BY TONY YAP PHOTOS BY WALTER SIDAS & TONY YAP

THUNDER TIGER

Raptor G4 E720 FLYBARLESS

PHOTOS BY WALTER SIDAS

Thunder Tiger has raised the bar with the introduction of the E720

Thunder Tiger has been busy lately and their latest creations are a slew of 700-class helicopters. Available in either nitro or electric and flybarred and flybarless, these new helicopters represent the pinnacle of Thunder Tiger's engineering prowess. For this review, we received the electric, flybarless version, dubbed the Raptor E720 G4, with the G4 representing the 4th generation design of Thunder Tiger's large size helicopters.

WHAT'S IN THE BOX

Upon opening the box, it's obvious that this helicopter is designed as a premium kit. All the silver colored, CNC machined head and frame components are neatly packaged in their own box, encased in black foam. Its looks so nice it was almost (almost!) a shame to remove it from the packaging. The quality of the machining is impeccable, with everything beautifully polished to a brilliant finish.

The canopy is placed within its own box inside the main box. Constructed out of fiberglass, it is expertly painted in red, black, and white. What's not visible from the marketing photos is that the paint has a metal flake finish, so in the light, there are blue and green sparking highlights coming from the canopy. This is a really nice touch that provides that extra bling factor.

DESIGN FEATURES OF THE E720 G4

Starting with the main rotor, the blade grips are machined aluminum, with steel inserts around the main blade bolt holes. This increases the overall strength of the grip without a large weight penalty. Each grip has a pair of radial bearings and a thrust bearing. The grips are mounted onto the feathering spindle, which is both hardened and ground. This makes the fit into the bearings perfect, with absolutely no slop, but still maintaining a smooth slip fit.

The main rotor head block is also machined aluminum. The main shaft of the Raptor G4 is huge, measuring 15mm in diameter making it the biggest main shaft I've seen on an RC helicopter. Because it's hollowed out, it weighs roughly the same as a solid 10mm main shaft of the same length, but is roughly three and a half times stiffer making it nearly indestructible.

As with the rest of the main rotor components the swashplate is also all metal. One really nice feature is an adjustment screw on the outer ring of the swashplate. By tightening the screw, it slightly compresses the outer ring of the swash bearing to remove any play that might exist.

The main frames of the E720 are comprised of four carbon fiber plates, separated by metal and plastic spacers. The electric and nitro variants share most of their components, and it is possible to switch between the two with just a small subset of frame components.

The majority of the fasteners in the frame construction are hardened 3mm Torx head screws. Included in the kit is a high quality machined Torx head driver. Be sure to apply Loctite to any of the screws that go into metal to prevent them from loosing.

Another nice feature of the G4 E720 is the battery tray design. It's composite plastic and had an integral latch feature. The main flight batteries are strapped to this tray and then the entire assembly is installed from the bottom of the helicopter, latching into the main frame. It's quick and secure, and no canopy removal is required to swap battery packs. The kit includes one tray, but I'd recommend getting additional trays for each of your flight pack sets for the utmost convenience.

I really like the rotor head design on this machine. Out of the box, all the rotor head linkages from the swashplate down are already preassembled and don't need any adjustments. Each of the servo arms consists of two pieces, a center 'hub' that matches the spline of the servos, and the arm portion. These can be installed loosely on the servos even before any power is applied to the radio system. The servos themselves are mounted on small slots, so leave the mounting screws a little loose until

NEED TO KNOW

MANUFACTURER: Thunder Tiger

DISTRIBUTOR: Hobbico Inc.

TYPE: High-end, 90-size (700-class), electric 3D helicopter

FOR: Intermediate to advanced pilots

PRICE: $950

Author's Opinion

The Thunder Tiger E720 is a blast to build, own, and fly. They really raised the bar in terms or parts quality, the ease of setup, and performance. I love the quick swash calibration procedure and the unique servo arms take a lot of the 'fussing' out of the initial setup. The gear train is virtually bulletproof, and the helical gearing makes it sound oh so smooth. With the KDE/Castle power system, the E720 is a rocket ship if you want it to be, or can be tamed down to produce longer flights. The Futaba electronics performed flawlessly and was really impressed at the performance of the CGY750 with just a basic setup. All in all, an awesome helicopter!

