KYOSHO 46VR set-up and modification review.

After the whole mechanics was assembled I found that it was kind of small for a 46 class helicopter. Even a 32 nowadays would be bigger then the VR. Fitting a 46 engine into such a small frame would mean the VR would be one heck of a fast machine, and that also mean the drive train would be required to be very precise cause any small amount of runout would make the helicopter shake like hell. I checked the mixing arm movements and found that to be smooth, maybe due to the use of ball bearings in them. Push-pull controls were used on elevator and aileron controls. The pitch mechanism of the VR was the "fixed swashplate type", i.e. pitch was not controlled by the swashplate moving up and down. Pitch changes were controlled by a pitch control arm that linked to a slider sliding up and down, and this collar was connected to the mixing arm above the swashplate by using two metal wires that went into a slot of a plastic sleeve that slot through the top bearing and swashplate. This control mechanism was simpler than the one used by Kalt Baron, cause there were no moving parts inside the main shaft. The black metal wires for pitch controls were flimsy and the slot of the plastic sleeve allowed play for them. Also, the pitch control slider was made in plastic, and the joint between the slider and the pitch control arm was connected by a linkage ball from the arm sticking into the cup. This would wear the plastic cup of the slider very easily as this linkage point takes a lot of stress.

Servo installation comes next, and it was also a no-brainer. I use JR DS8201 on the cyclic, 511 on throttle and a Futaba 9203 on tail. Gyro was a prototype heading lock one. When I make the pushrods, I found that all pushrods from the servo discs used "Z" bends instead of ball joint. "Z" bends gives slops, but Kyosho elected to use it to save cost I guess. All pushrods from the swashplate to the head had ball joints on both sides. The rudder linkage stretched from the front of the helicopter to the rear, and in the middle there was a "L" piece of plastic to joint two pushrods together. This design gave danger to loosing tail control if the collar of the plastic piece came loose, especially for me using a head lock gyro that worked the tail very hard. I kept that in mind and will think of a way to fix that later. The manual clearly showed the position of the linkage mounting point from the centre of the servo discs/arms. After all servos and pushrods were mounted, I set up the radio for the correct movements and ATVs. All servos seemed to move smoothly. then I routed all the plumbing of the servo wires and mount the receiver and battery pack. Setting up the Concept was very straight forward and all I had done was to follow strictly the recommended data supplied by the manual. One thing to note though, when I was setting up the pitch curve, I found that the pitch mixing base slide downward for positive pitch, and upwards for negative pitch. This was different compared to other helicopters, cause most helicopters used "up for positive and down for negative" way of mixing. At first when I found that out, I thought I had assembled something wrong, but all I did for assembly was just to put on the head and fix linkages. I trust Kyosho did assembled it the right way. I fiddled with the head for sometime, pondering to change it back to up for "positive pitch, down for negative pitch", but failed cause there was no way to do that without a major surgery. Then one phone call to a local Concept expert confirmed that what I had was right, and that brushed my worries away.

Assembly of the wood blades was very easy, and the manual showed clearly to first cut out the covering under the plastic blade root, glue the roots to the blades and screw fix them. These blades were 525mm length and they were kind of short for a 46 class helicopter. The blades were symmetrical but I felt they were too soft for real use. I use them nevertheless cause I could not found other 525mm blades in the market. After I assembled the blades I checked their balance and found that one of them was way off. I took some time to balance them.

The single task that consumed most of the time was cutting the canopy and decals. The canopy was construct of "plastic bottle" material, and that meant stickers will not adhere very good to it. The shape of the canopy was sleek, and I felt the shape of it was like the head of the Alien in the move "Alien". I found the decals very thin and sticky, but even this kind of decals they could be peeled off easily from the canopy. One good point to note was the mounting of the canopy. The front of the main frame had a plastic "torque" that slipped into a slot in front inner side of the canopy, and on the back of the canopy there were two holes to be fastened to the mainframe through a spring loaded mechanism that locked the canopy very secure. No fuzzy O-rings and screws, it was the best canopy mounting design that I've ever seen.

After everything was mounted, I checked the CG of the helicopter, only to find that it was tail heavy. I then used a 2,000 mAh battery pack to put more weight on the front. After using a bigger battery pack, the CG was now a bit head heavy. With everything ready and checked, I waited for the test flight to come.

