoother flying, improved version of my 'Satanas' (Corsica 1967).

The fuselage is basically that of the Satanas with the only modification being a deepening of the profile to get more lateral surface. This, of course, is necessary for knife-edge flight, but also helps the model to fall straight through with no 'wobbling' on the down side of double stall turns. The rudder has been enlarged slightly to give better yaw stability while retaining the other good qualities of the Satanas.

I used a symmetrical airfoil from root to tip, since I feel this type of wing is more stable. The tips won't stall before the centre section, helping to prevent snap roll on landing approaches. This is even more apparent when flying in windy weather. The thick wing does induce a lower drag ratio, but the

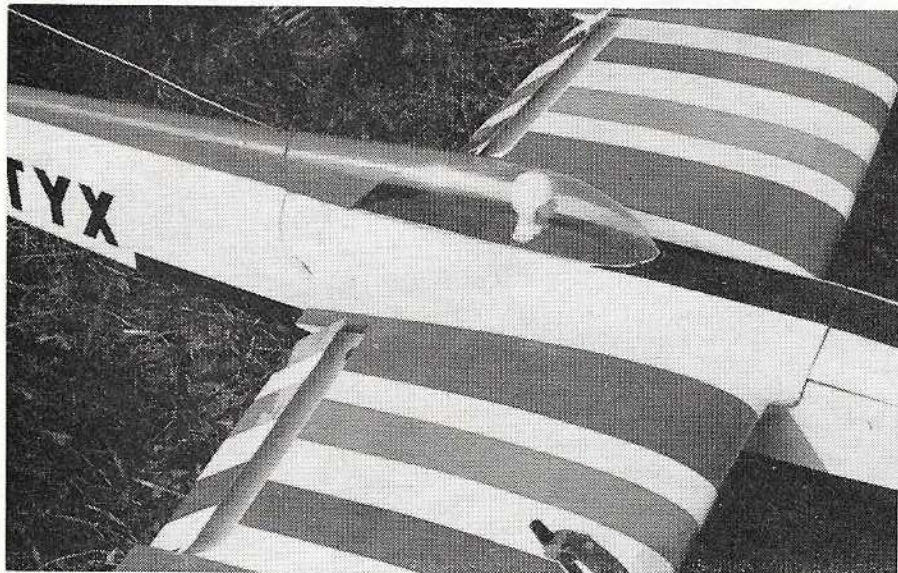
drag helps you to maintain a more constant speed throughout all your manoeuvres. I stayed with conventional ailerons on the Styx. I also kept them in-board of the wing tips to keep them out of the tip spillage where they would only induce drag while being ineffective. There is also turbulence at the tips of the wing which can induce aileron flutter.

The ailerons are hinged on the centre line. This makes it a simple matter to get any degree of differential aileron throw (in either direction) simply by changing the point of connection of push rod to the aileron horn. Several horns can be prepared with holes in various places relative to the hinge line, or one horn with several holes can be used. See plans for an explanation of how the differential is obtained.

The shoulder wing allows smoother take-offs and landings on a strip, since the boundary layer of air under the wing is weaker or more elastic than that of a low winger. This leads to a take-off run and lift-off that is predictable and controlled by the flyer rather than an abrupt leap into the air at an excessive angle (sometimes up to 40°). The latter is seen all too often on low wingers having a negative wing incidence or angle-of-attack with the ground. (*The bloodhound look - R/C Ed.*) The FAI Judge's Guide recommends that the angle of take-off be constant at between 5 and 10 degrees to the horizontal without dipping. We didn't see this at the World Championships in Corsica.

Now to the construction of the Styx.

As with any aircraft, the best building practices



must be followed. Failure to do so invariably leads to a warped wing or fuselage, or a misaligned rudder and/or stab. In building the fuselage, keep the aft section (and the tail) as light as possible through the proper choice of wood. Any unnecessary weight back here will result in the addition of many times that weight in the nose.

Pay particular attention to the building of the tail surfaces, as they have a very positive effect on the flying characteristics of this as well as all planes. The truer the aircraft, the less the flyer has to concern himself with compensating for the plane's bad habits.

When building the wing, cut out the ribs and save the left wood from under the ribs. These pieces will be used to form a cradle or jig on which the wing will be built. This is explained on the plans. Be especially careful when installing the aileron linkage. Don't allow any friction on the one hand, or excessive play on the other. Aileron response will be more positive with a tight, accurate servo-to-aileron linkage.

Completely finished with paint and servo, the wing should weigh between 17.5 and 20.5 ounces. This is important to the stability and roll response of the aircraft. Be especially careful to keep the wing tips light for the same reasons. In addition, there will be less tendency for the plane to fall off on a wing at the back of the outside loops. Every plane of mine that has had a heavy wing was not capable of consistent,

top-notch flights.

The wing is attached to the fuselage with two steel screws as shown. This eliminates the turbulence of the fuselage caused by the wing hold down dowels and rubber bands. The remainder of the construction is straightforward and well explained on the plans. Be certain to fuelproof the engine and fuel tank compartments with epoxy or several coats of fuelproof dope prior to covering and finishing.

