A tale of two Shuttles

Nick Papillon compares the standard Hirobo machine with the new XX version and finds a lot of improvements

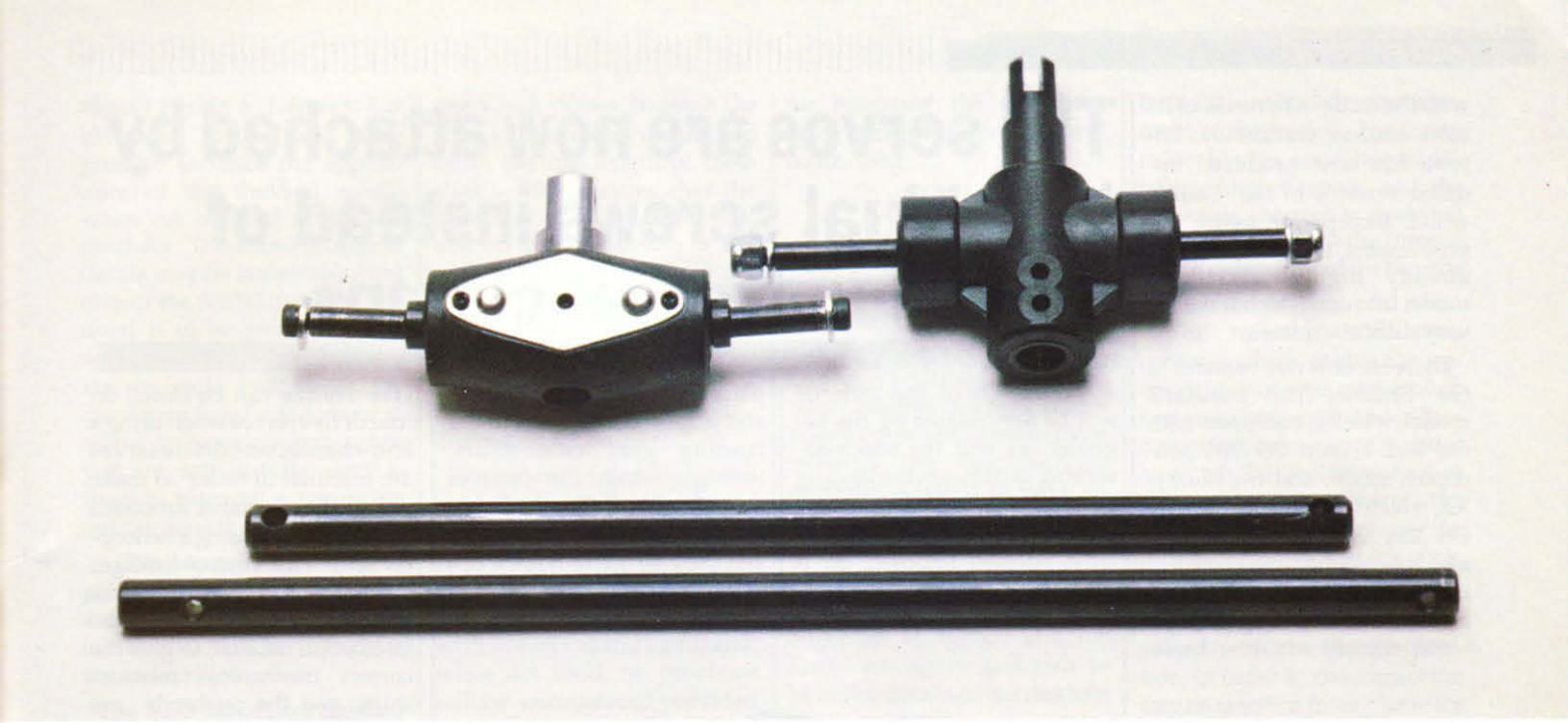
It is now more than two years since the Hirobo Shuttle first reached this country and no one at the time could possibly have foreseen the phenomenal success which this new arrival was destined to enjoy.

For, since then, this revolutionary design has introduced thousands of modellers to the world of helicopters and its widespread appearance on our flying fields is a visible testimony to one of the outstanding successes of the modelling industry.

Learning to fly a radio-controlled helicopter requires the development of new skills and the newcomer to this aspect of the hobby has enough problems without having to worry about any eccentricities of the model he is flying. It is also essential that the model will tolerate a degree of abuse without the need for constant re-adjustment and its handling should not differ significantly from the more advanced models to which the new helicopter flier may wish to progress.

These are demanding criteria for the designer of any model and they make the success of the Shuttle all the more of an achievement, for not only does it make an excellent training machine but it also has sufficient aerobatic potential to satisfy most owners.

An interesting result of this last capability has been the number of fliers who have used Shuttles in order to practise the more difficult (and potentially therefore more destructive) aerobatics. A frequent comment has been how useful the



Shuttle is for this type of flying, since knowledge of the durability and ease (and relative cheapness) of repair removes a large element of stress from the pilot's mind, inspiring confidence and leaving him free to concentrate on the manoeuvres.

These factors, combined with the stability of the Shuttle, make it the ideal model on which to break the psychological barrier of nose-in flying.

