VQ A-26K Counter Invader

by Dean Williams

Let me set the scene for you with the following few words. Twin-engine, heavy-metal warbird with camouflage finish and wing-tip tanks. Even now, just reading that, puts my pulse rate up a few BPM! How is your's going? These words describe the VQ Models A-26K Counter Invader ARF kit. It's actually based on a kit that has been around more than a decade, but what has changed recently is the kit has undergone some substantial cosmetic surgery for a freshen up. The new Southeast Asian jungle camouflage is the most obvious change from the previous "vanilla flavoured" finishes. Further there has been a slight structural update with a re-design of the cockpit area to provide an access hatch, notionally for installing electric flight batteries, and a battery tray mounted in the fuselage under the wing. This is my first review of a VQ kit, and as part of the process I did some reading of previous reviews of VQ kits in RCM News and in each there was praise for design, build and flight qualities, so my expectations were high.

The kit

First impressions are dominated by the covering, it's artfully decorated with printed matt camo finish and panel lines, it feels tough and a little heavy (compared to most coverings) as it's not unlike self adhesive book covering. The detailing might be a little over the top for some tastes, but I think it's all part of the fun. Inside the fuselage, the covering has the habit of collecting debris where the sticky backing is exposed by the cut-outs in the wood. There were no wrinkles or bubbles but should they develop, they can be removed with very gentile heat from a heat gun, but be aware, an iron will tend to rub the paint off, indeed the paint can scratch off with normal handling. Under this skin, the wood work is also artfully executed. The fuselage is built up from cleanly laser cut and extensively lightened interlocking ply and balsa that's all well glued and feels quite light for its size. The plastic guides for the rudder and elevator pushrods are installed, as is a pilot figure in the cockpit. The wings have a thick (17%) semi-symmetrical section and are fully sheeted (no starved horse look) except for some lightening holes in the lower sheeting along the trailing edges. The ribs and the frames for the nacelles are lightened ply with the front of the nacelle frames fuel proofed with grey paint. The tail feathers are built-up open frames with a flat section, but with tapered control surfaces. It was apparent that a lot of thought was put in at the design stage to reduce weight in the back end as twins are notorious for needing extra nose weight. All the control surfaces were pre-hinged (a nice time saver) with pin hinges for free movement and a good tug showed they were securely glued.

The kit included a number of nicely moulded components including fibreglass motor cowls and nose cone, clear lexan cockpit and observation canopies and ABS covers for the nacelles, wing tip tanks, elevator fairings and pushrod exits. All these come pre-painted, though the colours don't quite match the covering in a few places. The hardware pack features the usual fasteners, control linkages, fuel tanks and hardware, plastic spinners, nylon motor mounts as well as ply servo mounts and nose landing gear doors. There is fixed landing gear featuring mounts and coil sprung legs and lightweight foam wheels. To finish off there are the self adhesive decals, ply antennas and eight plastic moulded .50 calibre machine guns. The black and white illustrated and annotated instructions provided plenty of guidance in most areas but none in a few. However an experienced builder will be able to fill in all the blanks.

Power system

The instructions recommend fitting 0.25-0.32 two-stroke or 0.40-0.52 four-stroke glow engines. The box top goes even further to recommend electric motors of 800 watts rating. In choosing a power system, keep in mind prop size is restricted to a maximum diameter of 11 inches given the spacing between the nacelles and fuselage. For this project a couple of Scorpion 3020-12, 1080 Kv outrunner brushless motors where utilised, specifically because they have a good power to weight ratio (156 g and rated to 800 watts), proven performance (I have used one to ably pull around a 2.6 kg low wing sport model for years), and I had a matching pair on hand for just such an occasion. These were fitted with 3-bladed 9 x 7 props, and controlled by 60 amp SJ Hawk HV ESC's that were programmed for 5 degrees of timing advance as advised by Scorpion as well as soft low voltage cut-off (minimise the risk of asymmetric thrust). The actual cut off voltage was set at 12.5 volts as each motor would be run on a 4S RFI 30C 3,300 mAh LiPo pack. The throttle ranges on each ESC were set so the motors started together and ran synchronously (within 200 RPM) through the range of throttle stick movement. The red plastic spinners supplied in the kit looked very much out of place and were substituted with domed aluminium collet prop adapters that were painted with matt black enamel to look much more in character.

