Kari Brivik, a professional model from Oslo, Norway, poses on the beach at Corsica, France, with Chris Olsen's "Upset."

Chris Olsen's UPSET

From a basic design concept in 1953, Great Britain's Chris Olsen developed the "Upset," rated one of the finest entries at the 1967 World Championships.

THE conclusion one comes to after reading the majority of articles on model aircraft design is that they fall into three main categories; in the first the apparent image of the designer is that of a professional aeronautical engineer complete with slide rule, wind tunnel data, etc., to designing a model from a written performance specification. The second variety appears to be an experienced modeler with some basic knowledge of aerodynamics who takes the best features of successful designs and attempts to incorporate them all in one model. This type also, if we are to believe what we read, can be seen wandering about the local airport with a sketch pad copying the more exotic features on the full size aircraft there on the assumption that what is good enough for Boeing or Douglas should work well on a model.

Thirdly there is the cynical type who, although similar to number two, instead of copying the stated features of successful models, deliberately ignores them, assuming the designer knows little about his subject.

On reading further you may think I fall into the latter category; however this is not entirely true, as although cynical, I try not to take too much notice of other models since I believe the only way to design good models is by steady development and learning by your own mistakes.

However, enough of design philosophy (1) and on to design history, (2) on how this foul thing came into being.

Upset is a design which I made in 1965 in order to compete in the World Championships in Sweden. It was developed (3) from a number of previous models which date back to my first radio controlled model which was built in 1953.

The basic design of this model, which had a box fuselage, parallel chord wing, and stabilizer and due to the fact that low wing models had not then been invented, it had the wing mounted on the top of the box. This model was enlarged, reduced and altered in many ways until in 1957 it resulted in a model called Uproar. As far as I was personally concerned this model was a success and was flown in many versions, nearly thirty in all, until 1964. The differences were all in detail, wing sections, rigging angles, etc. The early versions had 18% thick wings but the fallacy of this idea soon became apparent.

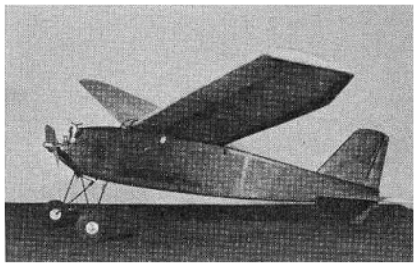
By the beginning of 1964 it had penetrated even my stubborn mind that the basic ugliness of the airframe was detracting from the better than average flying performance.

Since the performance had been arrived at largely by accident, and recognizing that I was on to a good thing, I was rather loathe to give it up as there appeared to be some difficulty in finding a replacement. During the period that I had been flying Uproar in competitions, 1958 to 1963, as a result of seeing a German model with a low wing nearly win the King of the Belgars cup in 1958 I had become interested in low wing models and had attempted to make a low wing version of Uproar assuming that if the performance was similar and it looked better it would be a much better competition model.

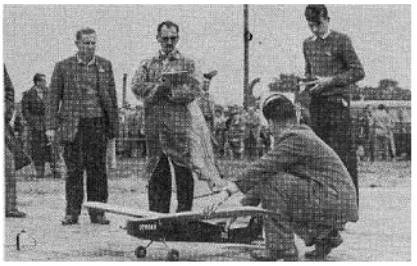
Unfortunately this model did not turn out to be quite as good as Uproar and although it was developed through ten models it never proved better. However in 1964 it was decided to use the low wing model, called Uplift, in spite of its performance being no better, on the assumption that it looked a lot better than Uproar and competition judges being notoriously short sighted tend to be influenced in their judgment by what they see when the model is within focus, i.e., on the ground.

The main problem with Uplift was a definite reluctance to spin and since some fool had explained to the British judges the difference between a spin and a spiral dive this was losing points in competition, also there was the competition in Sweden to consider, the judging is always pretty tough in these events.

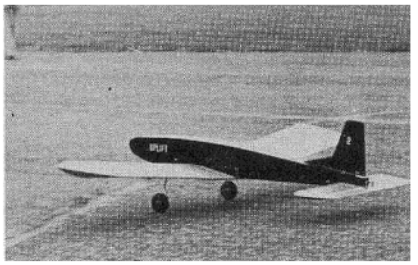
So with this in mind and a great deal more confidence than I should have had considering past experience, it was decided to design a completely new model during



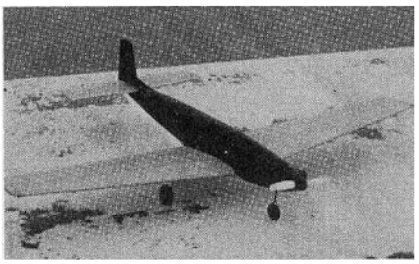
First radio model, 1953, .09 diesel, 2 channel reeds. Radio weight 2 lbs., airframe 1 lb., area 2 sq. ft.!