Drawing on the considerable level of experience built up

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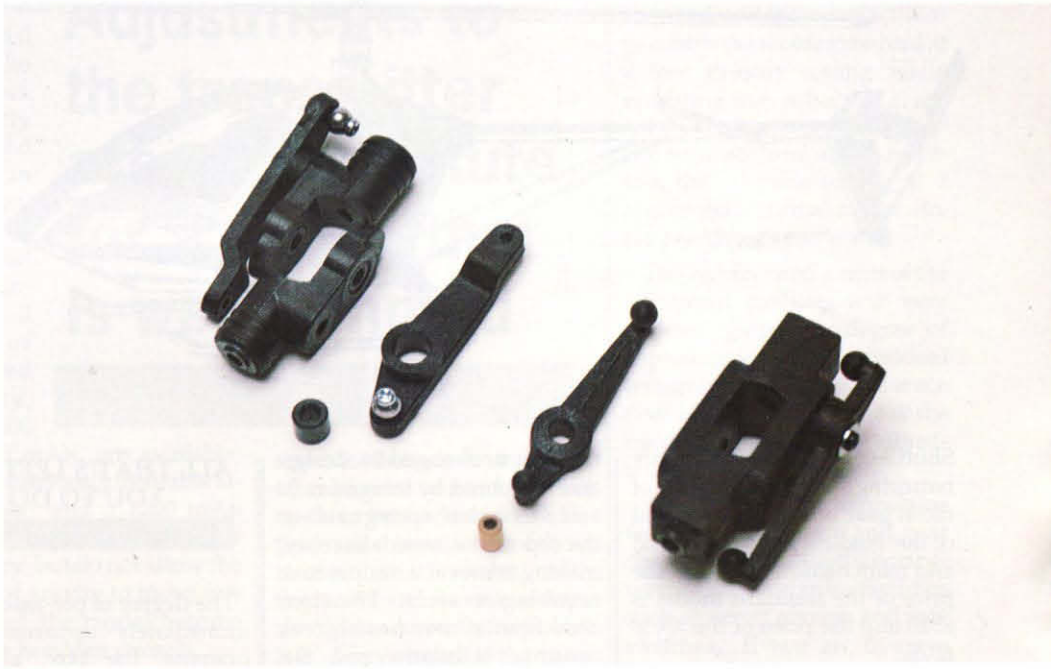

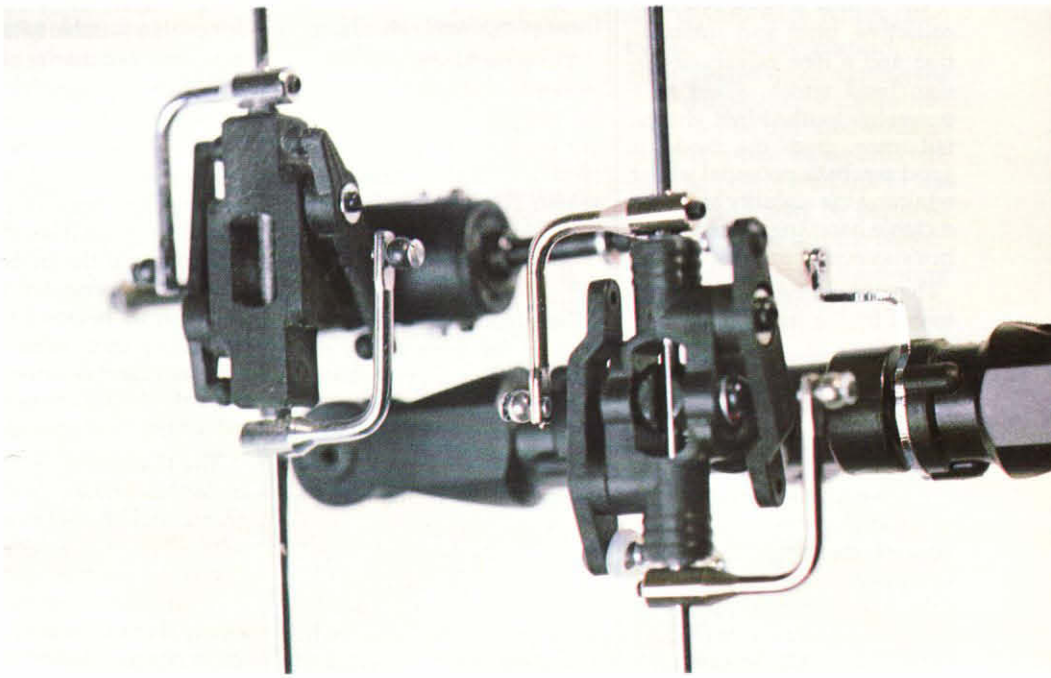

Left: What you get in the box - the components of the ready-built Shuttle XX.

Top: This comparison illustrates the change in the head design and the increase in length of the main shaft. The absence of coning angle in the new head shows up quite clearly.

Centre: Illustrating both the new design for the seesaw and mixing levers, with the new components on the left. You can also see the increase in size of the new bushes and the replacement of the moulded ball-joints with screw clevises and metal balls.

Right: The original assembly is shown on the left of this picture. The new seesaw and mixing levers and the new flybar control arms are contrasted.

with the model as a result of its sales success worldwide, Hirobo has now produced updated versions of the Shuttle which incorporate many improvements, transforming this already highly- acclaimed model into one which it will be very difficult to fault.