First test flight

On one sunny day I took the test machine to the field for flight testing. For the first tank, I filled it with Cool Power 15% and started the engine. After starting the engine, I let it ran idle for the whole tank to break-in the engine. The mixture needles were at 3 turns on idle needle, and 2 turns on the main needle, which was strictly according to the operation manual of OS engine. For the second tank I took it out for some hovering and trimming. When I increased the throttle, the Concept first seemed to be very sluggish to hover, and I had to increase the throttle to topmost position for it to barely leave the ground. At first, I thought it might due to mixture being set up too rich, so I tried to lean it down. After leaning the needles and increased the throttle, the engine sound was more powerful, but the helicopter's ascending performance was just the same as before. Some "old birds" at the field said there might be something wrong with the clutch, cause it looked to them like the clutch wouldn't engage properly. After several tries, all the people at the field started to smell some burning smell emitted from the Concept. I called a quit and stopped the engine. When I took the Concept back to the field stand I saw smokes came from the side of the muffler, a sign of the engine running very hot. The Concept did not even finished half a tank of fuel.

Discovery after first test flight

After the test flight, my friend Ming helped me to look for the problem. He disassembled the engine and clutch in order to check for the reasons of clutch slippage. We found that the clutch shoes had burnt marks on the leading edge of each shoe, and the inner lining was clearly burnt with marks. He then checked the clearance between the clutch shoe and lining and found that it was 0.7mm, which was normal amongst clutch helicopter designs. However, Ming commented on the design of the clutch itself. The clutch was a machined item, with the whole clutch in solid metal, as opposed to other clutch design that had cavities in the middle of the clutch. He further found that the clutch shoe was in a smaller proportion than other clutch design, so when it was spinning the clutch shoes required more centrifugal force for them to engage to the lining. Ming further expressed that maybe its just my bad luck to have a "lemon" clutch, and I should send the clutch back to Kyosho for replacement and see if the replaced clutch had the same problem.

I then asked around other Concept VR owners in the internet (There were none in Hong Kong at that moment) to see if they had encounter the same problem as I did. I found that mine was the only one that had this clutch problem. However, might that mean the quality control of the Concept VR was in question? Also, what would be the probability of another machine that had the same problem like mine?

I then sent the clutch, clutch bell, and a letter that described what's happened and my findings to Kyosho for their evaluation. Without the clutch, my Concept laid at a corner like wreckage after a crash. What should I do with it before Kyosho send me a replacement clutch? Ming went ahead to hand made a clutch based on his recommendation for testing in my machine, and in just one day's time I had a clutch hand made in T7075 installed. Ming expressed his clutch was based on the exact dimension of the stock clutch, but he used lighter materials to decrease the loading. The hinge point of the clutch shoe, that was the circle opening on the end of the clutch shoe, was now an oval shape to make the release of the clutch shoes easier. Ming said the clutch should required less centrifugal force for it to engage, and the easy way to achieve that was to modify the hole on the beginning of the gap of the clutch shoe and make it into an oval shape so that the clutch could be engaged in a lesser centrifugal force. I put on a new clutch bell ready for the second test flight.

Second test flight

On another sunny day I took the Concept installed with the new clutch to the field. I started the engine and took it out for its second flight. This time, when I increased the throttle, the Concept's clutch engaged ok and as the head speed increased the Concept began to hover eye level at 1/4 stick. Feeling that the engine was running too lean (I did not change the mixture from last time), I rich it a bit. I tried to test the clutch by increasing the top pitch to load up the engine just to see if there was any slippage of clutch at this loading, and there was no problem. I then reset the top pitch and jogged the throttle stick numerous times and the clutch seemed to transfer all energy from the engine to the main blades without slippage. During hovering, I found some vibration on the tail. Guess I had to disassemble it, dial indicate and balancing all major rotating parts to cure this. Cyclic had very powerful response, and it liked high head speed. While hovering the Concept, it looked like holding on the leash of a bulldog, cause it always wanted to leap forward. The engine finished the first tank in about five minutes, which was a bit fast due to the small fuel tank used. For the second tank, I flight trimmed the Concept, just to rudimentary set it up for acrobatics. When I flew circuits with the Concept, I felt the speed of it was very fast. I felt the stock blades were to soft for real hard knocks manoeuvres, so I did not do any high G manoeuvres. For the third tank, I let a famous local 3D pilot to "kick tires" with it. My friend did loop's and rolls with the Concept, and the blades flaps like crazy. He expressed that the blades definitely needed to be changed for serious flying, and he also found that it had tremendous power under its hips, but it would benefit to use a better muffler because the stock one was too restrictive. He did not push the Concept too far, afraid of breaking the blades mid air. My friend expressed that he would also like to have a Concept due to its power to weight ratio, and he felt that with better blades he could do lots of manoeuvres better than with his Ergo. Since better quality blades could not be had at that moment, I spent that day just coasting around with the Concept.