Online Bonus Content

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SPECS

FLYING WEIGHT: 12.35 lbs. /8.58 lb. without battery

LENGTH: 53.3 in.

HEIGHT: 17.1 in.

WIDTH: 8.9 in.

ROTOR SPAN: 63 in.

ROTOR DISC AREA: 3,117 sq. in.

ROTOR DISC LOADING: 9.13 oz./sq. ft.

TAIL ROTOR DIAMETER: 11 in.

RADIO: Futaba 8FG Super heli, Futaba R6208SB S-Bus receiver

SERVOS AND GYRO: Futaba CGY750 flybarless controller, three Futaba BLS451 brushless servos for swashplate, Futaba BLS251 high speed brushless tail servo

POWER SYSTEM: KDE Direct KDE700XF-495 motor and Castle Creation ICE2 120HV brushless speed control

FLIGHT BATTERY: Two FlightPower 6s 5000mAh 30c wired in series for a 12S configuration

RECIEVER BATTERY: Hobbico LiFe 2S 2100mAh, Scott Grey Reactor X2 regulator

MAIN ROTOR RPM AT HOVER: 1800

DURATION: 4-10 min, depending on power system used and flying style

MINIMAL FLYING AREA: RC flying club field

COMPONENTS NEEDED TO COMPLETE: Brushless motor, ESC, receiver, high performance digital servos, two 6S 5000mAh LiPo batteries, BEC or receiver battery, suitable connectors for battery and motor, charger.

PROS

•Top notch machined components that fit perfectly, beautiful painted canopy, heavy duty transmission that can handle high power motor setups, simplified rotor head design.

CONS

• Tailboom supports can bend slightly under stress as designed (see tips)

HOT POINTS

1. Huge helical main gear to handle high power brushless setups with minimal noise
2. Massive 15mm main shaft, hollowed out for strength and lightness
3. Fully machined rotor head with geometry optimized for flybar less operation
4. Quick release battery tray for quick turnaround between flights without canopy removal
5. Innovative two piece machined aluminum servo arms for easier setup
6. 2mm thick carbon fiber side frames
7. Large diameter carbon fiber tailboom
8. Lardened Torx head screws used throughout the frame
9. Bearing block captures end of motor shaft to reduce stress on motor bearings
10. Machined aluminum main grips with steel insert for durability
11. Torque tube driven tail rotor for positive tail control and awe some auto rotations
12. 105mm carbon fiber tail blades included
13. Helical bevel tail gears for quiet and efficient power transmission

after you've snapped on all the linkages. This will allow the servo to find its own 'home' position without having to adjust the links.

There are setup holes in the main frames and the mixing arms that align when everything is level. This is accomplished by Inserting a 3mm tool through these holes hold it in an aligned position. Then, power up the radio system and set the collective to mid stick. This will move all the servos to their neutral positions. Finally, tighten the locking screws on the three servo arms. With this done, everything from the swashplate down is mechanically perfect, without having to adjust any linkages, cut servo arms, or adjust sub-trims.

The only links on the rotor head that adjustment are the two linkages that go to the blade grips. With everything still at mid stick and level, adjust these linkages until the blades are at zero pitch. Once this is completed, the mechanical rotor head setup is all done. Instead of having to build and adjust 10 linkages, only two need to be done. With the E720, a lot of the difficultly in setting up the rotor head has been greatly simplified.

On to the transmission of the E720, main gear of this helicopter is HUGE! Measuring

PRO TIPS

• Sand the edges of the carbon fiber frames prior to building everything, as it will prevent the edges from cutting into any wires (or fingers!)