There are now two versions of the Shuttle, the standard model, which is equipped with the well-known OS 28H helicopter motor, and the Shuttle XX, which is fitted with the new OS 32H helicopter motor and also has fully ball-raced control linkages, tailboom struts and an all-metal landing gear. The

The servos are now attached by individual screws instead of the old universal clamps

and durability of this material will be appreciated by the beginner, as will the shock-absorbing qualities of the landing gear, now moulded in a new material to withstand the inevitable stresses imposed on it from time to time, even by experts. The one-piece canopy placed just behind the canopy, and a tube is attached to the landing gear cross-struts, through which the receiver aerial is passed. Essential tools for maintenance are provided and the instruction book is one of the best so far, with excellent diagrams.

Shuttle comes ready-built, only requiring the installation of radio gear and the attachment of the landing gear, rotor head and main blades; in the UK the price of the standard model is £320 and the price of the XX is £375.

The Shuttle is equipped with collective pitch and autorotation and a new advanced-design head which, allied to a powerful toothed-belt driven tail rotor, gives the model a good aerobatic potential whilst retaining the stability and predictable handling so necessary in a successful training model.

The sideframes, now reinforced by the incorporation of strengthening webs in the mouldings, are of carbon-filled glass resin and this material is used extensively in the head, tail gearbox and elsewhere,

This keeps the flying weight to around five and a half pounds, ensuring a lively performance on the standard OS 28H motor and a positively exhilarating one on the OS 32H of the Shuttle XX. The strength remains unchanged in design and is secured by integral rails and a moulded spring catch at the top of the main assembly, making removal a simple task requiring no tools. The standard Shuttle now has a green canopy, tailplane and fin whereas the Shuttle XX has these components in white.

The main blades are finished in white and evenly matched for weight and the tail blades are moulded in white plastic (and are highly resistant to grass!) The fuel tank is already installed and plumbed; a filter is not supplied but is easily fitted.

There is an integral radio platform at the front of the main assembly and a gyro platform within the sideframes, ideally positioned, just in front of the mainshaft.

Instead of being held by universal clamps, the servos are now attached individually by screws into the pre-drilled mountings. The left sideframe has a pre-drilled radio switch mounting point, conveniently

ALL THAT'S LEFT FOR YOU TO DO

The degree of pre-assembly is immediately apparent upon opening the box; although there is little remaining to be done, it is advisable to take your time to familiarise yourself with the workings of the model and to check the security of all the nuts, bolts and screws.

After removing all the components from the box, the canopy is removed from the main assembly and the landing gear is attached, using the self-tapping screws inserted from below. The main rotor head is fitted next and secured in place with the bolt supplied and a nyloc nut.

The five servos are now installed as shown in the diagrams and the screws which secure them are tightened sufficiently to prevent them from moving under load, but not so tightly that the rubber mounts will no longer absorb vibration. (The Shuttle can be flown on four or five servos when using a four-channel set but five servos are essential in order to make use of the specialist functions available when using a helicopter set.) The control linkages are now set up by drilling the output discs as shown in the instruction manual, to give the correct mechanical relationships, and the pushrods are adjusted as necessary.

A gyro is recommended and there is a moulded platform for mounting one in front of the motor. The receiver and nicad are installed on the front platform and may be moved to adjust the centre of gravity. The fuel tank is already fitted and plumbed, although no filter is provided.

There is a short piece of cranked metal tube joining two lengths of silicone, just behind and below the carburettor needle valve, and this should be replaced with a suitable filter. I also removed the tank to check it for cleanliness and then refitted it after putting a small amount of liquid silicone under the corners to stop it from moving about.

The engine alignment should also be checked by sighting the clutch bell against the starter pulley; the bolt holes in the sideframes are elongated to allow some adjustment and the engine must be installed square to the clutch in both fore and aft and side to side axes. This also ensures the correct meshing of the small gear with the main gear.

The flybar control arms and paddles are now checked for alignment and tightened, after checking that the length of the flybar on either side of the head is the same and all the linkages are connected up. A check should then be made to ensure that all nuts, bolts and screws are tight.

A sheet of self-adhesive decals is supplied, with a choice of two colour schemes. These are

almost as thin as transfers but extremely strong and they greatly enhance the appearance of the finished model when cut out and positioned carefully. (Positioning of these decals may be simplified if the area of the model to which the decal is to be applied is first wetted with a mixture of washing up liquid and water; the decal may then be slid about to adjust its position and, when you are satisfied, the decal is fixed in place by squeegeeing out the liquid).

The canopy may also be painted if required - I used enamel paint successfully but, if in doubt, check first by applying to a hidden area.

The main blades are finished and matched for weight and the root fittings are already attached. All that remains to be done is to apply the different - coloured decal strips to the ends to assist in adjusting the blade tracking. I have balanced several sets of Shuttle blades over the last two years and have never found a significant difference in weight, but I try to eliminate the least source of vibration if possible.

The tail blades are moulded in plastic and require only to have the decal strips attached to the ends if desired. The main blades are now fitted and the bolts tightened sufficiently just to stop the blades from swinging under their own weight when the model is tilted on its side but not enough to prevent them from taking up their own position in flight - do ensure that the supplied nyloc nuts are used on these bolts.

The controls are now re-checked for correct direction of travel and amount of movement. It is essential that full movement of the control stick plus full trim should not result in the servo being stalled at the extreme of its travel, since this will rapidly discharge the receiver nicad.