Whilst the battery hatch under the cockpit was a nice idea, in practice, the fit was too tight. So instead, the batteries were located out to the nacelles behind the motors. The meant making up a bridging circuit to pass through the centre section of the wing to equalise the voltages between the two battery packs and ensure each motor would see the same voltage (and run at the same revs) throughout the discharge cycle. In testing, both ESCs hit their low voltage cut-off at exactly the same time which was good. The bridge was made up from 12 GA wire, with a trio of low ESR electrolytic capacitors (35 V, 220 uF Jaycar part number RE6336) soldered between the positive and negative wires at equal spacing. These

SPECIFICATIONS

Wingspan	**176.5 cm (69.5 inch)**
Scale	**1/12th**
Wing area	**50 sq dm (777 sq in)**
RTF Weight	**5,100 g (11.25 lb)**
Wing loading	**102 g/sq dm (33.3 oz/sq ft)**
Power	**1,566 watts (2.1 Hp)**
Power loading	**140 watts/lb**
Speed	**130 Kph max. 90 Kph Cruise**
Airframe	**ARF balsa ply printed film covered**

Hardware used

Motors	**Scorpion S3020-12 (Kv = 1080)**
ESC's	**SJ Hawk 60HV**
Batteries	**RFI 3,300 mAh 4S 30C LiPo**
BEC	**Castle Creations CCBEC**
Props	**Master Airscrew 9 x 7 three-blade**
Radio	**Hitec Aurora 9 TX and Optima 9 RX 2.4 GHz**
Servos	**Hitec HS-5485HB x 4, HS-225MG x1**
Retracts	**E-Flight 60-120 size electric trike 90 degree**
Struts	**VQ Oleo straight (mains) and offset (nose)**

suppress voltage spikes induced along this extra 45 cm of wiring. Such spikes have the potential to overload and destroy the speed controllers. Not good.

This wiring was also used to provide a means of getting power from the flight batteries to a Castle Creations CC-BEC mounted in the fuselage to then supply power to the radio gear. An EC3 plug set was wired close to one end of the bridge so each drive can be isolated until they are connected to (and disconnected from) their respective batteries. This is to stop one of the exposed (male) Deans plugs going live in the process. On the bench, 30 seconds into a full throttle run from a full charge, the motors would spin the 3-bladed props at 12,800 RPM on 14.6 volts and each pull 54 amps for 788 Watts per side. A good outcome that was pretty darn close to the quoted performance requirement.

Other bits required

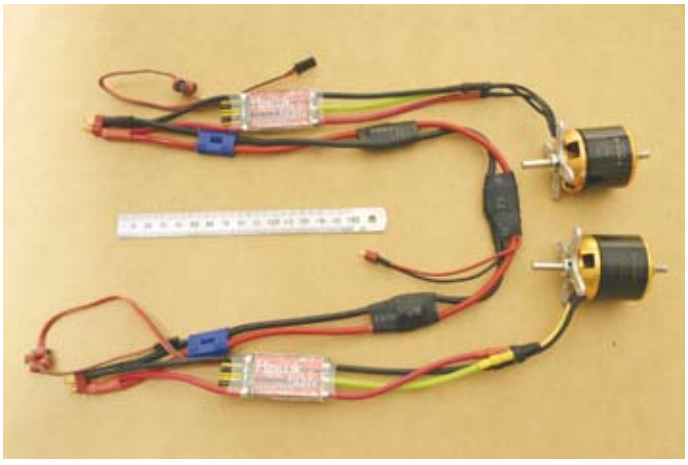
Additional items required include a 4-channel radio system as a bare minimum but more channels will do a better job of it. Standard servos fit all around, the number will depend on power system (6 for fuel or 4 for electric) and an additional mini-servo can be employed for independent nose wheel steering (metal gear recommended). A few extension leads will also be needed. Retracts are optional (but strongly encouraged), either air or electric to suit a 5 Kg model.

Given the size and configuration of the model, a cradle to rest it in whilst working on it (particularly in the latter stages of construction) and assembly at the field is good idea. In this case, my usual preference for a styrofoam vegie box wasn't going to cut it so a timber (pine) cradle was knocked up.