• When building up the tail rotor, stack the bearings in the reverse direction onto an Allen driver or similar tool to create a bearing 'kabob'. Then slide the entire bearing stack into the tail grip. It's much easier than trying to do everything one piece at a time into the grip.

• Per the manual, the plastic tail boom support ends just push into the carbon rods and have screws to secure it. For additional strength, I also sanded the plastic ends and epoxied them into the carbon rods.

• There is no angle built into the tailboom clamp for the tailboom supports, so naturally, the boom supports want to stay parallel to the tailboom. While it doesn't take much to flex it slightly to meet the mounting points on the frame, I didn't like the fact that there was a built in 'stress' to the design. To alleviate this, I put the very end of the tailboom support into my vise, and used a heat gun to soften the plastic end and create a small angle. Now when it is mounted, there is no built in stress.

• It's important that the tail rotor pushrod is kept as straight as possible to minimize friction. Even a slight misalignment of the tail pushrod supports adds a lot of additional drag. Sight down the length of the tailboom from the rear of the helicopter and adjust the tail pushrod supports so the rod is perfectly straight.

• The machined servos arms included with the kit come with bushings that are designed to match the splines on Futaba or Ace servos. If you plan on using other servos, be sure to order the corresponding servo arm bushings.

• The KDE Direct KDE700XF-495 motor is rated at 495RPM/volt. With the stock 11T pinion that comes with the E720, it will provide a governed head speed of about 1900rpm, producing excellent power for 3D. For those wanting even more, a 12 or 13 tooth pinion gear will provide more head speed for more collective authority.

• I found that the easiest way to install the battery tray and batteries is to place the assembly on a table. Then pick up the entire helicopter and place it over the battery assembly. Next, lift up the battery and engage the locking clips. This method allows the use of both hands for each step, making installation quick and easy.

• The kit comes with a single battery tray. Get extra trays for each of your battery sets to eliminate the need to remove and re-strap the batteries between flights.

17mm tall, it's at least 50% thicker than anything I've seen before. However, due to some fancy plastic molding, it's still very lightweight. The gear teeth are helical, which greatly improves the strength while also producing a significant reduction in gear noise. While some side load is created by the helical gears, the extra thickness of the gear creates more than enough strength in the part to handle this load.

The main gear assembly is a typical split gear arrangement, with the main attached to the rest of the assembly with a one way clutch. This keeps the tail rotor directly geared to the main rotor for positive tail rotor control during autorotation. The tail rotor is driven via a torque. The torque tube itself appears to be stainless steel, with machined aluminum ends. It is supported in the tailboom by two ball bearings, to eliminate the possibly of the shaft 'whipping' around inside of the boom.

The front tail transmission consists of molded bevel gears, supported by ball bearings. These parts reside in a molded housing, which also serves as the front tailboom mount. The rear transmission is housed in a single piece, aluminum machined, tail case. The gears in the rear transmission are not only bevel, but they are also helical. As with the main gear arrangement, the addition of the helical design feature increases strength and reduces noise. II found it interesting that Thunder Tiger chose to implement helical bevel gears in the rear transmission but not in the front.

The tail rotor of the E720 is all-metal, with a pair of radial bearings and a thrust bearing in each grip. Like the main rotor, it is nicely polished. Included with the kit are a set of 105mm, carbon fiber tail blades. Tail pitch is controlled by a metal pushrod, supported by molded guides. The tail servo is installed near the front of the helicopter, which helps keep the CG of the E720 in check without having to add additional nose weight. The tailboom appears to be carbon fiber over aluminum, and additional stiffness is provided by carbon fiber tailboom supports. A nicely machined tailboom clamp securely holds the supports to the tailboom.

IN THE AIR

After doing a final checkout of the E720, it was time for the first hop in the backyard. Spooling up for the first time, I was amazed at how quiet the E720 was. There's very little gear noise, thanks to the helical gearing on the main gear and the tail gears. Everything felt as smooth as glass, a tribute to the excellent design of the E720.