At the same time, sufficient movement must be available for adequate control of the model and this will be achieved if the dimensions for the servo output discs, which are quoted in the Shuttle instruction book, are followed. When full collective (plus trim) is applied in either direction, up or down, the horizontal rod in the linkage which passes through the slots in the sideframes should move the full length of these slots; this ensures that the necessary pitch range is available on the main blades to absorb the full power of the motor at one extreme and to allow autorotation at the other. The operation of the gyro is also checked to ensure that it is applying corrections in the desired direction.

The centre of gravity of the model is checked, and adjusted if necessary by moving the receiver and nica. On the subject of nicads, I have always used a standard 500 mAh pack with five servos and a gyro and, while not ideal, no problems will be encountered provided operating time is restricted and the nicad pack is fully charged and in good condition. Now that similar-sized packs of increased capacity, such as 600 and 700 mAh, are available, they are obviously desirable alternatives and a 1200 mAh pack can be accommodated if necessary, but do not allow the centre of gravity to move forward and the model become too nose heavy as a result.

The centre of gravity is checked by setting the main blades in a straight line and then supporting the model under the end of the main shaft, using a screwdriver or similar rod held horizontally; the model should balance at the centre of the shaft with the fuel tank empty (and the canopy fitted).

The glowplug on most model helicopters is less accessible than on a fixed-wing model, and the Shuttle is no exception. Most glowclips will not fit but a simple pair of leads with two crocodile clips on the ends will suffice - the second lead is clipped to one of the cap-head bolts which secure the motor in position.

The small box spanner which is included in the kit is for removing the glowplug, since most plug spanners will be too long

FLYING

The Shuttle will require little trimming if the instructions in the handbook have been followed but there will always be minor variations in servo travel, control linkages, motor power output &c. and for these reasons the beginner is strongly advised to have an expert carry out the first flights of a new model.

I took my first Shuttle back to Dave Nieman Models, the importers of Hirobo kits, for final setting-up and also to have the details of the modern specialist helicopter transmitter explained to me, for, if full use is to be made of the facilities available with one of these transmitters, it is vital that both the model and the transmitter should be correctly adjusted. It is always better if the newcomer to helicopter flying is sure that the peculiar behaviour of his model results from his handling and not the model or the radio! It is worth pointing out that a helicopter transmitter is not essential for flying a Shuttle but the use of one does considerably simplify the task However the adjustments available on the transmitter are no substitute for a well-trimmed model.

Adjustments to the transmitter are no substitute for a model that is well trimmed

For readers who are not familiar with the details of a specialist helicopter transmitter perhaps a brief description is in order. The usual four channels required for a fixed-wing model (aileron, elevator, rudder and throttle) are also used to control a helicopter, plus a fifth, called the collective channel, which directly controls the up and down movement of the model. The transmitter has the usual two sticks, giving four channels, and the collective channel is operated in conjunction with the throttle by the movement of the throttle stick.

The transmitter has extra controls which enable the operator to vary the relationship between the throttle and collective servo movements, in order to match the power output of the motor to the pitch of the main blades throughout the movement of the throttle stick.

A further control enables the tail rotor pitch (rudder) to be varied with the throttle position, in order to counteract the torque reaction from the rotor head when the power setting is changed, and there are facilities to enable the motor to be held at a low throttle setting while operating the collective channel normally, in order to practise autorotations, and to maintain the throttle setting at a higher than normal minimum, for practising aerobatics.

The number and extent of the additional facilities will vary depending upon the degree of sophistication of the individual transmitter, but their presence does not prevent the use of the transmitter for flying fixed-wing models.

The basic four channels as well as the auxiliary and gear channels are used in the normal way, as are any extra facilities such as servo reverse and rate switches. If you are flying a twin engined model, the second throttle may be operated by the collective channel; this greatly helps when starting the second motor, since the throttle stick may be operated without the first motor being affected, and the power outputs of the two motors may be balanced throughout the throttle range.

If you fly both fixed-wing models and helicopters, a helicopter transmitter is a very worthwhile investment since it makes the flying of a helicopter much easier and may also be utilised to the full when flying a fixed-wing model.

Flying the Shuttle is highly rewarding. The handling is similar to the larger Hirobo models and there is none of the instability and twitchiness so

