here's a fabulous fun flier!

★ FAST—

★ AEROBATIC

★ GOOD-LOOKING!

★★★★★★ BOB STUDER'S MINI-SNA

FOR THE uninitiated, or recent readers to RADIO MODELLER, the *Snark* (R.M. Jan. '72) is a really fine aerobatic/pylon type model that "goes where you aim it, stays where you leave it, and does everything you ask of it" (provided you move the sticks of course). This description, by *Snark's* designer Bob Bowman, really sums it up. Once hooked on *Snark* flying there is *no* substitute for the club flier. It combines the best of pattern/pylon or sport flying in a modest 48in. wing span—the choice of motor really dictating the style (and tension).

After three years of *Snarks*, and the pressing need to economise on material and running costs making itself felt in these inflationary times, however, consideration was given to producing a baby *Snark*. Several small size aerobatic models using '20' size engines have been published in model magazines but all seemed to have been designed around the relatively new mini-mini type of proportional gear of around 10oz. airborne weight for a full house set.

The modern generation of '20' motors really 'go' with the right prop/fuel/needle valve setting/plug combination however, and they throttle well into the bargain. Surely, we argued, such motors could "carry" the older style of airborne set (weighing about 16oz.) without sacrificing performance—subject of course to a clean plane with a "going" wing section. Would a *Mini-Snark* do the job? Well there was only one way to find out, it was agreed, and yours truly got his head down over the building board.

The problems really seemed to arise right at the beginning. Trying to design (or is it decide?) the sizes, areas, moment arms etc., and then drawing the beast up on paper with the aim of making it look like *Snark*. Pro-rata-ing *Snark* dimensions to make a 'mini' just would not work with the radio pay-load contemplated.

For chaps contemplating a dabble at design, the following notes may be helpful (but please don't take the criteria too seriously, my main principal is—"if it looks right it will probably fly right").

Wing Loading: 22oz./sq.ft. adopted from previous experience.

Estimated Construction Weight:

Radio airborne set	16oz.
Engine & silencer	11oz.
Wing (plywood)	10oz.
Fuselage	12oz.
Tank/motor mount, undercarriage etc., wheels and linkages	6oz.
Total	55oz.

42" span—.19 power!

Wing Area Required: 55/22 × 144 = 360sq. in.

Wing Shape and section: swept leading edge preferred, aspect-ratio—between 5 and 6 to 1. With a mean chord of 8.50in. (root 8.9in.—Tip 8.1in.), a Span of 42in., excluding tips, adopted giving 4.9 aspect-ratio. Aerofoil section—Bob Bowman 'special'—1.15in. depth 13%.

Tailplane area and shape: preferred area—between 20 and 25% of wing area with aspect-ratio between 3 and 4 to 1. 80sq.in. adopted—5in. chord by 16in. span swept at leading and trailing edge (for looks).

Fin Area and shape: preferred area—between 7 and 10 per cent of the wing area. About 30sq.in. total adopted. Shaped for looks but large rudder area required for effective action on take offs etc. since the writer does not favour steering nose-legs for general club flying.

C.G. Position and Moment Arms: Centre of gravity at say 30 per cent chord = 30 × 8.9/100 = 2.7in. from wing root leading edge.

Tail Moment: Between 2 and 2½ times the root chord (from C.G. to elevator hinge line) 23in. chosen—which is slightly longer than *Snark's* proportions, with a view to damping the longitudinal pitch ('cos small twitching planes ain't no fun to fly).

Nose Moments: About 1¼ × root chord but can vary considerably (measured C.G. to back of spinner). 10¼in. chosen having regard to the weight of the engine selected.

Fuselage Width: Dictated by practical considerations to give maximum flexibility of Rx/Nicad placement to avoid ballasting for balance; the 3 servo abreast configuration was adopted with servos located at rear of wing opening in fuselage.