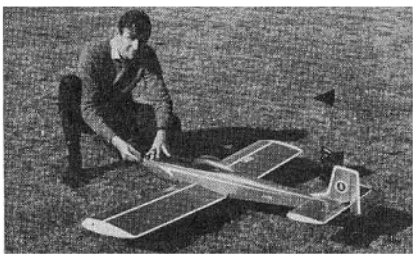
Uproar at 1958 King of Belgians in Germany. Fox .29, 8 channel reeds. Model #10 in Upset series. 5¾ lbs.



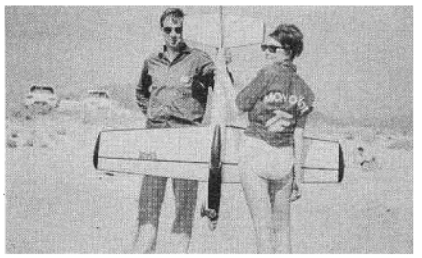
Early "Uplift," 1959. Fox .29, 8 channels, 5¾ lbs.



1961, and part of Olsen's low-wing development. "Volkswagen" influence. ETA .29, 8 channels, 10% wing.



Uplift, late 1964. ST .56, 6¾ lbs. 10 channel reeds. Immediate predecessor of Upset.



Chris Olsen at Corsica with MonoKote covered Upset and model Kari Brivik. Excellent development. . . .

the early part of 1965. This model was smaller than previous models because of the mandatory silencer rule which came into force in England in 1965 and it was considered that to use the same motor with a silencer, due to the loss of power, would need a smaller, lighter model, about ¾ of the wing area of Uplift and to weigh about 5½ lbs. The wings were tapered as it was considered that the tip stalling characteristics of tapered wings could be used to help spin entry. This model was a failure mainly because it weighed 6¾ lbs. instead of 5½ and as a result flew rather like a powered brick, however on the credit side it did spin, so well in fact that it was difficult to recover.

Another fact which came to light was the necessity for a larger engine than the Merco 49 if the model weight exceeded 6½ lbs., i.e., a Merco 61.

Careful evaluation of this model during the twenty flights before I flew it into a fence convinced me that the basic design was alright, but it was too small for the weight and power so it was decided to make a similar model but with greater wing area.

By this time it was the middle of March with only four months to go before the competition in Sweden so it was with some trepidation that I started on a new model again.

Fortunately this model, Upset, was one of those which flew straight off the board and gave no problems. I should have been in a mess if it had not been so.

In the ensuing six months I obtained some two hundred odd flights and have concluded that it is an improvement on both the previous models both in performance and looks.

The reasons why one model flies better than another are a continual source of argument and discussion and I think it is time to say that few people know the effects of certain features on a model (still less to predict results) before the model is flown. In spite of this I shall try to explain why Upset has certain features and why I think they work.

The wing was tapered in order to take advantage of the fact that on tapered wings the tip stalls before the center section, if being thought that this would make the model spin more readily. This proved to be the case. The taper ratio was chosen as it seemed a good compromise. The aspect ratio and taper combine to place most of the lift and drag close to the fuselage and this combined with rather more than usual dihedral seem to make the model less affected by rough air than those models with high aspect ratio wings which appear to be more popular at the moment. The fact that in England the flying conditions are somewhat more windy than in America may make this fact more noticeable.

The low aspect ratio and taper also make the horizontal and vertical rolls more smooth. The dihedral also appears to make the rudder effective, it has been observed that rudder only models which roll well have a lot of dihedral and low wing models with little dihedral have small rudder effect all of which is in the yaw plane. This yaw action is very useful for stall turns but as proportional people have found out a bit of roll caused by the aileron is a help in kicking a model into a spin.