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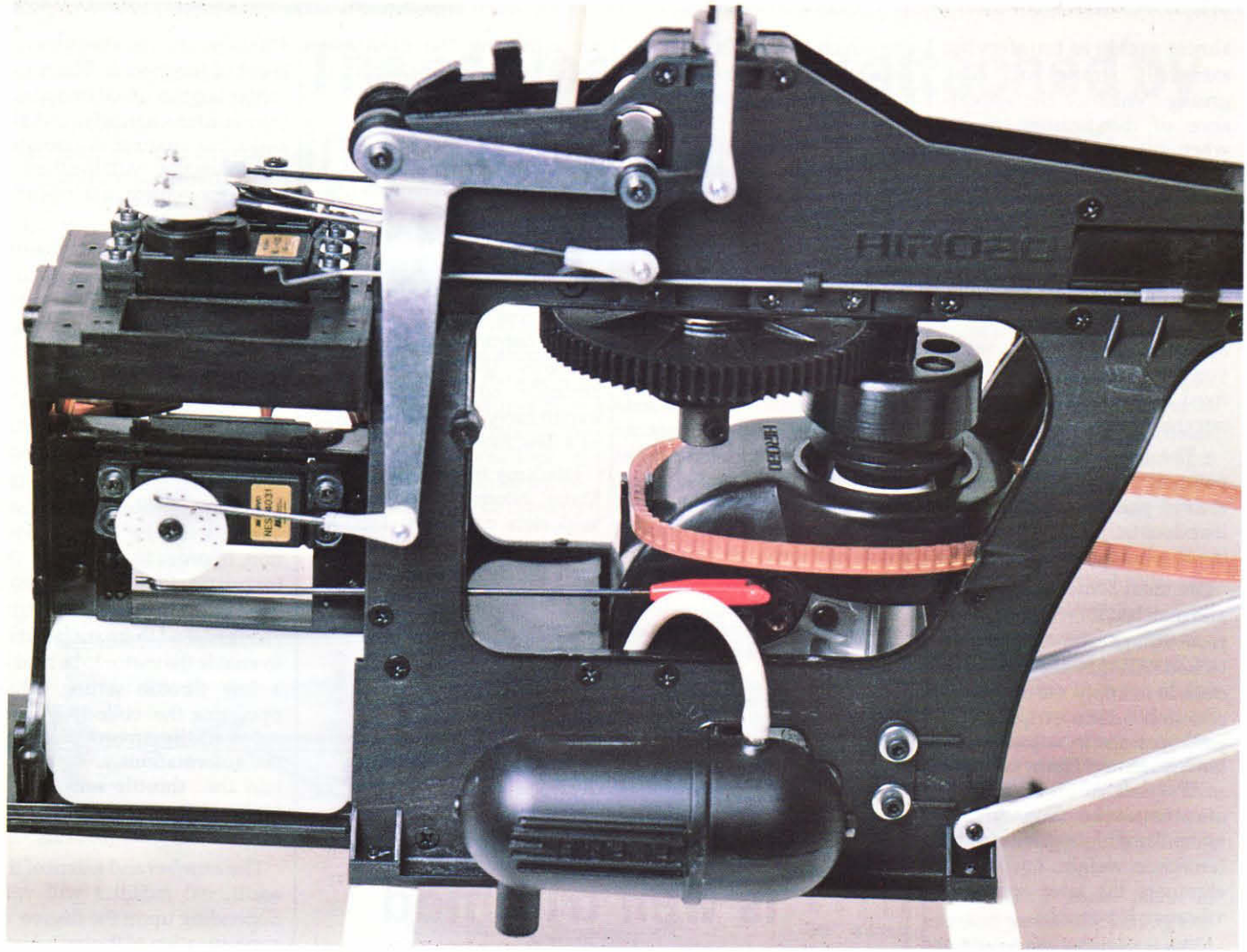
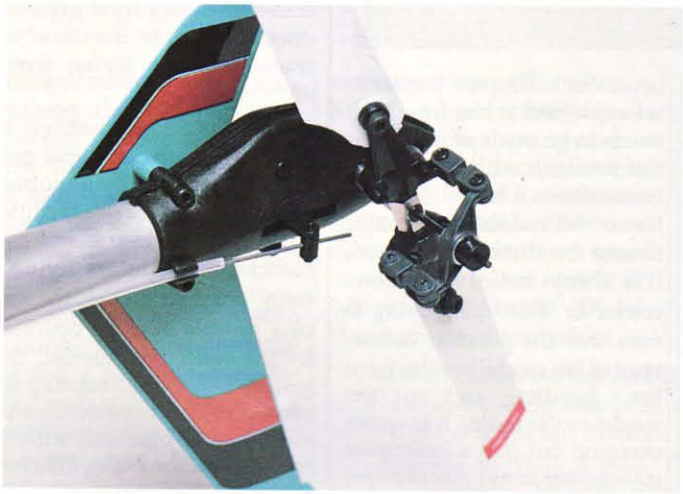
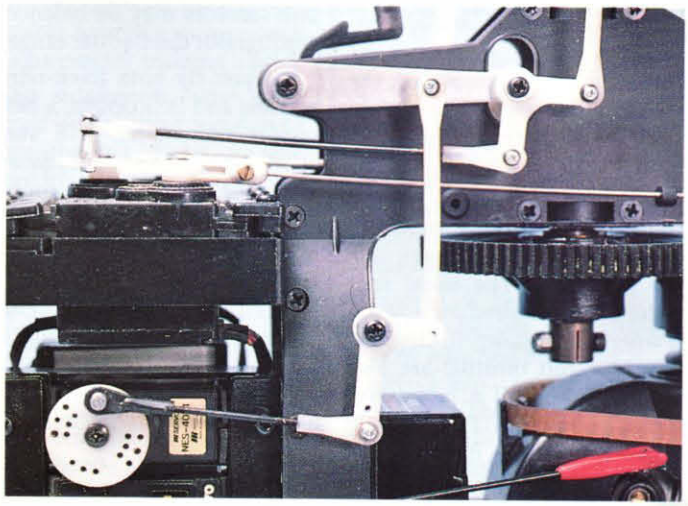






Above: Showing the new Shuttle from the port side, with the re-designed silencer. The changes in the collective pitch control mechanism, the lowered ball-joints on the roll servo output disc and the side-frame mounting points for the tail-boom braces may be noted. The individually mounted servos are also visible.