After the second flight, I laid the Concept aside, waiting for some blades and some upgrade parts.

Upgrades after the second flight

While searching for a suitable blade, my shop took delivery of some Kyosho Zeal parts. Since its my policy to test each item that I sell, I installed these parts into my Concept to see whether they were good. These were the parts that I've put on to my Concept:

1. Hatori #449 muffler

I took delivery of four different types of exhaust for the Concept VR - K&S #633, Hatori #449 muffler, Zeal #Z3036 muffler and Hatori #514 header and #444 tune pipe combo. The Zeal one was a very nice looking item, with the word "Zeal" engraved on the side of the muffler. It was a hot item and two days after I had them they were all taken. The K&S one was a very powerful one and from my experience using them I found that these mufflers produce very good mid range torque, but I did not choose it for my Concept cause I wanted to test something new. Likewise, I had a Hatori #444 on one of my Ergos and personally I didn't like them. I chose to install a Hatori #449 muffler. The Hatori #449 muffler featured an offset mounting that let users to gain access to the idle needle for adjustment. For other exhaust options, access to the idle needle would be blocked, which makes it impossible to adjust idle needle without taking off the exhaust. I had been using Hatori mufflers before, and I have high confidence on their quality.

2. Funkey #5366 FRP blade

There were several 525mm FRP or carbon blades that suit Concept, but sadly none of them available here. With great effort, I located two pairs of Funkey #5366 FRP symmetrical blades. These blades were at least better than the woodies that came with the kit.

3. Tobee Craft air filter

I have been using it in every of my OS32 and 46. It was by far the best air filter available and was cheap insurance against dirt and sand in the air. I tried other air filter, but they either choke the engine to death, or would be too flimsy to have any real use.

4. Zeal #Z8022 6mm hex starter adapter

During starting, I found that the starting mechanism of the Concept was not as good as expected. I used an airplane style starter cup on my starter, and when starting I had to "jam" that cup on to the start cone to engage. When there was fuel on the start cone, I had to use more force to keep the starter cup from slipping and minor hydraulic lock would make starting even harder. Also, as I used a Sullivan Pylon Starter, the tail support brace of the Concept was in the way of the top part of the starter, so I had to slant the starter a bit to get the cup engaged to the starting cone. With this Zeal part, I could do away with the start cone and use a regular 6mm one way start shaft to start the engine, and this way provide a better engagement.

5. Zeal #Z3016 Metal cooling fan

I am always a fan of metal cooling fan. This part was a one-piece design CNC machined from aluminium. The instruction that comes with the fan said it was suitable for OS32 class engine, but fitting it into my OS46 provided no problem. There were two shims that comes with the fan to adjust the clearance between the fan and the clutch, I used all two shims but still I found the fan touching the back of the fan shroud.

6. Zeal #Z3035 Tail drive coupling II

This was a part to replace the stock tail drive coupling. The stock one was made of plastic, and was fixed onto the drive shaft by a pin. However, I found that the stock item had a terrible runout and that would lead to vibration, so I opt for a better part. This part had outer shell CNC machined in aluminium, and a Delrin inner sleeve. It used three set screws to fix on to the tail drive shaft, each spaced 120 degree to each other. One of the set screws had a pointed end and it had to be aligned to the hole of the drive shaft that was originally for the fixing pin. At first, I just tightened all screws, and thought that was it, but after fitting the whole assembly into the main frame and turn the idler gear I found the drive coupling had a terrible runout. Later I checked with a dial indicator and showed a 0.1mm runout, and this was unacceptable. Then, I had to loosen the set screws, clamp the whole assembly onto a lathe with a dial indicator to check the runout while tightening the screws. This was a very time consuming process, and it was definitely needed cause the point of having this part was just to eliminate the runout of the stock part. In no part of the manual mentioned that I had to check the runout. After I got the shaft down to 0.02mm runout, I install the part back into the main frame, only to find out another problem of this part.