Mount the radio equipment with care, paying special attention to shock and vibration dampening. This will go a long way toward guaranteeing many flights without equipment failure due to a bad switch, broken lead, or erratic servo. Vibration can cause premature wearing of the feedback potentiometer (especially around neutral). It can also cause the failure of transistors, resistors, etc. and solder joints. The wing and tailplane are set at 0 degrees incidence, and the engine has 0 degrees (no right) thrust to eliminate secondary effects during the rolling manoeuvres. My research into the vibrations of wing and tailplane incidences has shown this combination to be optimum. This brings the thrust vector through the fuselage and the lift vector due to the wing and stab nearer a common line. This is important since they can never be truly defined and vary with air speed and attitude of the aircraft at other incidence and thrust settings. This improves the axis of roll and



Above: two views showing the unusual flaps used by Pierre Marrot on the Styx. These extend almost as much above the wing as below and were used by Marrot to slow the Styx down on the landing approach rather than to add lift. In the old F.A.I. Schedule, they were depressed to aid recovery in the tail slide.

Left: Pierre Marrot awaiting his turn to fly during the 1969 World R/C Champs in Bremen. Always took both his models out to the flight line. Model was then wax polished at the flight line before flight. Right: Pierre and Nichole Marrot after one of Pierre's high point flights in Bremen.

pitch without requiring undue attention from the flyer.

The 'Radio Pilote Digital 10 Competition' equipment used has special encoder potentiometers on the transmitter sticks. The 'S response' of those pots allows slight displacements of the surfaces for generous movements of the sticks around the neutral position and normal displacements of the surfaces as the sticks are moved further. This made for smoother straight flying with sufficient throw for all the manoeuvres. (*Verrrry interesting! - Ed.*)

In order to get maximum surface throw, I used Orbit PS-2D servos for the control surfaces and a Bonner E.F.S. for the throttle.

The 10-ounce tank gives flying time of 12 to 15 minutes of powered flight when I use 5 per cent white gasoline and 2 per cent nitro in the fuel. The addition of the gasoline reduces the output of the engine somewhat, but also reduces the fuel consumption. A powerful engine is always a pleasure to have in the nose of an aircraft, but it's better to be able to finish the flight. The problem arises during very windy weather when considerable flight time (and fuel) is spent putting the manoeuvres in the most favourable position in the sky for the highest scores from the judges. The result is all too often an incomplete flight. This is an instance when a good helper can keep the flyer posted on the elapsed flight time.

During the course of the 1968 contest season, I had the opportunity to try quite a number of engines of various makes. They were generally mediocre at idle speeds, requiring a thorough reworking of the carburettors. I settled on a 'Rossi 60' fitted with a Kavan carburettor and a Mini Vox muffler. The latter helps to get a reliable idle, but I advise against it if possible because of the restriction it causes. An engine equipped with an exhaust baffle would be better since the muffler would no longer be necessary.

The Rossi is a very rugged engine due to its piston sleeve, but I think it would be interesting to replace the front ball bearing with a very good fitting, high quality bushing that would not leak. I feel that such a bearing would reduce the loss of power due to vibration.

From the standpoint of power versus wing loading, all of today's engines are sufficient, but for idling it's certainly true that much remains to be done. It's unfortunate that in the majority of engines and especially on the competition engine, one must replace the original carburettors with a Kavan in order to improve the carburation and idling. This is not an advertisement, but rather a compliment to Mr. Kavan, who was smart enough to design a workable carburettor without a multitude of adjusting screws, four needle valves, three air intakes, etc. All that to stall at the exit of a spin!

It's important before each contest to filter your fuel and check that the fuel line is not leaking or the flow obstructed and to ascertain the condition of the fuel line in the tank. If the engine stalls, it is usually due to one of the above, to poor carburation or to play in the throttle linkage.

In order to perform well-executed manoeuvres, it's necessary to have the aircraft trimmed for maximum smoothness and penetration. The better the aircraft grooves, the less the flyer will have to correct for flutter and drifting. This, in my opinion, improves the overall flight and makes a better impression on the judges. While on the subject of aircraft flying trim, I feel that at least one hundred flights must be flown before the trim can be considered exact. Many flyers don't spend enough time on adjustment of the trim

or adjustment of the throttle setting. Only when these two important items are perfect can a flyer begin training in earnest, always striving for a mating of man and machine. Having arrived at the proper trim and throttle settings, it is very important to be certain before each flight that nothing has been misaligned or knocked out of adjustment through handling.

It's necessary to have a fairly simple means of making trim adjustments which are predictable when one is on the ready line. This is sometimes necessary to compensate for weather conditions which sometimes change during the course of a contest. Because of this, you must know how the aircraft will respond in windy as well as calm weather, so trim can be adjusted to suit prevailing conditions.

On the Styx, the ratio of the wing to stab areas, while not large, is ample enough to facilitate spins and also results in manoeuvres that are flown through and not 'horsed around' by exaggerated rear surfaces. This aircraft is quite sensitive to elevator response and flies through inside and outside loops smoothly with no tendency to fall off on a wing on the back side of outside loops.

The centre of gravity should be within  $\frac{1}{8}$  in. of that shown on the plans with the tank empty.

We all know that there are many excellent contest aircraft today, but a flyer must have confidence that his aircraft is excellent also. You must know all your aircraft's good and bad features (every design has a few). This knowledge only comes through continual practice and a capable helper who can offer constructive criticism. Also, a contest flyer can win only if he is in good physical and mental condition. It's the human skill that wins the contest, and not luck or being half right. All too often you meet modellers who blame their mistakes on the aircraft, the radio, or the wife who forgot to filter the fuel, when the engine stalls.

When flying this aircraft at full speed through vertical manoeuvres and suddenly cutting back to idle, I've found that there is a tendency to fall off to the left. This is not unique to this model. I've seen this many times on low-wingers also.

I hope these thoughts and recommendations will be of benefit to you Sunday and contest flyers, and I wish you many hours of happy flying with the Styx.