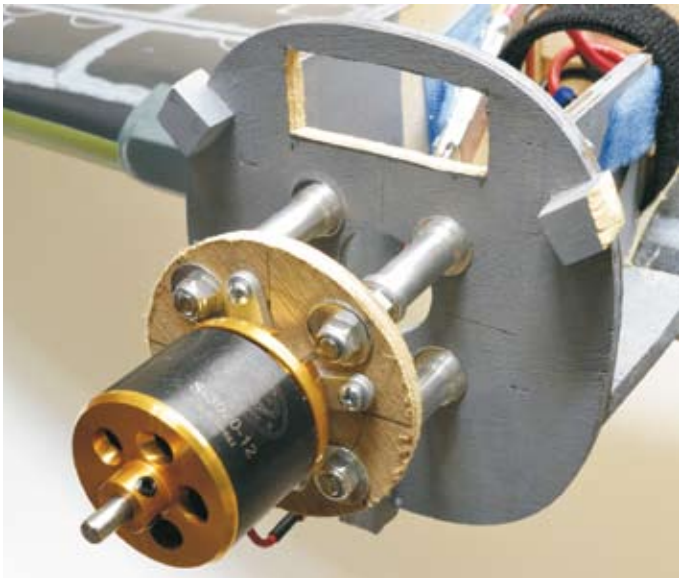
It was designed to hold the Invader on its belly for mounting the wings and checking retract functions and on its back for battery swaps. It can be pegged down so it will also restrain the Invader at full throttle.

The build

To start, the first step of the building phase was deferred, this was the joining of the wings. Keeping them separate makes fitting all the hardware much easier, starting with the aileron servos. These were easily mounted on the rails attached to their respective hatch covers. These rails were only butt glued to the covers at the factory with no additional bracing, so for extra hold, the rails were secured with small screws. Each servo needed a 30 cm extension lead and the leads were drawn through the wing with the handy factory fitted draw strings. Fitting the control horns and linkages followed standard procedure, except Z bends were employed instead of the adjustable keepers on the servo arms, providing a reliable and low maintenance substitute.

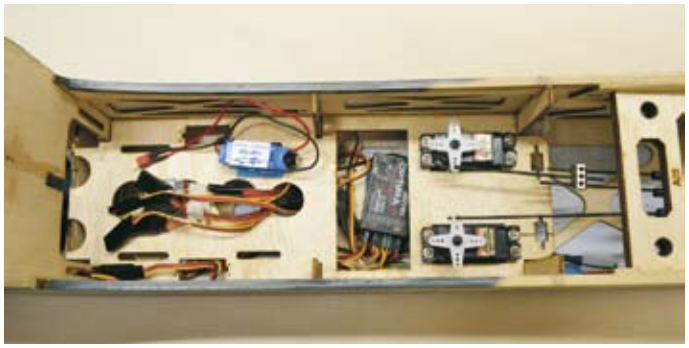


Powerful but light Scorpion motors and SJ Hawk ESC's provided plenty of urge on 4S LiPo's. Two systems bridged at the battery leads ensure the battery voltages are balanced throughout the flight. The bridge featured electrolytic capacitors and , wiring to tap power off the system for the radio via a Deans micro connector