When I tried to slot the tail with the tail drive wire into the main frame, I felt something was blocking the bull's-eye end of the wire from engaging into the sleeve of the coupling. At first, I thought it was the orientation of the slot to the bull's-eye of the drive wire did not match, but after numerous tries still I could not get them engaged. Frustrated, I took the drive gear assembly out from the main frame, and try to dry fit it onto the bull's-eye of the drive wire, only to find that the bull's-eye was bigger in width than the opening of the coupling! I use a dial calliper and check that the width of the bull's-eye was 7.00mm, while the opening of the slot of the coupling was only 6.35mm. No wonder the wire wouldn't engage! Not blaming Kyosho for too soon, I checked the catalogues once again and everything said this part was for Concept VR, but how come this part wouldn't fit? It was ridiculous! Feeling discouraged, I nevertheless used a razor to cut the slots wide enough to fit. After cutting the slot, fitting was no longer a problem.

7. Zeal #Z3037 Pitch lever II

The stock pitch arm was weak, sloppy and flimsy. This Zeal part was CNC aluminium and replaced the stock plastic one, with the rotation point installed with ball bearings for smoother operation. Also, since I would be installing the Zeal #Z3027 Slipper clutch for driven tail, using this metal arm I didn't need to cut out a portion of the arm to clear the slipper clutch as with the case of the stock pitch arm.

8. Zeal #Z3027 Slipper clutch for driven tail

This part add on to the top of the main gear, and will provide drive to the tail on autorotation. The slippage could be adjusted to suit individual needs. It was very useful for autorotation. It came with either red or blue anodized. I chose a blue one. One thing to note while installing this clutch was to

Loctite the thin locknut. I had a friend who had this nut of his Concept came loose during inverted. His helicopter lost power totally and it was not a pretty scene.

9. Zeal #Z3004 metal swashplate, Z3032 Upper bearing case, and Z3025 Pitch rod guide II

The Z3004 was a CNC aluminium swashplate that replace the stock plastic one. However, I found that except it was constructed in aluminium every other features of this Zeal swashplate was in fact a downgrade compared to the stock one. First thing was that the centre gimbal of the Zeal swashplate had a very rough surface. The gimbal movement was very rough with the Zeal swashplate. Since the swashplate was always tilting in flight this coarse surface will wear the inside of the swashplate, and shorten its useful live. The stock plastic one had some coating on the surface of the gimbal and it was smooth as a mirror. Putting the Zeal and the original swashplate side by side, the original one looks more like "upgrade part" then the Zeal one!

The Z3032 upper bearing case was a CNC aluminium one that replaced the stock plastic one to strengthen the main frame.

The Z3025 pitch rod guide was a machined aluminium part replacing the stock plastic pitch rod guide. The stock one was constructed of soft plastic and used a separate collar to fix it on to the main shaft. This Zeal part had the collar integrated into it, and was designed to give less slop for the pitch rods.

These three parts had to be fitted one on to another, but to my surprise the fitting of these three so called "upgrade parts" was a disaster. The pitch rod guide had to be fastened on to the main shaft, then the guide would slot through the upper bearing block then to the inside of the swashplate. First, when the pitch rod guide was fastened on to the main shaft, I found it was offset heavily to one side. Once again I had to dial indicate the guide while securing the screws. The was bad enough, but more was coming. When I tried to slot the upper bearing block on to the guide it wouldn't fit without applying tremendous pressure. Using a dial calliper, I measured and realized that the O.D. of the guide was 12mm, while the I.D. of the bearing in the bearing block was 11.98mm. No wonder they didn't fit together! Further I measured the I.D. of the swashplate gimbal's hole, and found that to be 12mm, and for sure the guide would have a hard time going through the swashplate too. I was totally disappointed seeing this, and wondered what happened with Kyosho's quality control team! This was definitely unacceptable by any standards! These were all "upgrade parts", we were suppose to get better quality parts by paying for more, but the fitting of these parts left much to be desired! I was lucky to have a machine shop so I clamp the guide on to the lathe to shave down the OD of the guide to fit the bearing block and swashplate. However, not many people could have access to the machineries like myself, so what could they do? They could only use abrasive paper or file to sand or file the OD of the guide, but if taking to much material off the guide it would make it unusable.