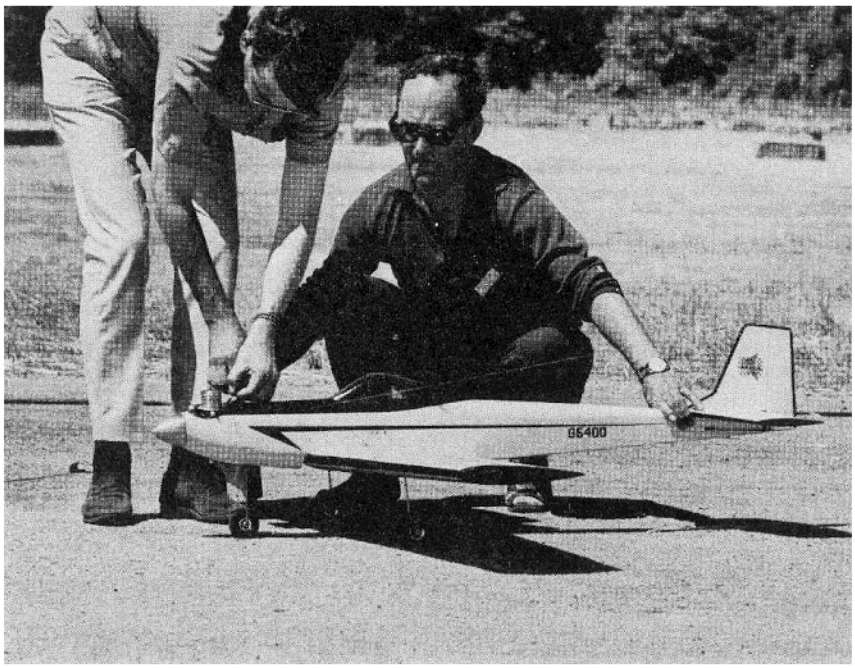
Conventional ailerons are used as I consider that the rolling action is more positive, they are less liable to damage while being transported than strip ailerons and I am yet to be convinced that strip ailerons are that much easier to build.

The symmetrical wing section, one I have used for some years, started life as NACA0015 but like many things got developed along the way. I have considered for some years that symmetrical wing sections have an advantage in contest flying as the characteristics are similar both upright and inverted and equal servo movement gives similar sized inside and outside loops. Both the wing and stabilizer are mounted at +1° incidence as this is necessary to get the model to fly flat when level and upright, zero incidence gives a nose up attitude when in level flight.

Although the wing and stabilizer set up appear to be zeroed out, the model has some positive longitudinal stability and will tend to recover its original flight path if disturbed by a gust, a feature which I find makes straight inverted and inverted turns easier although it does require greater use of the trim control. The long moment arm appears to make for smoother maneuvers in the vertical plane although this may be imagination.

An upright mounted motor is used as it was considered that it is less troublesome than the inverted position although this does look nicer. There is also the point that having started an inverted motor with the model inverted, the preferred method, the antics that result from attempting to get it upright with the engine running are dangerous and undignified — do not forget that in front of judges dignity is important.

The motor used is a Merco 61 with a Merco silencer, the latter causes the loss of about 600 R.P.M. which gives a performance in the air slightly better than a Merco 49 without a silencer, no doubt this loss of power will be overcome in time but for the time being we shall have to live with it. Many propellers and glow plugs were tried, the most satisfactory being an 11 x 7 "Rev-Up" prop and K&B idle bar plug. A certain amount of experiment with fuels over the past few years has shown that the addition of small quantities of nitromethane .5%-10% to straight methanol and castor oil mixture make the motor run more smoothly and give a little more power, 10%-20% gives even more power but



the slow running becomes unreliable. The addition of up to 15% gasoline stretches the motor run considerably and makes the slow running more reliable but makes the engine run hot and lose some power; since the silencer has a similar effect, this can cause overheating. The final mixture for use with a silencer was 5% nitromethane, 5% gasoline, 25% castor oil and 65% methanol. If no silencer is used up to 15% gasoline in place of methanol can be used.

The above fuel gives a smooth long run and a good idle which cannot be put out in the air. It does not appear to be affected by changing weather conditions either. In Sweden the needle was set on the first day and was not touched for the rest of the week, the motor running consistently all the time.

A twin plug head Merco was fitted to one model but was not used in the contest in Sweden as not enough experience had been obtained with it prior to the contest, however subsequent use has shown that while it has no more power to offer, the running is more consistent at all speeds and the idle can be set lower with similar reliability.

A Woolworth's 8 oz. polyethelyne bottle was used as a fuel tank as it was a convenient size and readily available, however, any similar sized bottle will do as long as the center of the tank is ½" below the needle valve, this position is important if you want a consistent motor run, experience has shown that if the engine runs richer inverted than upright the chances of it cutting in a contest are less since most observed engine cuts seem to occur during outside maneuvers on whilst inverted.