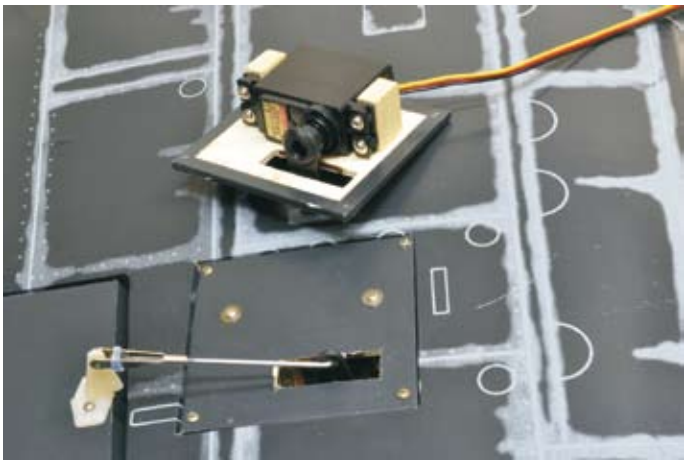


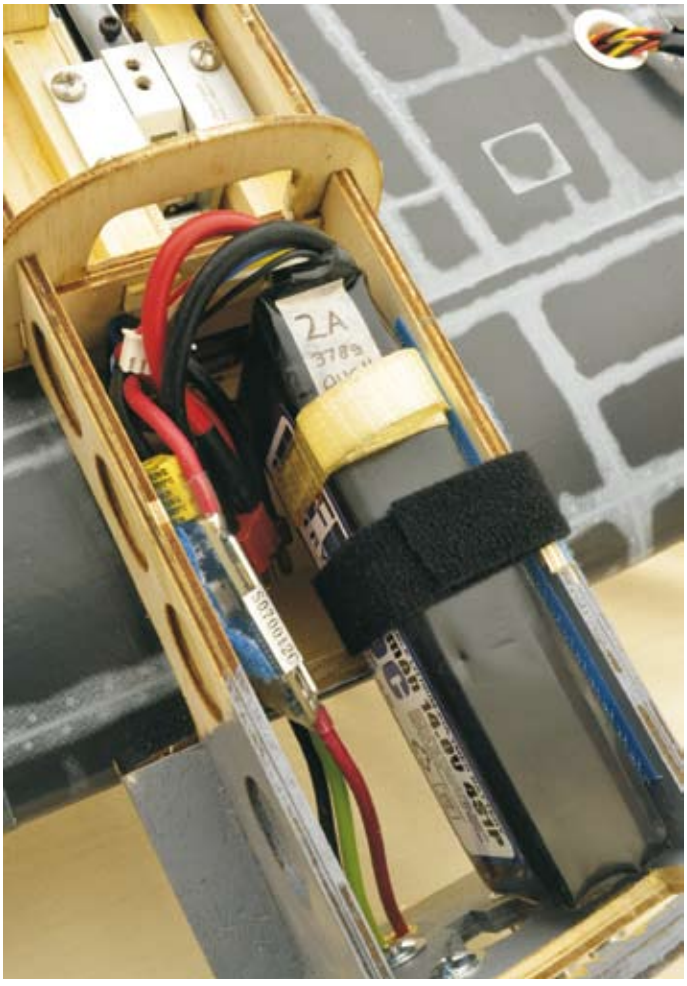
The Scorpions were screwed to 6 mm ply mounts, which were in turn bolted to the firewalls on standoffs. A hole was cut in the firewall to let cooling air into the battery bay

When mounting the motors, the instructions recommend a distance of 104 mm between the firewall and the front face of the prop adapter to clear the cowls, though I found 100 mm to be plenty. This meant using standoffs (not supplied) to mount the motors. The radial mounts of the Scorpion motors aren't very meaty so were not suitable to be directly mounted to the stand-offs. Instead, supplementary mounts were simply cut from 6 mm ply using a

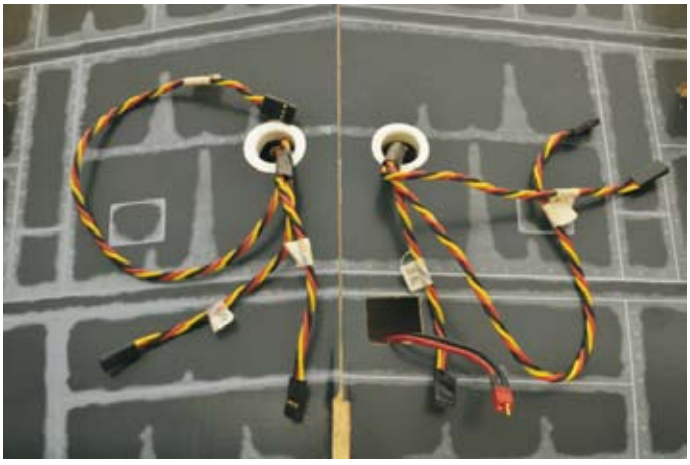


With plenty of room available, the standard sized radio gear was easily installed in the fuselage under the wing. The Castle BEC sits on the redundant flight battery tray





Fuel tank bay directly behind the firewall provided plenty of room to house the LiPo battery and ESC



Above right; mounting rails were spaced for standard size aileron servos and small screws were used to provide extra grip as the rails were only butt glued to the covers

Spaghetti anyone? The extension leads exited the centre of the lower wing skin through neat grommets. Each was labelled and later colour coded with tape to avoid mixing them up when connecting them to the receiver. Power was fed to an external BEC from the wiring running through the wing centre section that linked the two flight batteries

hole saw. The motors were attached to these, and these in turn were bolted to the firewalls using 3/16 mushroom head bolts, nyloc nuts, aluminium standoffs and plenty of washers to prevent crushing the ply. There was no right or down thrust built into the firewalls, and whilst a little bit of me wanted to put at least a dash of down thrust in, I did resist the urge.

Some creative thinking was needed on how to mount and access the ESC and LiPo behind the firewall. The former was easy, both could be held to the sides of the tank bay with Velcro, with an additional Velcro strap to hold the LiPo. Getting easy access for battery changes meant cutting and forming a hatch from the lower nacelle covering. The mouldings were tough enough to hold their shape when the 14 x 7 cm hatches were cut free with careful strokes of a sharp scalpel. The openings were lined down each long side with thin ply for the hatches to seat, whilst short lengths of bamboo skewer were epoxied to the front of the hatch to hold it down. Commercially available spring loaded latches were used to hold the rear of the covers with the aid of a ply plate glued to the rear of the opening and drilled to arrest the latch pin.

