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THE BELL 47G III

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Flying at Charmouth in almost perfect conditions the Bell 47G certainly looks the part

THE BELL 47G III

VARIO'S LARGE BELL 47 G III IS A CLASSIC AND A DELIGHT TO FLY

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PHOTOS: RICHARD MORRIS

Design of the Bell 47 began in the 1930s, but a decade passed before a prototype was completed in 1945 and in 1946 it became the first helicopter to be approved for civilian use. By the time production stopped in 1973, over 6,000 Bell 47's, in several different models, had been produced. Bell 47's are still used throughout the world, and are especially popular for training helicopter pilots. Perhaps the best known use was during the Korean War, when the helicopters were used by the United States Army MASH (Mobile Army Surgical Hospital) to evacuate wounded soldiers from the battlefield. Scenes of the Bell 47 being used for medical evacuations were often shown on the television series "M*A*S*H*.

In addition to its use in saving lives, the Bell 47 was the first helicopter in the world to transmit TV signals when in 1958, KTLA's 'telecopter' made its debut in Los Angeles. The Bell 47's usefulness to the media doesn't stop with the purely practical; the helicopters have also been featured as a favoured mode of transportation for movie heroes from Batman to Bond.

So as we can see, the Bell 47G is a classic helicopter, which was built in a very large number of versions, some of which are still in airworthy condition today. Vario has produced a three seat GIII version, not least because a full size machine is based at their premises. Although a turbine version of the Bell 47 was produced, it was decided to stay with the piston engine version for the purpose of this model. This has made the model relatively compact and it can even be transported in a small car thanks to the removable tail. Only three screws have to be undone! The Vario/Zenoah G23 petrol engine provides the power for the model, and the mechanics are also suitable for installation in other helicopters. So all in all, this model should prove to be a very practical large-scale model helicopter.

Having seen an example of this model being flown by Dave Hollins and requiring a replacement for my Robinson R22, I decided that this would be my next scale project. In addition to this, I am also very lucky that I have flown in a full size machine that is based relatively near to where I live. This machine belongs to another contributor of this publication and in addition to having flown in this machine on a number of occasions, I also have access to the machine to enable me to take those all important close-up pictures of all the important little scale details.

So as you can no doubt appreciate, this certainly swayed my decision towards the Bell 47G as my next scale subject. Once I had made the decision to build a Bell 47 it was not long before I was taking delivery of the kit.

ASSEMBLY

Upon opening the box the first thing that takes your eye is the beautifully made tail, but more about this later. The first part of assembly is building the mechanics, which are new for this model and will be replacing the original mechanics used in the R22. If like me, you have built several Vario machines, many parts will be familiar to you.

The first stage is fitting the very substantial auto-rotation hub to the main gear and anchoring it by means of two grub screws to a flat on the long main shaft. These are not tightened at this stage, allowing for adjustment later. The main shaft runs in three bearings, two of which are held in metal bearing blocks, while the top block is plastic and also carries the swashplate guide. The lower of the three bearings has a smaller internal diameter, which fits on the one end of the main shaft that has its diameter reduced. A thrust race is fitted beneath the top bearing block to take care of the vertical loads on the main shaft.

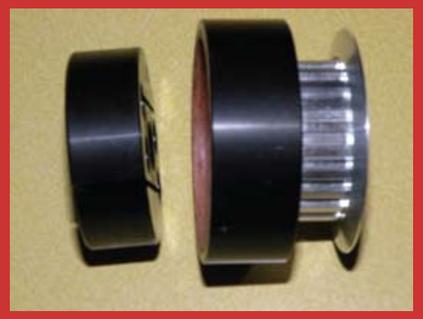
A pinion gear fitted on a second shaft that also carries the tail drive bevel gear drives the main gear. This second shaft is carried on two bearings both held in metal bearing blocks. The bevel gear on this second shaft engages with another bevel that is located at the rear of the main frames, which is locked onto a further >>>

Everything comes sealed in plastic bags numbered to coincide with the assembly instructions

This sturdy main gear has the autorotation unit attached and is clamped to the main shaft by the visible grub screw

The tail drive is transmitted through this bevel gear, which as you can see this is more than strong enough