Motor Choice in Set-up: Taipan 3.5. R/C with exhaust pressure fuel feed via silicone tubing. Rigid alloy motor mounting. Taipan 8in. × 6in. glass-filled nylon 'toothpick' propeller. 6oz. fuel tank of the 'slant front' type in order to place it as close to the front bulkhead as possible and keep fuel lines to the shortest length (for good, even motor runs).

When the foregoing guide-lines were firmed up on paper, the plans were vetted by Bob Bowman, whose views were not too unkind, then wood cutting was accordingly commenced.

In the event, the results of all this cogitation turned out well, and *Mini-Snark* has now been flying for the past twelve months (that's what I call fuel economy—on a 6oz. tank). Weight turned out to be 56oz. without fuel and the flying performance is not disappointing—being in true *Snark* style. Admittedly take offs are a little slow, particularly on grass, but once airborne and "on the step" *Mini-Snark* is a treat. Don't take my word for it—try one—it's easy to lug about, and to clean up too! And far, far cheaper per mile to fly than '40' or '60' size planes.

Modellers contemplating this type of model should not, of course, be newcomers to the game of building and flying r/c planes, and only a few construction notes will therefore be given.

CONSTRUCTION

Wing

Thin plywood (0.8mm) is used for sheeting and cap strips in preference to 1/16in. balsa since it stands up to plenty of abuse and resists dents during handling. This ply is easily shaped by damping the outside of curves required and it can be held in place, during construction, with masking tape. Capstrips may be kept in alignment whilst the glue is setting by using straight lengths of wood as weights, placed parallel to wing spars.

Ribs are formed by the 'Stack' or 'Sandwich' method (ply root and tip templates), using sheet remnants to save costs. (Don't forget a left-hand and right-hand set must be made). Cut-outs for spars are formed afterwards, through the whole 'stack' using a hacksaw—the ribs being

kept in alignment on brass tubing. Set out the aileron cable runs and servo placement, undercarriage torsion gear arrangements etc., before sheeting the top centre section (see photos).

Strip ailerons are cut out from the completed wing and are eventually top-hung via the wing covering film. This type of aileron has proved very efficient right down to slow flying speeds and can be used effectively without risk of stalling a wing.

Tail Surfaces

Sandwich the three $\frac{1}{16}$in. sheets and spacer pieces between stiff ply boards and get plenty of weights on. Build 'rough' with pre-sanded skins and cut to accurate profile after glue has dried. Keep the pressure on for several days, since glue takes a long time to dry out. Built up hollow surfaces are superior to solid sheet, being stronger and warp-free.

Fuselage

'Evo-Stick' the ply doublers onto the front sections first, just using ply sections of approximate size. Then trim them up properly and set out the fuselage sides and shape etc. A bandsaw helps enormously with shaping wing-seat curves and ply formers, but a fretsaw works equally well.

The foam turtle back is really simple and an effective way of getting a rigid fuselage top. A hot wire is *not* essential—a bread knife can be used to trim the foam! Sheeting (pre-sanded 3/32in. sheet) is held in place with foam contact glue and placed roughly (after wetting to get curve). Trimming to the fuselage side joints is then done by 'eye', with a sharp modelling knife.