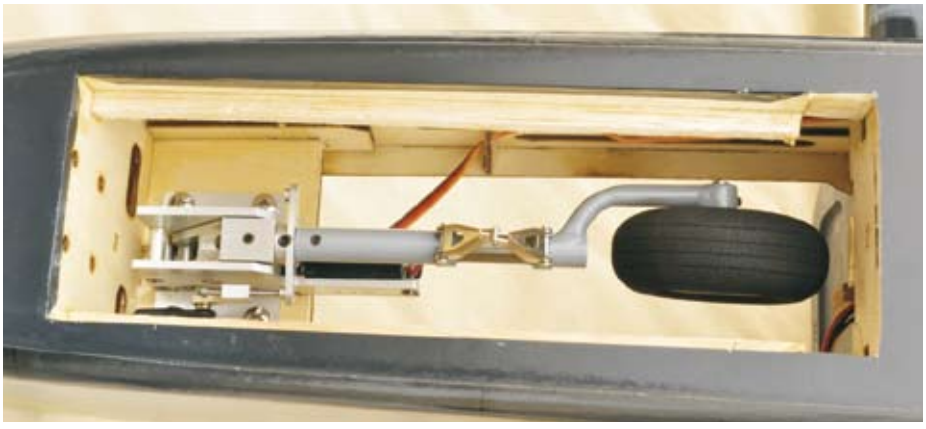
So the two power systems could be connected by the bridging circuit, holes were drilled through the inner sides of the tank bay so the wiring could pass through the rib openings in front of the main spar. A hole was cut in the lower wing sheeting so the wire to connect the BEC could pass through into the fuselage. A large hole was also cut in each firewall to let cooling air into the battery bay, the warm air would escape out the landing gear openings.

E-flight 60-120 sized 90 degree electric tricycle retracts were chosen to lift and drop the wheels, and provided for much simpler installation and maintenance than air retracts. These were dressed up with a VQ Models offset sprung oleo strut on the nose gear and VQ Models straight oleo struts on

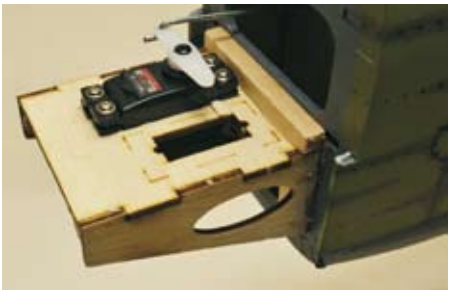
The main retracts, struts and wheels fitted nicely within the nacelle formers with very little work

Before – the stock mounting rails for the main landing gear looked a little light-weight for a 5 Kg model

After – the main landing gear rails were braced using 12 x 20 mm pine stock



The opening for the nose gear in the fuselage belly needed lengthening rearward by about 15 mm to accommodate the VQ nose gear strut. The retract mount was also beefed up



A mini Hitec metal gear servo was used for nose wheel steering and was neatly mounted in the nose on the supplied plywood frame.

the mains. Fitting the struts was very easy, only the mains needed to be drilled out to accept the 5 mm mounting pins which were cut from the wire struts supplied with the retracts. The hubs of the kit wheels also needed drilling out to accept the axles, and spacers were needed on the axles to keep the wheels from rubbing on the struts. Flat spots were ground on the mounting pins and axles where they were held with grub screws, and the grub screws were held with thread locker. The mains needed to be oriented with the scissor arms forward of the struts (not scale) so the strut retaining screw would not jam on the retract motor when the legs were retracted.

Before fitting the retracts, their mounts were beefed up to cope with rough field operations. The mounting rails for the mains were braced with 12 x 20 mm pine stock, whilst a plate of 6 mm ply was added to the nose gear mount. The retracts were then screwed in place, the final positioning of the mains was determined by the opening in the lower nacelle covers. However, the openings still needed some scalpel work to enlarged them slightly to provide clearance for the struts and wheels during operation. There are no doors to hide the mains when retracted which is quick, but not entirely neat.