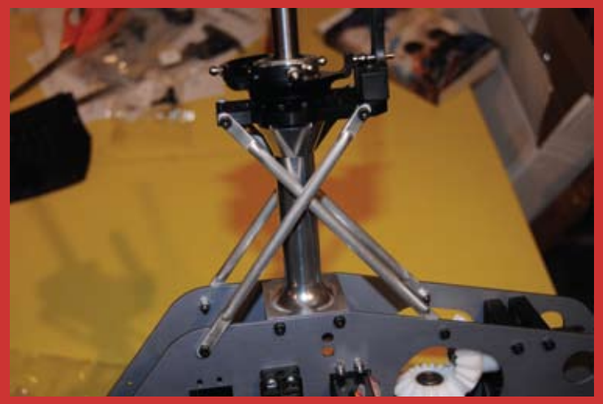
The first side frame assembly with the transmission installed ready for the servos to be installed before the other side frame is added



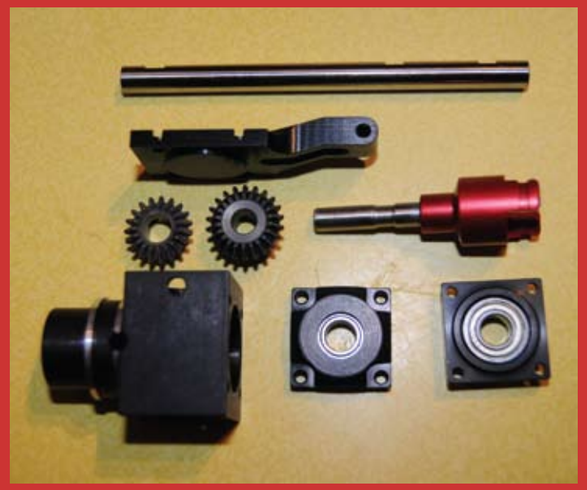
Anyone who has built a petrol powered Vario model will be familiar with this clutch

The trusty Zenoah G230 petrol engine is certainly powerful enough and reliable

Once again a familiar part the metal swash-plate



This metal mast support with braces is added because the main shaft is 514 mm long!



The component parts of the all-metal gearbox, the sort of quality we have come to expect from Vario

shaft that runs in two ball races and also carries the tail drive coupling. Once these three shafts have been loosely assembled, you are ready to start work with one of the side frames.

In each side frame you will find three holes that are for servo mounting. The front two are used in the right frame, while the rear two are used in the left. I would recommend that you fit your cyclic servos at this point, taking care to ensure that they are in the correct orientation, although it is possible to fit the servos when the model is complete, it would be challenging.

I also took the opportunity of fitting the servo output arms, as again this would be more difficult at a later stage. Once the servos have been fitted into the right hand side frame you are ready to add some spacers, along with the shaft sub-assemblies. With the shafts fixed in place, you are ready to adjust the bevel gear mesh along main gear position relative to the pinion gear that is carried by the rear shaft.

With this stage complete, you prepare the engine for installation. The model is designed around the Zenoah G230 helicopter engine so that is exactly what I elected to use, rather than the slightly more powerful G260 engine. You will need to change the throttle arm on the carburettor and adjust its position so that full throttle movement is possible with the throttle servo that will be fitted to the chassis base plate.

Before mounting the engine on this plate you need to fit the substantial clutch and a taper sleeve fits on the taper crankshaft and carries the clutch bell that is held in place by a large circlip – you will need circlip. On the front of the tapered sleeve you fit the clutch shoe and this whole clutch assembly is bolted firmly to the engine. The complete engine is mounted on the main base plate, with the clutch protruding beneath the plate.

At this time you need to set-up the throttle servo and linkage, as it will be almost impossible to make any adjustments once the mechanics are installed in the framework of the Bell 47G.

With the throttle operating correctly, you are now ready to fit the side frame to the base plate and add the second side frame, complete with its servos. Take care at this stage to ensure that all the screws are tightened properly and a thread-locking compound is used as required. At this stage, also be sure to adjust all the gear meshes and positions, taking extra care to ensure that all grub screws locate on the flats provided for them.

Once you have done this, you are ready to fit the large pulley to the rear shaft with its drive belt over the clutch bell. Moving the engine backwards and forwards in its mounting slots tensions the belt. With the engine in the correct position, an additional brace is fitted to the top of the engine to make the whole assembly more rigid.

You are now ready to install the swashplate, which is an all-metal unit that anyone who has built a large Vario petrol model will instantly recognize. All that you need to do is add the necessary linkage balls, taking care to use thread lock and not to over tighten them. You can also fit the cyclic control linkages and adjust them so that with the servos set at the hover position, with the output arms all horizontal, the base of the swashplate should be 13 mm above the top of the side frames.