Left: A close-up of the new tail rotor control mechanism, showing the re-designed pitch control linkage. This is the standard Shuttle, seen from the port side.

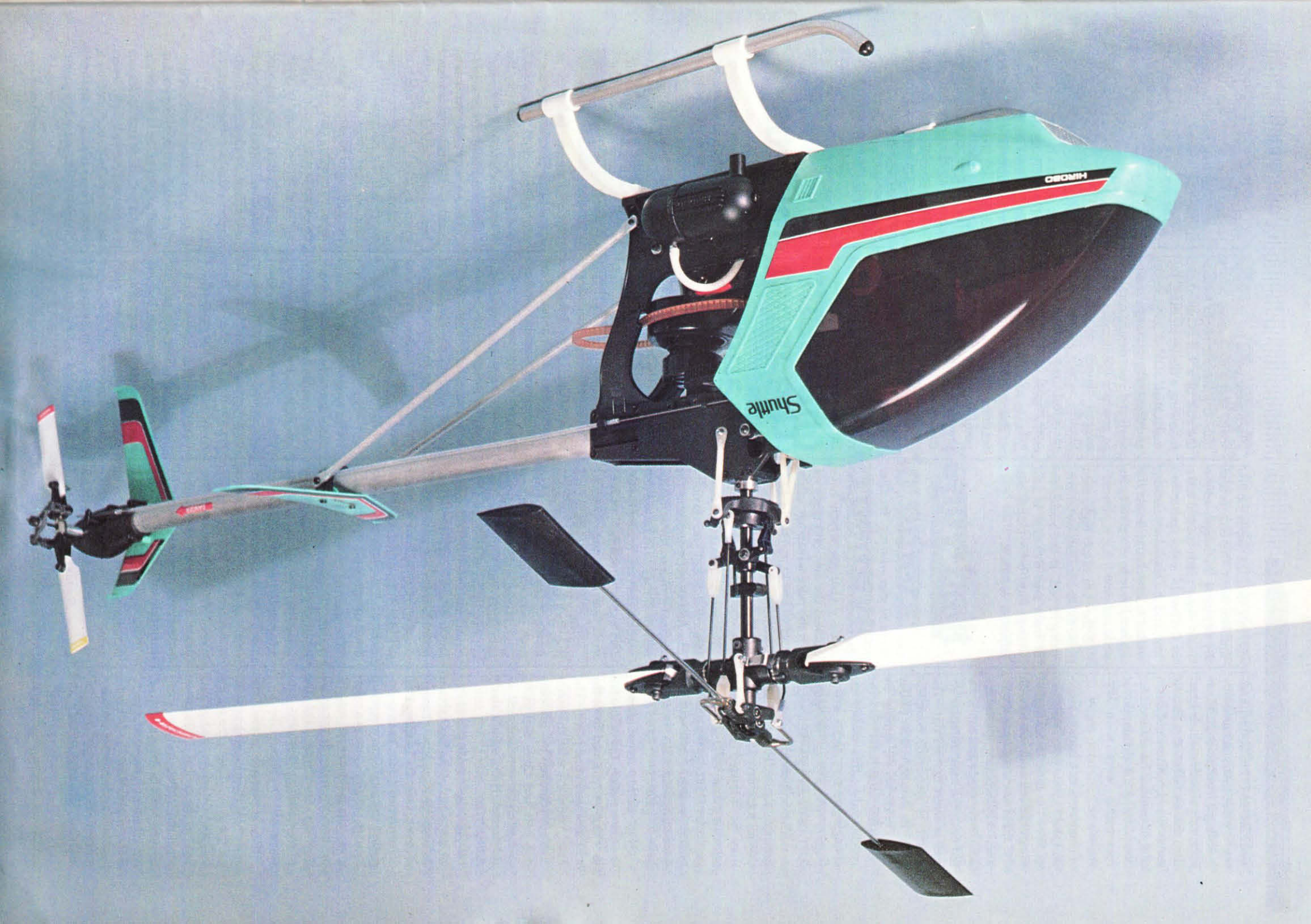
Below left: The original Shuttle again, showing the collective pitch mechanism and the raised ball-joints on the roll servo output disc. The servo clamping bars may also be seen.

Right: The completed new standard Shuttle.

common in other small helicopters. The Shuttle is fully aerobatic and, in the hands of a competent pilot, will complete all the FAI schedule manoeuvres without difficulty. The new design of the head has made the handling even better - I have described all the changes to the Shuttle in a later section, Autorotation is greatly improved and is now straightforward, full control being available right to touchdown, and boom strikes should become a thing of the past. The tail is very powerful and 540 degree stall turns and pirouettes are easily performed.

AFTERTHOUGHTS

Having flown a variety of Shuttles over the last two years, I have discovered a few points which may be of interest, I had always viewed the prospect of a ready-built model with some suspicion, particularly a helicopter, because I believe that one needs to have some understanding of the principles of operation of a complex flying


HIROBO
Shuttle

machine and this understanding is most easily achieved by building it from scratch. However, any worries which I had that the fact that the Shuttle came ready-built would mean that it would be difficult or complicated to dismantle or reassemble were soon dispelled.