After I fitted the whole assembly I tried the smoothness of the pitch mechanism, only to find that the pitch rods were tight on the opening of the guide. I then disassembled the guide and measured the gap on the guide for the pitch rod to be 1.7mm and the pitch rod was also 1.7mm diameter. Even without load from the outer diameter of the guide the gap would not give enough room for the rods to slide smoothly, and after fitting everything the gap would be even smaller cause the I.D. of the bearing block and the swashplate would squeeze the guide and the gap would be smaller. I used a file to make the gap wider a bit, but was very disappointed with the fitting of these parts.

After fitting all these, days later I received a replacement clutch from Kyosho. Ming suggested to modify the stock clutch to make it a better part, using his "oval hinge point" theory. I let Ming did that, and install the modified clutch into the Concept. I also balanced the head and tail rotors on a high point just to make sure everything was balanced.

Third test flight

On a hazy Sunday I took my "new" Concept to the field. It was easier to start the engine this time, due to the use of a hex adapter. The modified clutch engaged ok and as the head speed began to increase I tried testing the clutch once again by jogging the throttle stick numerous times and there seemed to be no clutch slippage. I felt the engine was a bit too rich so I lean it a bit. Hovering was now more

stable, and the next tank I took the Concept up for some serious "tire kicking". I found the Concept very fast and nimble. In simple, its a rocket. With the better blades I dare to do some high G turns, loops and rolls. With my Concept 46VR, power was always there. Even though it lacks the precision of some other machines, but it tops in pure power. At one time, I did twenty loops in a roll and not one of them load up the engine. It was a very fun filled machine, and nothing about precision and grace. It was suitable for bullying around the field, with other pilots exclaimed at the raw power and speed of this little helicopter. It is definitely not for a beginner, due to the excess power, but it suit someone who just need to have a helicopter that could let him raise hell.

Discovery after some crashes

After some time with the Concept, here is what I found. The metal clutch bell is a "must have" item. Here we already had several VR either had their clutch bell melted or the side wall of the clutch bell would be torn off after hard crashing. These phenomenon are due to the fact that on some crashes the engine is not completely dead after the crash, and most of the time when the engine is still going at high throttle and the rotor was stuck. Most of the times when the side wall of the clutch bell was torn the clutch shoes would be broken too. Also, in crashes the main gear will mostly be stripped. The one part that is the most sturdy is the main frames. My VR had been through over five crashes, two very hard ones, but the main frames were still intact (However, this is not the case with the servo frames, they breaks quite easily).

Conclusion

After I had my Concept, several of my friends also got one for themselves. Now, if there are more than one Concept in a field, we would pylon race them, or some would bet how many rolls or loops one could do, or how high his Concept will shoot entering a stall turn. We had so much fun with the Concept, and I am happy to bring back the Concept from the grave in Hong Kong. However, there are something that Kyosho could do to make it better. First is to keep a better quality control. The quality of some Zeal parts left much to be desired, and seriously I have never saw some upgrades that are as bad as Zeal's swashplate, tail drive coupling and drive guide. They are good designs to begin with, but end up as jokes and discouragements. If Kyosho get their act together and tightened up their quality control, they would earn a bigger market for Concept, cause there are lots of pilots who would like to have a "pocket rocket" for them to have fun and raise hell. Second, I felt that the Concept VR is jade hidden inside a rock. Further polishing it would reveal the true identity for people to appreciate. Take a look at the TT Raptor, nobody said its a good and precise machine, but its success is due to the fact that many people consider it to be fun and economical rallying around with a Raptor. The Concept VR had a very good base design to work with, better than Raptor in my opinion, but what it lacks is the refinement that will make it more a joy and less a pain. Someone once told me that the problems of the 46VR is due to the use of an OS46 engine and I should change the engine to an OS32 to make the problem go away, my answer is why? I want the Concept 46VR as it is, cause I like the power. Why not cure the problem at the root by improving the quality, but change to a smaller size engine just to hide the problem? The 46VR was as good as it is, just some fine tuning would make it a better machine, and if I wanted more precision (and if I could afford the extra spending) I would buy upgrade parts to make it a better machine. However, with the Concept VR, both the stock machine and upgrades parts left much to be desired.