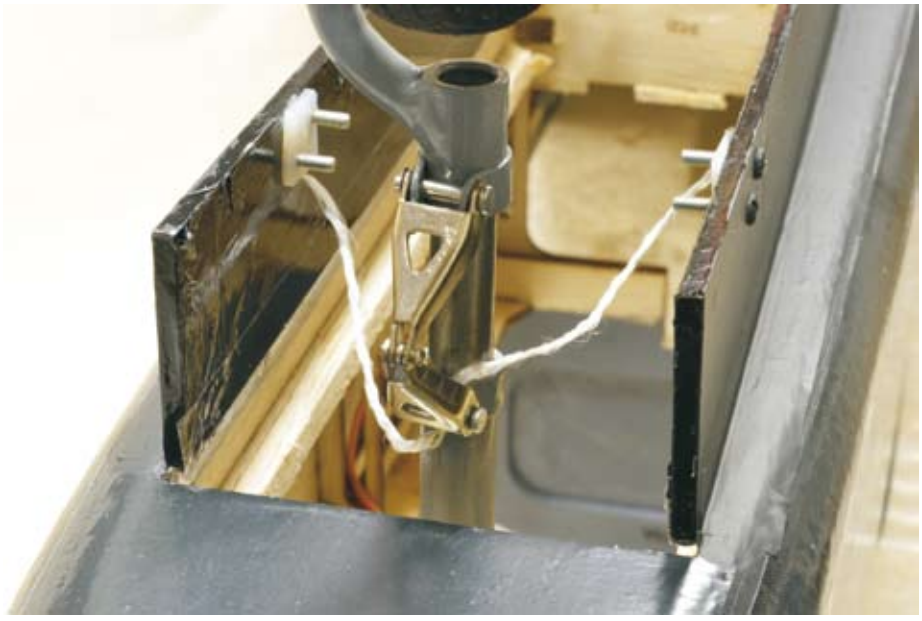
Fitting the fancy strut meant the opening in the fuselage for the nose gear needed lengthening to clear the wheel as it retracted, this was fairly basic wood work. This also meant new longer gear doors needed to be made up from 6 mm ply. The instructions make no mention of how these doors are to be hinged or operated. The approach taken to open the doors used a set of Dubro control horns, mounted on the inside at the rear of the doors so they over hung the hinge line. These were joined with a rubber band tensioned so there was enough spring to pull and hold the doors open, whilst not so much tension that the retract could

Special thanks to Ark RC for supplying the Scorpion motors, www.arkrc.com.au

horns are located low enough so the rubber band tied between them pulls the doors open, not closed. The availability of different holes in the control horns to tie the band means the tension can be finetuned between closed an open

A draw string looped through the nose gear strut and clamped with control horn backing plates allows the doors to be pulled closed at the gear retracts. Clamping the string means its length can easily be adjusted in small increments to get the closure just right

not pull the doors fully closed. To pull the doors closed, a draw string was threaded through the scissor mechanism of the strut and fastened to the inside of the doors using the backing plates from the control horns. Because the backing plates were clamped onto the draw string, it was possible to make fine adjustments to the length of the string to get the closure just right. The backing plates were positioned so the string was loose when the gear was down. The doors were hinged with pin hinges, hinge tape was tried but the tension of the rubber band kept peeling the doors off.



With all the hardware installed, the wings were joined using the supplied dihedral brace and plenty of PVA glue and after curing the joint was neatened up with the provided strip of covering. The wing mounts to the fuselage with a pair of nylon wing bolts at the rear and a tab at the front that slips into a slot in a ply fuselage former. The slot needed opening up a bit so the wing would seat neatly in its saddle. The amount of wood restraining the front of the wing seemed a little light on. However, as most of the flying and landing loads are directly on the wing, it should be adequate. The fuselage over wing cover was meant to be glued to the wing. This would mean the wing bolts would need to be accessed through ugly holes in its spine. For a neater finish, the cover was modified to be removable and held with dowel pegs at the rear and a screw at the front, accessed through the removable cockpit.

Rather than glue the over wing fairing on, it was made removable with pegs at the rear and a screw at the front. This provided much easier access to the wing bolts and without cutting holes in the fairing to access the bolts, a neater look overall was achieved

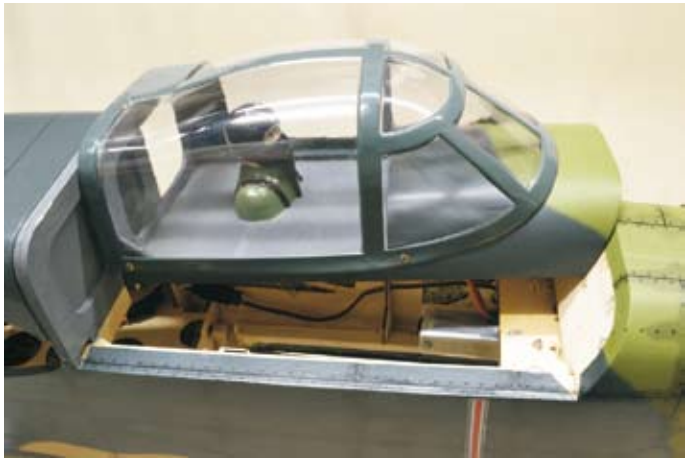
The wing was used at the reference for setting the tail plane halves which neatly glued into their respective slots in the fuselage, formers inside the fuselage helped set the dihedral in the “horizontal” stabilisers and these were locked down with the fin. Standard digital servos (Hitec HS-5485HB) fitted neatly into their respective mounts for elevator and rudder control and their pushrod guides were trimmed and secured with 5-minute epoxy. Fitting the control linkages again followed standard procedure, with the adjustable keepers being substituted with Z bends on the servo arms.