The instruction book is excellent and anyone who wishes to explore the inner workings of the model can easily do so with the aid of the diagrams; moreover, replacement parts are accurately made and easily fitted and the most complex repair is easily carried out. The motor is removed, complete with its mount, starter pulley and clutch shoes, simply by removing four bolts and the needle valve; this makes the changing of the starter belt a five-minute job, although I have never broken one.

The tailboom is clamped between the sideframes and the tail rotor drive belt tension may be adjusted simply by loosening four bolts - it should be stressed that this is a toothed belt, requiring a fraction of the tension needed with the plain belts fitted to some models.

If the belt is removed from the drive pulley, the whole tail unit can be removed from the mainframes in one piece. The head, complete with the mainshaft, is removed by undoing one bolt and three ball joints and even the replacement of sideframes isnot particularly difficult.

While the Shuttle will fly straight out of the box , it is at its best if the head speed is correct and, since the head and tail rotor speeds are geared together, the model may be set up by using the tail rotor as a reference - the faster the tail rotor is turning, the more thrust it will develop (assuming that the pitch setting remains unchanged).

IF no expert help is available, as a guide the model should lift off the ground with the tail rotor pitch lever, on the tail gear box, in the centre of its travel and the collet on the pitch change shaft in the position set by Hirobo. If the model turns left or right, then the tail rpm, and hence the head rpm is not correct - if the model turn left and full right trim will not correct this, then the rpm is too low and vice versa, This is corrected by adjusting the length of the main blade pitch control links to the head - if the rpm is too low, and the blades are also out of track, first bring down the higher blade by shortening its rod.

If the rpm is too high, then raise the lower blade by lengthening its rod. If the blades are in track and the rpm is still wrong, then both blades are adjusted together.

THE NEW SHUTTLES

I have referred to the new versions of the Shuttle and, for those of you who are familiar with the original, I will describe the changes which Hirobo has made - changes which have enabled the new Shuttle to retain the price advantage of the original but to match the handling and degree of sophistication of the best of the competition, regardless of size.

The new Shuttle is now available in a choice of two versions. The first directly replaces the original - indeed most of the new parts may be fitted to existing Shuttles - and retains the OS 28H motor which has proved more than adequate.

The second version, the Shuttle XX, has all the improvements of the first and, in addition, is supplied with the new OS 32H motor as standard. It is also fitted with fully ball-raced control linkages (a total of 18 extra ball-races), all-metal landing gear and metal tail boom braces. The new Shuttle is now supplied with green cabin, fin and tailplane whereas the Shuttle XX has these components in white.

The most obvious changes to the Shuttle, apart from the new colours, are in the new head assembly. The separate feathering spindles of the original head, which allowed a considerable amount of independent movement of the blade tips, have been replaced by a one-piece unit which is retained within the original damping arrangement.

This also has the effect of reducing the coning angle to zero. This one-piece spindle necessitates a new yoke, since it passes through the original attachment point for the main shaft, and also a new centre hub. In order further to reduce the risk of a tail boom strike following a heavy landing, the main shaft is also lengthened and these alterations in mainshaft and yoke design combine to produce the increase in the overall height of the new Shuttle, which is one of the main features to distinguish the new model from its predecessor.

The original dampers are retained and the flybar and paddles remain unaltered but the flybar control arms are modified. New mixing levers are fitted, with an altered mixing ratio, and the ball-joints for the links connecting the levers to the swashplate have been replaced with screw and clevis fittings. The new mixing levers are also more substantial than the originals. The flybar and mixing levers are mounted on an improved seesaw of a more compact design.

The most obvious changes to the Shuttle are in the head assembly

A new washout assembly, again of more substantial construction, is fitted and the ball joints for the links connecting the levers to the flybar control arms have both been replaced with screw and clevis tittings for improved strength and reliability.

This type of fitting also eliminates the twisting force which was applied to the original installation by the offset ball joints. The blade holders, main blades and swashplate remain unchanged, but the blade holders are now retained by 7mm nyloc nuts on the ends of the new spindle.

Modifications to the tail end are not so extensive but are again designed to improve the precision of control, the pitch control mechanism has been redesigned, eliminating the original ball and link arrangement, but the Stork blade holders and axle, which were fitted to the later models of the original Shuttle, have been retained.

The connection between the tail pitch control rod (from the servo) and the tail pitch lever has been changed from a simple Z-bend in the rod to a screwed connector; this makes removal of the tail gearbox assembly much simpler and greatly facilitates the fitting of scale fuselages (this modification first appeared on the Hirobo Hughes 500 Shuttle).

The tail gearbox and the boom remain unchanged but the mouldings for the fin and tailplane are new, with the tips reshaped to improve the appearance (and, incidentally, to eliminate the very sharp edges of the originals). The braces fitted between the sideframes and the tailplane securing bracket, which featured in some of the Shuttle advertising, are now supplied with the XX and will be available for the standard version as well.

The Shuttle main assembly features several improvements. The side frames have been considerably strengthened by the incorporation of reinforcing webs in the mouldings and the material for the landing gear cross struts has been changed to reduce breakages - the other change to the cross struts is in the colour, they are now white instead of black.

The Shuttle XX is supplied with an all-metal landing gear and this is available as an optional extra for the standard model.