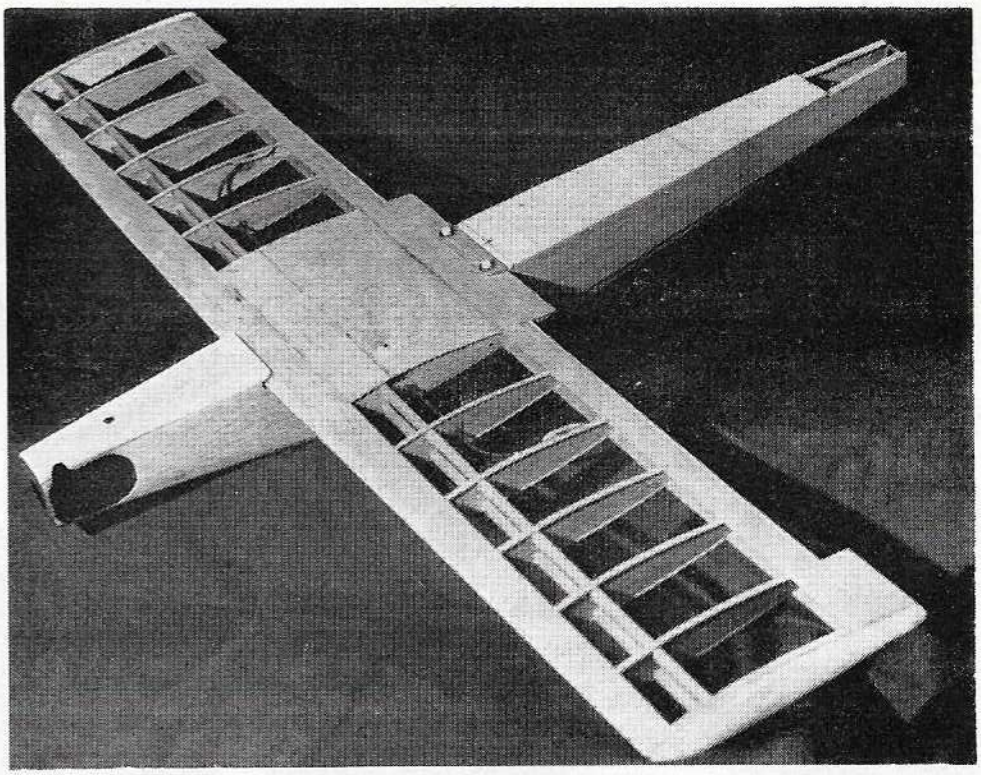
The motor mount should be cut down and filed as small as possible and the home-wound undercarriage leg can be sandwiched between mount and front bulkhead via a suitable plywood 'spacer'.

Covering

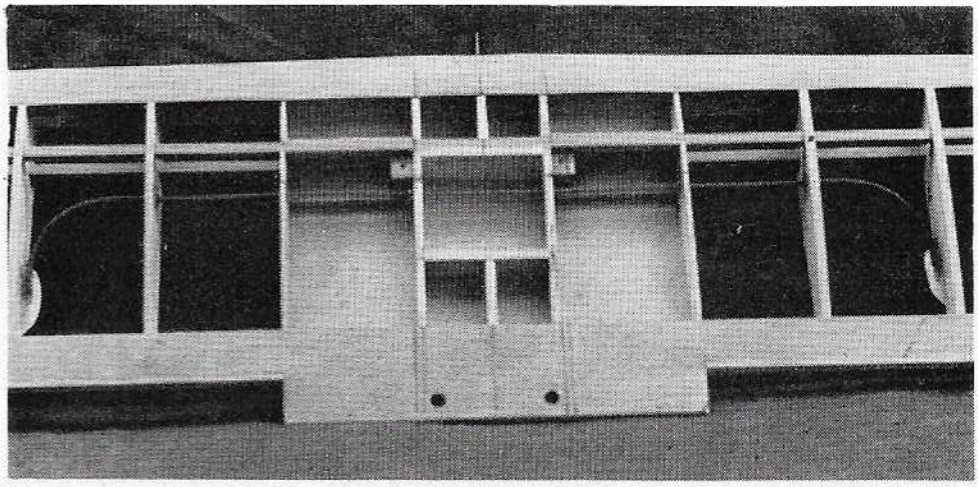
Iron-on film was used for the prototype—wings and fuselage can be done using single pieces with a little pre-planning. Cover the underside of wing, panel by panel, including the aileron hinging, before taking film over the top of the leading edge to cover the upper surface.

Tail control surfaces are mylar/toothpick hinged first, then covered with single pieces of film (slots cut in the film to clear hinges) before being fixed to the tailplane and fin surfaces.