The model was originally intended for a proportional system but the position in this field was so confused in England at the beginning of 1965 and the reliability of available systems was suspect at that time, so it was decided to continue using a reed system of proven reliability (the latter being considered to be of great importance). This decision was, I believe proven right in Sweden since I am sure I could not have done as well as I did using any proportional system if I am to judge by the performance of flyers in England who have made the change from reeds to proportional in the past twelve months.

The point I am trying to make is that although the model was intended for a proportional system it was not designed for this, as I consider a model has similar requirements which ever radio system is used and if a model only flies well with reeds it is not a very good model.

The radio installation is conventional, the only modifications to the equipment necessary were to tidy up the wiring by using a printed circuit board on which to mount the servos and an overtravel board on the elevator servo in order to get an extra amount of up for a spin when simultaneous rudder and elevator are given. It was found necessary to use a mechanical reduction of elevator movement, about 2:1, in order to avoid using an extra long elevator horn. This system gives a very wide range of adjustment and enables the adjustment of looping radius to be very accurate.

The weight of both models when new was 6¾ lbs. due no doubt to an excess of zeal when using a paint brush, this increased on one model to 7¼ lbs. after repairs as a result of a collision with a fence. This model which was the one used in Sweden did not seem adversely affected by the extra ½ lb. except in the vertical rolls which had to be done in rather a hurry. The weight should be kept down below 7½ lbs. if possible as over this weight the wing loading becomes rather high and the structure may not be happy during violent maneuvers.

The construction of Upset will seem old fashioned in view of the many new techniques which have been applied to model aircraft construction the past few years, particularly fibreglass fuselages and polystyrene foam wing cores. I have seen no evidence as yet that the average modeler can afford the time and money involved in making fibreglass moulds and core cutting jigs unless he is part of a group who intend making a large number of models. Neither am I convinced that the strength to weight ratio of these models can compare with that of a balsa model.

For some years now I have had a theory that once a modeller becomes a proficient pilot, disregarding radio failure which usualy means a write-off, he then only requires a model which will withstand the air loads incurred in violent maneuvers and the occasional "hard landing." With this in mind I have used somewhat flimsy structures than are commonly used today. There is also an effect which can be called airframe mentia which relates to the weight of the airframe destroying itself when the airframe becomes too heavy. You often seen small single channel models dive vertically in the ground only to be picked up and flown again, but has anyone seen this happen to a multi model? Also if the model is very strong then the radio and motor tend to break up instead of the airframe.

So having got that off my chest, we will proceed to the construction, some points of which may need explanation.

Since I prefer building wings we will start with the wing. The wing is the thing that makes it possible for the model to fly. If it is straight the model flies straight, if not it is a problem to make it do so. The extra trouble incurred by making an accurate jig is well worth while.

Upset's wing is tapered and to make an accurate set of tapered ribs is quite difficult particularly if you wish to make more than one wing. The system used here may sound complicated but does ensure an accurate set of ribs. First cut out two ⅛" ply rib templates complete with all holes and slots. Mount the ribs on two lengths of 3/16" threaded rods with ten pieces of ¼" balsa between them, between the ¼" balsa should be interspersed appropriate pieces of 1/16" and ⅛" for the ribs, screw up the block tightly, sand and carve to shape, if a flat block is used for sanding an accurate taper is achieved, take the block apart and replace the 1/16" x ⅛" ribs with 1/16" x ⅛" blanks for the second set of ribs, carve and sand these to shape and hence a second set of ribs. This method can be used if a different root and tip wing section is used.

The main spar is out from 1/16" sheet as shown on the plan, the trailing edge sheets likewise, note the top sheet is wider than the bottom. The leading edge is made by sandwiching a piece of ½" x 1/16" between two pieces of ½" x ⅜". This piece of 1/16" serves to locate the ribs and ensures an accurate wing assembly. At this point some sort of jig is necessary, either to make half a wing at a time or the whole wing in one piece. The leading and trailing edges are packed up as shown and the accuracy checked with a spirit level.

Fit root and tip ribs to main spar and stick to leading trailing edges in correct position, add other ribs, then top of trailing edge and 3/16" sq. spar, if you have a one piece jig add leading edge sheet, cap strips and centre sections heet leaving hole for servo. If half wing jig, turn over and add other 1/16" spar, make other half and join, not forgetting dihedral braces and 1/16" ply at leading edge for dowels, sheet wing and add cap strips. Pin each wing half down

(Continued on Page 77)