A major change in the collective pitch control operating mechanism is the elimination of the bellcrank and its link up to the collective pitch lever; they have been replaced by a new, one-piece, L-shaped, metal collective pitch lever,

connected to the servo by a single link. This eliminates the lost motion associated with the bellcrank and its mounting and is a simple, effective and inexpensive modification to fit to an original Shuttle.

The servo installation system has been changed from the clamping bars of the original to individual screw mounting for each servo.

The integral rails are predrilled for standard servos and the new arrangement means that individual servos can be changed without disturbing their neighbours and also that when a servo is removed for any reason its replacement will be in exactly the same position as the original. The raised ball-joints fitted to the roll servo output disc have been reduced in height, thereby decreasing the twisting load on the servo output shaft.

The silencer has been altered so that the pressure tapping is now on top; this eliminates the problem of waste oil being fed back into the fuel tank when the engine is running.

All of the new components may be fitted to existing Shuttles, although certain of the changes, particularly to the head, will necessitate the replacement of more than one component.

The new Shuttle may be fitted with the ball-races which are standard on the Shuttle XX, but these ball-races (and the new, larger, bushes) will not fit existing Shuttles and it will be necessary to replace the relevant components as well.

Flying the new Shuttle is an interesting experience. In calm weather, when carrying out simple hovering manoeuvres there is little to distinguish the new models. However, the first opportunity I had to fly the new version was on a fine sunny day with half a gale blowing and it is under these sort of conditions that the improvements to the handling show up.

The new Shuttle is less affected by gusts and the controls are more positive than before and while the longer main shaft contributes to the increased stability, it does not seem to detract from the manoeuvrability of the model. I look forward to many more hours of flying the new version and, when the necessary parts are available, I shall certainly convert my present models to the new specification.

IN CONCLUSION

It is interesting to speculate on why a ready-built helicopter should be so appealing to the average modeller, whereas ready-built fixed-wing models have never enjoyed similar success. The main reason, I suspect, is that helicopters had always had an aura of mystery about them and had seemed to need (and, in some cases, had actually required) the facilities of a sophisticated engineering workshop in order to construct them.

Furthermore, once assembled they had to be flown in order to adjust them, thereby placing the novice pilot in a classic dilemma - if you can t fly it in the first place, how do you adjust it? The second reason was the price.

The Hirobo Shuttle changed all that. Suddenly the average club modeller could buy a helicopter which he knew would fly straight out of the box, at a price including the engine which left other manufacturers offerings in that range looking like expensive meccano sets.

It rapidly established a proven track record, with a performance to satisfy beginner and expert alike and moreover, when the beginner had his inevitable mishaps, it was readily repaired and retrimmed.

It was extremely crash-resistant to start with and the materials used in the main construction did not distort permanently when stressed, they either sprung back to their original shape or, ultimately, they broke and you replaced them; this saved the novice flier from the dilemma of not knowing whether his problems stemmed from himself or his (bent) model.

Curiously enough, I believe that a further attraction of the Shuttle when it was first introduced was the total lack of choice - it was blue, powered by an O.S. 28 and complete, even to having autorotation; there were no decisions to be made and furthermore, no one could buy a better one than yours because there wasn t one. Obviously, human nature being what it is, the situation could not last and so Hirobo were faced with a difficult problem; when you have designed a winner, what can you change without risking jeopardising the overall success of a complex flying machine?

The answer, of course, was the colour and so we had the white Shuttle (conversion kits now available - all it takes is a white canopy and fins, white heatshrink for the boom and a new set of transfers).

It was always likely that even the least demanding Club flier would not be satisfied by this marketing ploy for long and there had been pressure almost from the first appearance of the Shuttle for a scale version using the same mechanics.

The compact design and inherent strength of the layout and materials used in the construction of the Shuttle make the model suitable for a wide range of scale fuselages and several options are now available, albeit differing widely in their degrees of completion and price.

Hirobo now produce no less than three scale versions, each available either as a ready-built model or as a conversion to an existing Shuttle; the first to appear was the Hughes 500E, which is the latest version of the well-known Hughes 500, and this was soon followed by the Jet Ranger and the Twin Squirrel.

When purchased as a ready-built model the fuselages are finished even to having the complete colour scheme applied and fuel-proofed; conversion kits are available with either the fully-finished fuselage or a bare, unpainted shell. The quality is superb and the final result looks immaculate, with the absolute minimum of work involved for the purchaser of the completed models; this is naturally reflected in the price.

The other alternative for the modeller is the new range of fuselage conversions now available from Dave Nieman Models and this includes the Jet Ranger, Airwolf and 222 to date.

These are bare glass fibre fuselages, available in a range of colours, which are fitted to existing Shuttles; however, unlike other fuselage conversions, because of the design of the Shuttle these really are bolt-on conversions and the amount of work involved in fitting these fuselages is reduced to an absolute minimum.

It is in the detailed finishing and choice of colour scheme that the individual modeller can express himself and the low weight of the fuselages and good power-to-weight ratio of the original Shuttle allows a fair degree of embellishment.

While all the scale versions have been available for some time now and all flew using the original mechanics, there is no problem with fitting the latest versions and Hirobo kits will be supplied with them already installed.

Whilst there will never be one model helicopter which will completely satisfy everybody, I believe that the Shuttle will come as close to this ideal as anything else so far produced if only because, looking back over the last two years, it has always been and still is fun to fly - and surely that is what it is all about? □

Hirobo's ready-built baby made others look like expensive meccano sets