The tailplane and fin are then covered in film and hey-presto!—

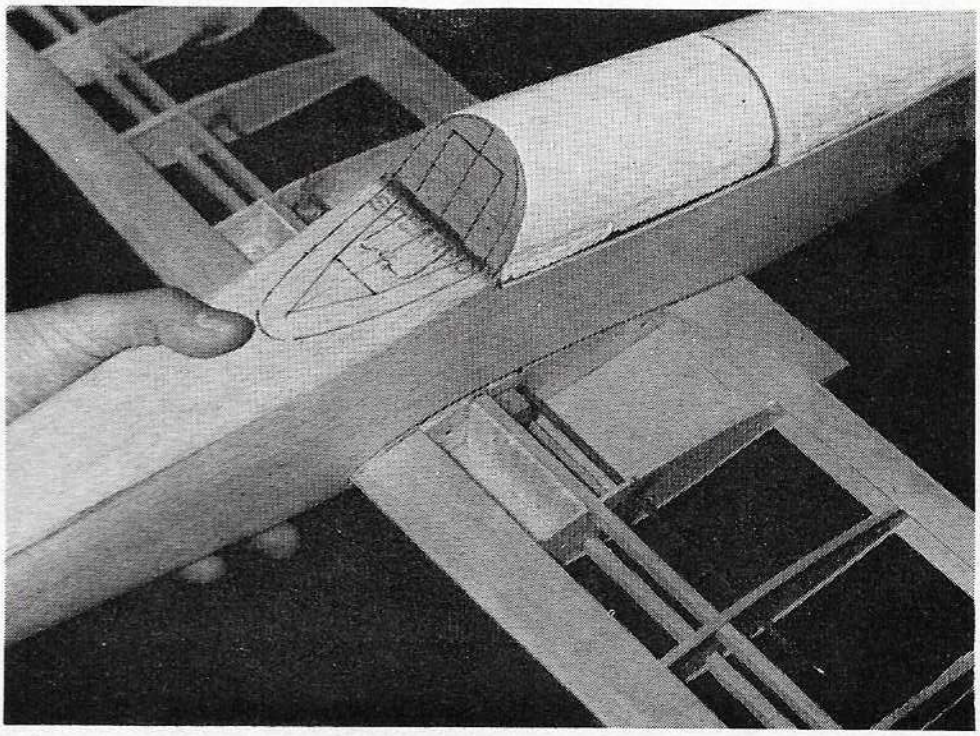


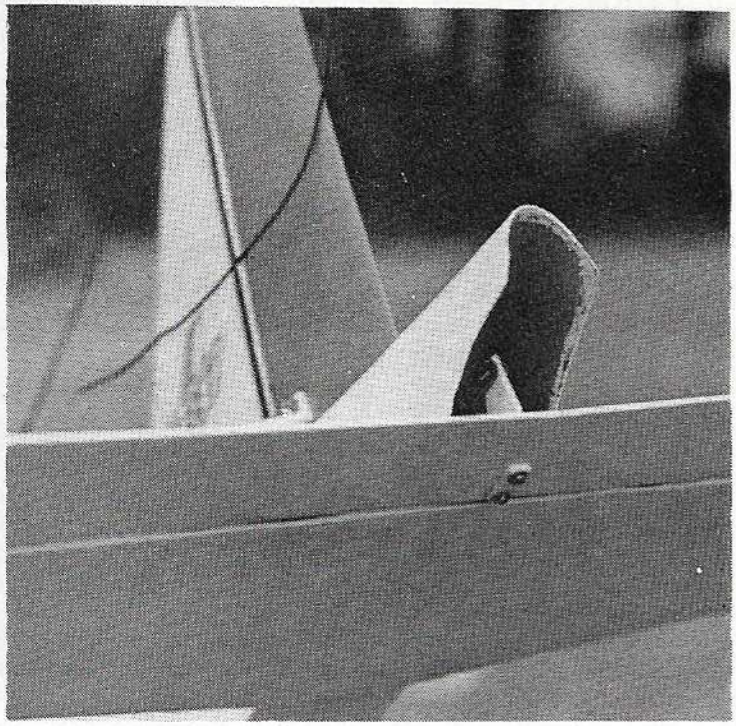
Part-built model inverted to show wing fixing and general configuration



Wing centre section, showing tube and cable aileron linkages, servo well and fixing bolt-holes.