The elevators operate via a spit pushrod that utilises a 3-way connector where after adjustment, thread locker was used on the grub screws. Nose wheel steering was handled by an analogue Hitec mini metal geared servo (HS-225MG) that was located on the provided plywood mount in the nose, driving the steering arm via a short pushrod. This was operated off its own channel that was mixed to the rudder, allowing it to be independently and easily adjusted for trim and throw and deactivated when the gear was retracted so there were no issues with binding on the steering mechanism. A Hitec Optima 9 2.4 Ghz receiver was mounted with Velcro low in the fuselage just forward of the tail servos. Only 6-channels were used as the ESCs, ailerons and retracts where paired up through Y leads. The Y leads were labelled and colour coded with tape to avoid a mix up when attaching them to the wiring in the wing. The positive (red) wires on the ESC Y lead were cut and insulated to disengage their BEC function as these can't be run in parallel. There was plenty of room to Velcro mount the Castle Creations CC-BEC on the redundant battery tray and this was programmed to feed 6 volts to the receiver.

The moulded nacelle covers fitted easily and the paint job matched the covering pretty well, although the panel lines were embossed rather than "inked" like the covering

The fibreglass fuselage nose cone featured

The nacelle mouldings were thick enough to cut and make hatches for access to the flight batteries. Sprung latches at the rear provided quick and easy access



The cockpit hatch was held at the rear by tabs and strong magnets at the front for easy and quick access. However, it wasn't needed for battery access. It was nice to see a pilot figure installed at the factory

Some 4 mm balsa sheet glued into the nose cone provided support for the machine gun barrels which were glued with 5 minute epoxy

Eight, 0.50 cal machine guns provided in the kit looked good. Shame only the

embossed panel lines and these were given a bit more definition with a fine pointed felt tip pen to better match the covering. To install the 0.50 Cal. gun barrels, a section of 4 mm balsa was first epoxied into the nose cone as a support, leaving clearance for the servo tray. There were dimples in the nose moulding to show where to drill the barrel holes, and these were drilled out on a drill press (also drilling through the balsa support) to ensure the barrels would mount evenly and square. The barrels were then cut to length and epoxied into the nose cone. The nosecone in turn was mounted to the fuselage and held with 4 screws.

The engine nacelle covers were offered up to the wings and fitted with only minor trimming around the leading and trailing edges. These were held with multitudes of the supplied small screws. The rear cones were glued on and there was a slight mis-alignment in the paint finish between these and the covers. The mounting blocks for the motor cowls needed trimming and once the cowls were correctly located relative to the prop adapter, they were drilled and secured with screws. The wing tip tanks fitted neatly and were glued on with canopy glue after stripping the covering to expose the bare wood along the glue line.

Finishing off

The moulded fairings to complete the tail planes and pushrod exits were glued in place and these and the plastic control horn fittings were given a lick of paint to blend them into the covering. This was done using Revell matt enamel No 69 for the dark green, Humbrol matt enamel No 80 for the light green and Revell matt enamel No 9 for the matt anthracite (black), the latter was a little too matt. A semi-matt might have been better. The decals stuck well but they had a glossy finish in contrast to the matt finish of the covering and

A simple pine cradle was made so it could be held stable while the wing was installed, retracts cycled and flipped inverted to install the battery packs

fibreglass pieces. The ply antenna arrays meant for the spine were not fitted as they could quickly be broken off during normal handling.

With the airframe assembled and all the gear on board, the balance was checked in wheels up configuration. Lateral balance as fine, but to my surprise it was nose heavy so 40 g of lead was glued into the tail and this brought the balance back to spot-on the recommended point of 110 mm from the leading edge at the fuselage. Due to the gear retracing aft this was checked with the gear retracted. *(Us non-electric afficianados, "petrol heads", should check with tanks empty. ED)* People *Checked with gear up or down? Ed)* This made the ready to fly weight 5.1 Kg, exactly as specified on the box top, so that was satisfying. The controls were set up by the book (13 mm each way on elevator and ailerons and 20 mm each way on rudder) with 30 % expo. Higher rates (about 150% of the specified rates) were set with 45% expo.