Attention now turns to the tail rotor gearbox, which is an all-metal component and similar to that used on other large models in the Vario range. The input shaft is carried on two ball races, as is the output shaft that carries the metal tail rotor hub. Each tail blade grip is mounted on two ball races with end loads being carried by a thrust race. As always, take care to get the thrust race round the correct way!

The tail pitch slider is again a familiar unit, with a plastic control yoke being attached to the blade grips with substantial plastic levers. These levers are fixed to the yoke with metal pins and the smallest circlips you ever did see. Vario have taken to supplying a couple of spare clips as inevitably you are going to lose one or two during assembly.

That just about concludes the assembly of the mechanics apart from the fuel tank, which is the standard Vario tank that only requires the usual fittings to be added.

The model is based on this full size helicopter

The quality of this scale rotor head is obvious being beautifully machined

The job is always easier with the right tools and this tube cutter makes cutting the tail drive accurately easy

The scale rotorhead has a dummy Bell Bar, and so flies as a flybarless rotorhead.

One of its first outings in public at the Rollstone fly-in sporting the scale rotor head

THE FUSELAGE

With the mechanics safely put to one side, you are now ready to tackle what can only be described as the fuselage. This consists of the bubble at the front and the lattice boom at the rear. The first stage is fitting the tail rotor gearbox. As the tail is not straight but angled up at the back, there is a coupling at the point at which it is angled up. This means that the drive from this coupling to the gearbox is fairly short and is where assembly commences. The tail gearbox mount is glued into the back of the tail boom and two self tapping screws added just to be extra sure that it will not move.

The short section of tube drive that runs along this part of the tail boom is supported by two bearings and drive is taken care of by a cruciform coupling at the gearbox end and a dog bone at the other end. Once the tail gearbox is mounted and the tube drive cut to length, attention is turned to the long tube drive that runs the complete length of the lattice part of the tail boom. This tube drive is supported along its length by three bearings, located in blocks that need to be attached to the tail boom.

Before these blocks are glued in place you will need to line them up in the correct position. To do this I fitted the coupling to the one end of the tube and engaged it into the far end of the tube drive that you have just installed. I then slid into position the three single bearings and positioned them accordingly on the tail.

At the front end of the tail two more bearings are fitted into a metal sleeve, which has been ready mounted on top of the lattice tail. I fitted these in place with the tube drive passing through them. This meant the tube drive was held in position at both ends and allowed me to locate the three support bearings and glue them in place. I used JB Weld for this as it takes 24 hours to cure and gives you plenty of time to work with the parts. Once the glue has set, you are ready to cut the drive tube to the required length and fit another cruciform coupling.

A short piece of tube is then cut to length and assembled with a coupling at each end and a bearing unit in the middle and this is what is fitted to the front of the tail section. The next stage is to fit the rear section of the tail pitch pushrod between the tail gearbox and an intermediate crank. You can then fit the vertical and horizontal fins, before setting the tail section to one side and turning your attention to the front section.

The next thing to do is fit the undercarriage to the mainframe of the helicopter and I then mounted the mechanics in position. They attach by two long bolts that pass through spacers at the front and two saddle clamps towards the rear. The top of the mechanics is prevented from moving around by two stiffening frames, which also double as the mounts for the scale fuel tanks. Now you can add the tail assembly, which is held in place by three bolts through the main lattice and an additional two that add extra security to the front tail tube-bearing mount.

At this point another short driveshaft has to be assembled to carry the tail drive between the mechanics and the front coupling of the tail assembly. This shaft has to be adjusted so there is a small amount of end float between the couplings. It is important at this stage to fit

ABOVE: Hopping in to land over the hedge, the Bell 47G is a model I look forward to flying for a long time to come

the leather pads into the female sides of the couplings before finally adjusting the length of this driveshaft.

The tail servo mount is the next job and this is fitted to the side of the main mechanics and once done, you can fit the tail pitch pushrod and adjust it to the correct length. This pushrod runs through three guides that need gluing to the tail framework much the same as you did for the tail tube bearing blocks. All that is now left to do is fit a couple of extra tie rods, between the tail and main mechanics, before your attention is turned to the main shaft of the helicopter.