Below: getting a good wing seating. (Note the shaped poly-foam rear top-deck—light, and easy to work).





Left: designer Bob Studer with his prototype. *Right:* a glimpse up the tailpipe reveals that it's a neat cover for the elevator horn.

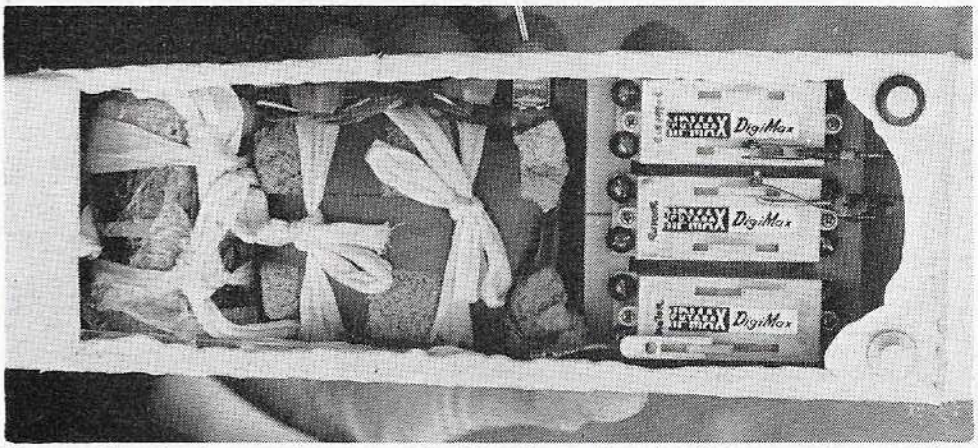
hinges are invisible and, with careful workmanship, can be virtually gapless (desirable for good control response).

Wing Seatings

In situ, tailor-made seatings are achieved using a silicone compound, which is also used for securing the canopy, and for forming white fillets at fuselage junctions etc.—O.K. if white film scheme is used for the model! (Use Dow-Corning Bath Caulk or similar).

To form wing seatings, the compound is applied to the fuselage cutouts, the wing is protected by polythene and then placed in position and secured, checking for alignment during wing bolt tightening. Allow to cure for at least 24 hours, then remove the wing and trim the excess silicone off flush against fuselage sides with a sharp knife. Simple but very effective seats result.

Fillets are formed to shape using a 'wetted' finger and surplus silicone wiped away with tissue before curing.



Three medium sized servos abreast, even in this quite small model. Yet, as may be seen below, the fuselage lines remain sleek and streamlined.

Trimming and flying

Check the c.g. and surface throws etc., before the first 'ordeal' and, once the 'moment of truth' is over, adjust the control surface throws to obtain the same rate of response in roll as pitch. It makes far easier and balanced flying. It's no fun flying a plane that rolls like the clappers and is slow on elevator, or *vice-versa*. Also, keep experimenting with trim; it really takes a lot of time and thinking effort to get a 'plane well trimmed out—it's nearly always a compromise. Remember to be patient at this stage and don't over do the 'throwing about the sky' thing until you are well acquainted with the beast.

Acknowledgement

Finally, a few words of thanks to my pal Bob Bowman, of Modelcraft, Fleet, who conceived virtually all of the ideas behind *Mini-Snark;* for his encouragement throughout the project—and his patience when teaching me to fly via a buddy-box some years ago!