Here is a wish list that I hope Kyosho could make them happened for the Concept VR:

1. Even though I am the only one who had clutch problem (Cause I asked around and no one had the same problem I faced), why me? That problem clutch should not see any customer if the quality controls are good. By modifying the clutch the probability of clutch slippage would be reduced somewhat, but the main problem might be the quality control.
2. Tightened the quality control for Zeal parts. As a customer, I am spending more for upgrade parts, and expect they should look and work like upgrade parts. I don't like to use a file, dial indicator, lathe and saw to install any upgrade parts. I paid for extra quality, but with some of the Zeal parts it isn't there!
3. Clutch Bell - The clutch bell was made of plastic composite. In case of clutch slippage the clutch bell might melt. I recommend Kyosho to produce a Zeal aluminium clutch bell so that I

have a upgrade path. I knew there was a Zeal aluminium clutch bell when they had the SRX, but not for the 46VR. I tired to ask Ming to hand made me an aluminium clutch bell, but he said due to the gear arrangement (The gear on the clutch bell had offset on it) it would be near impossible for him to make one.

4. Linkage - One end of the linkage are in 'Z" bends that introduces slops. Even though there was a Zeal linkage set (Z8031) it only covers the rotor head linkages. There should be another set for servo linkages.
5. Graphite frames - Plastic frames flexes while being stressed. I still remember in the days of SRX there was a set of optional metal main frame available. The metal frames provided strengthened foundation for the Concept to perform. I guess Kyosho could re-design the SRX metal frame to fit the VR, since both plastic frames of these helicopters are in the same dimension.
6. Metal tail pitch arm - The stock plastic tail pitch arm was very flimsy. I remember that the SRX era had a metal Zeal tail pitch arm, but it went out of production now. I hope Kyosho would re-issue that.

Hope to see the above happened one day. For the mean time, my Concept 46VR will still be terrorizing the skies above our field, and every time I see another Concept VR in the field I know fun will come.

Follow up

After I have finished this web page, I asked Kyosho for comment. The came back to me on several things:

1. Clutch - Kyosho acknowledged my problem with the clutch. I also send them two clutches made by me for evaluation. Kyosho came back and said my design worth consideration and they would incorporate my design into their future clutch design. What about the clutch problem now? Kyosho still did not have an answer for this.
2. Clutch bell - Kyosho finally released a metal clutch bell for the 46VR. The clutch bell was made in aluminium, with gears in metal alloy. The whole clutch bell is very well made, and in fact one of the best I've seen so far. Definitely a must have item for 46VR owners!
3. Fitting of upper bearing block, metal pitch guide, and swashplate - Kyosho acknowledged (but did not admit) to the problem in fitting together these three parts, and vowed to improve the fitting of these parts. Later in the mail I received these three parts from Kyosho, and these three parts fit together nicely. Kyosho said future production of these three parts will have fitting like the ones they sent me. Also, the swashplate now have a gimbal with a much smoother surface.
4. Tail drive coupling - Kyosho said the tail drive coupling was design to fit with their carbon tail drive, not the stock wire drive. It is understandable that the better coupling should be used with the carbon drive, but in no part of the instruction sheet that come with the coupling mentioned that the stock wire would not fit. Kyosho said they would change the instruction sheet of the coupling to reflect that using the stock wire drive will require modification to the coupling.

I am happy that Kyosho acknowledged the problem of the VR that I found, and go about to modify and make changes to better their product. It is no good to produce product that have quality problem, but acknowledge problems in production and go about to improve is the way a responsible manufacturer should do, and what Kyosho did to improve the VR would benefit them in the long run.