As the Bell 47G uses a very long main shaft, the original top bearing block supplied with the mechanics is replaced by an extended mast support, which eliminates any mast flex and raises both the swashplate and the anti-rotation bracket. The swashplate pushrods can now be added, along with the swashplate and the pitch compensation mixer. Note: you will not need this if using the scale rotor head, but more about this anon.

TANKS AND COCKPIT

You are now ready to start on the scale fuel tanks. These fit either side of the main mast and depending whether you want to put your actual tanks inside these, will depend on how you build them. There are two parts to each tank, with the lower half acting as a carrier that has a bracket and two captive nuts glued in place.

The dummy tank is then fitted and allows it to be screwed to a frame holding it in place on the main frame. I elected to keep these tanks as dummies because using them would mean fuel being stored above the carburettor, which might cause problems of flooding the engine. I used the supplied tank fitted in the front of the model.

On the front of the main frame work you need to bolt in place two pieces of plywood marked '01' that will eventually be bonded to the fibreglass part of the cabin assembly to produce what I can only describe as the firewall. The first part of the cabin build is to cut out the doors and the rear where it will sit onto the main frames and the firewall. This is possibly the most time consuming part of the assembly. You really need to position the cabin just so!

Once I had the cabin positioned where it needed to be, I tacked it to the two wooden part formers with some 5 minute epoxy. I then built up the two seat formers, which will be bonded to the firewall at each side of the mechanics, which double as the mounts for the seat, in addition to adding strength to the cabin.

In addition to the seat formers, two more formers run around the front of the cabin to stiffen the cabin and also support the cabin floor. Once you are happy with their positioning, along with all the other formers, then you can glue them in place and you are ready to trim and add the bubble. Very little in the way of trimming was required; just a little excess material was removed around the door openings.

It was quite remarkable just how simple this part of the build was, as I had expected this to be a very time consuming operation. Now that the bubble was in place it was time to fit the doors and door handles and once mounted, I set about trimming and fitting the glazing.

That completed the cabin, apart from the cockpit detail, so I decided that I would fit the floor along with the rear wall and the bench seat before stripping the model down ready for painting. As ever I employed Mike Drinkhill to do the honours with the spray gun. Although at first glance there would not appear to be too much in the way of painting, it turned out that this model was quite a challenge for Mike to get it the way he wanted it to look. As I mentioned earlier I am lucky enough to be able to get access to a full size machine so the model was painted in the LHC livery and Mike made a superb job of the painting.

REASSEMBLY AND FINISHING

With the model back from the paint shop, I had the job of carefully reassembling the machine for the final time. I built the model, but this time I did not add the glass bubble or cabin doors as this would allow me plenty of access to the front of the cabin, so I could install all the electronics under the floor.

In addition to the electronics I also had to install the fuel tank, which just fits under the floor in the middle of the cabin area. Each side of the fuel tank I anchored the receiver flight batteries, two 6 V, 5000 mAh NiMH units. These batteries power the Spektrum AR9100 receiver via a Power Box regulated switch. I operate four satellite receivers with the AR9100; two of these fixed under the floor and two others behind the cabin. Once I had installed the radio, I was ready to fit the glass bubble and turn my attention to the rotor head.

I had initially started off with the standard flybar head similar to that used on the R22 and my Huey. However, having seen Dave Hollins using the scale rotor head on his Bell 47G I decided to change over to the same scale head. This is beautifully machined, complete with dummy weights on top just like the full size version. Using this rotor head does however mean that the swashplate has to be setup with a 90° offset, so should you decide to use this head take great care when setting up the swashplate movements.

Both rotor heads are similar in as much as they use a 10 mm feathering spindle and the blade grips are supported on two ball races with a single thrust race. The linkages are of course different for each head, but both are straightforward to set-up. I started by setting about 5° pitch, with the swashplate at the mid point of its travel, so that should give approximately the correct rotor speed. Next it was time to check everything over once again and get the model charged ready for the test flight.

FLYING

I waited for some time before the weather was suitable for the first outing, but at last my patience was rewarded. I did a range check just to be sure that everything was operating correctly in the radio department. I then filled the fuel tank, primed the engine and got it started. As always the Zenoah burst into life and was soon ticking over smoothly. Again I did a radio range check. This time it was with the engine running and a friend of mine poised with his finger on the engine kill button just in case. I need not have worried, as everything seemed fine, so it was time to bolt in place the rotor blades, ready for that first flight.