The build was a little more demanding and a lot more time consuming than the average ARF model, but this is not your average ARF and the builder must expect to put in more time and effort to assemble and fit it out. The payoff is that satisfying feel of completing a model that will stand out and attract more attention than your average ARF.

Flying

Thinking about it, the airframe is really just a high wing model with a bit of dihedral, large tail surfaces and a tricycle undercarriage. Sounds a lot like a basic trainer, except perhaps for the high wing loading, retracts and twin-engine stuff! At the field, the cradle makes fitting the wing easy and changing the batteries goes quickly and smoothly. I will say that the first outing was, ambitious to say the least. The wind was too strong and whilst the Invader was controllable, the landing proved challenging and damage was done to the landing gear and retracts, requiring a new retract

Static photos taken by Dean Williams, flying photos taken by Ricky Price. Pilot was Dean Williams

unit and struts. Despite this, all the wood work survived intact. Live and learn.

The next outing was quite a contrast, no better conditions for testing a new model could be asked for, bright sunshine, and light wind straight down the strip. Into wind take-offs needed very little rudder correction and elevator input was only required when it looked like it was ready to unstuck after about a 30 to 40 metre run. This makes for a nice light work load to start with. It's happy to climb out steeply but that doesn't look right so a gentile climb is usually executed at not much over half throttle. (*Steep climb after takeoff is not recommended technique when flying a twin. Even electrics. Ed)*

The trims only required minor tweaking and there was very little pitch change in response to changes in throttle, so no need to fiddle with down thrust. The controls felt good on low (the recommended) rates with plenty of authority and no twitchiness. Rolls were about 1 per second and a little barrelly, whilst it will pull a good sized loop at full throttle, with a gentile pull out (see comment about wing attachment). Inverted flight needed very little elevator input to keep the nose up. It does need a steep bank and a good dose of elevator to bring it around in a turn, which looks very fighter-esque. It's responsive to rudder and will readily drop the inside wing, so to achieve flat turns it needs a good dose of opposite control.

It cuts a striking and somewhat menacing shape in the air, particularly as it banks over to show off that aggressive planform. There were no problems with orientation, the sandy coloured patch on its back particularly contrasts with the black underside, the wing tip tanks also help. Its signature manoeuvre is a low level strafing run to unleash the awesome hitting power of those nose mounted machine guns. It felt quite slippery through the air, from the Hitec GPS and allowing for wind, cruise speed was about 90 Kph and top speed was about 130 Kph. With power off it enters a nice shallow, but fast glide slope. Surprisingly, it didn't seem to have that locked in feel as despite its weight, it got bumped about a bit in the thermally air.
As with most warbirds, landing is about elevator and throttle management. In fair conditions, it's not too hard to achieve a nice flare and gentile touchdown as there was plenty of stability and elevator authority. It does carry quite some momentum, so touching down with plenty of room at end of the strip is a good plan, as is being easy on rudder until the speed bleeds off. If a landing approach is not shaping up too well it's better to execute a go-around rather than dump it in as it won't like that. After a constant diet of tail draggers of late, I had forgotten how pleasant the ground handling of a tricycle undercart was. Flights were typically about 7-minutes of mostly cruising with some hooning and this used about 2,700 mAh of the 3,300 mAh packs, which leaves a good safety margin. After a typical flight, the power system components were just 10 to 15 degrees C above ambient, no stress there. Whilst flight testing had a bad start, what followed was a delight thanks to what felt like a very well sorted airframe.

Conclusion

I am very glad this kit has stayed in production long enough for electric flight technology to develop to a stage where they can be combined with ease and without compromise. I can't see why anyone would now go glow on this kit, the electric version delivers plenty of performance without the mess and stress of running twin fuel.

The biggest improvement this upgrade delivers is all about the new look which is striking on the ground and in the air. Whilst it needed a few small tweaks, structurally it comes across very well and assembly progresses quite smoothly. When it comes to flying, this kit has all the basics spot on right from the start which is great for confidence and enjoyment. The build and flying are not for the beginner or novice, but if you have had a good feed of fast single engine warbids and want a new challenge and a new look, this is a great option for a change up. Dean Williams

The VQ A26 Invader is distributed to hobby shops by The Hobby Specialists. www.thehobbyspecialists.com.au