I moved the model out to a safe distance from the pits and after again checking the radio I started the engine. Once I was standing behind the model I gradually started to open the throttle and get the main blades turning. It was at this point that you become aware of just how big this model is, even for me who am used to flying large machines.

As the rotor blade speed increased I became aware of the Bell becoming light on the skids, but the blades were not going fast enough. A quick adjustment on the throttle and pitch curves soon had the rotor speed up at about 900 rpm. A little more pitch and the Bell lifted into the air. A small amount of back cyclic was required to get the model hovering almost hands off. I noticed the tracking was not quite as it should be. There was a small amount of vibration on the horizontal tail fin so the model was landed and the tracking adjusted.

Adjusting the tracking takes longer than you might think as stopping that rotor disc certainly takes some time. Once the tracking was adjusted the model was once again lifted into the hover, where it stayed for the remainder of the flight, allowing things some time to bed in.

On the second flight I tried some slow lazy eights trying to get used to the machine. It was probably at this point that I decided that perhaps my first choice of rotor head was the right one for me but I tried to get

John White's beautifully crafted Bell 47 scale cockpit, the pedals, cyclic stick and collective lever all move following the Tx control and the pilot's head rotates with yaw control

Drive is taken from the clutch to the mechanics by a toothed belt and this large pulley is simple and efficient

Everything about the Bell is big and simple, so maintenance should be straightforward

RIGHT: The full size Bell 47G coming to a halt, not a sight you see every day

LEFT: The Vario cockpit details are certainly a good start towards a scale like interior I must find time to do more

ABOVE: The flybar rotor head makes the model fly how I like it

RIGHT: Another familiar component is the metal tail rotor gearbox

used to the model for several weeks and even fitted a device to help with the feel of the machine. Eventually after about 5 or 6 weeks of flying the model in different weather conditions and varying amounts of wind, I decided to replace the rotor head for the flybar head.

Sometimes you just know when something is right and as soon as I lifted the Bell up into a hover with the flybar head I was sure that this was the correct choice for me. I was soon flying the model around in large low slow circuits and all this before doing the important front cover pictures. The only thing I have done to this model is to start adding some cockpit detail, although compared to the cockpit made by John White of Vario UK where the pilot and controls move with the radio, mine is very basic. The trouble is, I cannot do the cockpit as I am always flying the model!

CONCLUSIONS

At first glance the Vario Bell 47G III looks like it will be quick and easy to build but there is a lot of work in this model to get it looking really good. The cabin requires a lot of time and effort to get it to fit properly, as does the floor and rear wall. The large glass bubble was much easier to fit than I had anticipated it would be and being able to get all of the radio tucked away underneath the floor allows you to fit out the cockpit with as much scale detail as you like.

Mechanically this model should prove to be bulletproof, with many items being taken from the well-proven R22. The 23 cc Zenoah supplies ample power to fly the model in a scale like manner. Remember the full size was not the most powerful of machines. Everywhere I have taken the Bell, it has certainly been the centre of attention with people of a certain age. It is instantly recognizable and when I fly it, a crowd soon assembles to watch.

Personally I am delighted with this model and although I am using a standard flybar rotor head it does not detract from the overall appearance of the model.

VERDICT

The Bell 47G is most certainly an iconic helicopter that almost everybody instantly recognizes. Although this model might appear to be no more than a sophisticated pod and boom machine it is much more than this. The full size has lots of character as does the model and you need to devote time and patience to it to do it justice. Sometimes you instinctively know when something is right and this is one of those times. Vario have most certainly created a model that they should be proud of. MHW

Spec

PRODUCT:	Bell 47G III
MARKETPLACE:	Serious scale model builder
MANUFACTURER:	Vario Helicopter, Seewiese 7, D-97782 Gräfendorf, Germany. www.vario-helicopter.de
UK IMPORTER:	Vario UK Sales First Floor, 229-231, Church Lane, Lowton, Warrington, Cheshire, WA3 2RZ Tel: 01924 273888 Fax: 01924 273886 www.vario-helicopter.co.uk
MAIN ROTOR DIAMETER:	2360 mm
OVERALL LENGTH:	2,370 mm
ALL-UP WEIGHT:	13.5 kg
CONTROL REQUIREMENTS:	5 servo heli radio (4 servo eCCPM) and gyro
POWER REQUIREMENT:	23 cc Zenoah petrol engine