Per the manual, I set up the Futaba CGY750 flybarless controller with 70% gain on the elevator and aileron, and 60% on the tail. This proved to be great starting points. Giving quick jabs of elevator, the control was extremely responsive, and the movement stopped the instant I let go of the stick without any bobbing or oscillations. Quick movements of aileron and rudder also produced similar results. Control is so good; it's almost like flying a 'perfect' helicopter in a computer simulator. The E720 does exactly what you tell it to do, no more, no less.

I did find that the default yaw rate produced by the CGY750 was a bit too fast for my liking. To tame things down a little bit, I reduced the travel on my rudder channel from 100% down to 90%.

With the Castle Creations 120HV ESC set in 'governor high' mode, I achieved the following head speeds with the throttle positions below:

Throttle Percentage	Head speed	Current draw @ hover
44%	1790	21A
47%	1877	23A
50%	1973	25A

For those who are into sport flying a head speed of 1600-1700 would be ideal. The E720 is still very responsive, and the reduced head speed will provide flights of 8-10 minutes.

Flipping into idle-up at around 1975RPM, the E720 maintains its excellent habits, but collective response becomes much stronger. The KDE motor is extremely flexible because its power output can be adjusted by simply doing a gearing change and by modifying the maximum collective pitch. With the stock 11T pinion, there's plenty of power for any 3D stunt, without being overly sensitive. However, for those who want to throw their E720 around like an overpowered 450-sized heli, switching to an optional 12 or 13 tooth pinion will increase governed head speed up to 2250 RPM.

I found that the KDE motor to be a torque monster! I'm fairly confident that if I tied the E720 to a tree stump, it would pull it out of the ground without breaking a sweat! Full pitch climb-outs from a hover are breathtaking, as the E720 rockets skywards. This is with the relatively tame gearing and 12 degrees of collective pitch. For those wanting more, switch to a 13T pinion and 14 degrees of pitch and prepared to be blown away.

In forward flight, the E720 is extremely fast and tracked straight as an arrow. The E720 is about 10% bigger that other 700-class helicopters, making visibility excellent. Loops can be as big as you want them, with my favorite being a high speed pass into a 100 foot diameter loop as the helicopter passes front and center. Tail control is about as perfect as can be, with no bobbles, blowouts, or vibrations during the fastest backwards flight. During fast tic tocs, there is no discernable tail wagging, a tribute to the excellent combination of mechanics and electronics.

SPECIFIC SPECS

FRAME

MATERIAL: Carbon Fiber with metal and composite spacers

TYPE: Four piece stacked frame

SERVO LINKAGE TYPE: ECCPM with push-pull linkages

ROTOR HEAD

GRIPS: Machined aluminum with thrust bearings

HEAD BLOCK: Machined aluminum

LINKS: Composite with steel rods, pre-assembled.

SWASHPLATE: All metal

MAINSHAFT: Huge 15mm diameter, hollowed out for low weight

TAIL

DRIVE SYSTEM: Stainless steel torque tube with helical bevel gears

AUTO CAPABLE: Yes, tail is driven during autorotation

TAIL PITCH SLIDER TYPE: Brass sleeve with aluminum housing

TAIL BLADE GRIPS: Machined aluminum, triple bearing

TAIL CASE: Single piece, machined aluminum

BOOM MATERIAL: Carbon Fiber

BOOM STRUT MATERIAL: Carbon Fiber with composite ends

GEAR RATIOS

ROTOR TO PINION: 1:10.09 std., 1:9.25 and 1:8.54 optional

TAIL TO MAIN: 1:4.67

COMPLETING THE E720 G4

I chose to use some of the best components available to complete the E720 G4. The E720 doesn't include any main blades, so for this review I used a set of Mavrikk G5, wide chord, flybarless blades. At 690mm long, they are beautifully finished, and have nice red and black accents that match nicely with the color scheme of the E720's canopy.

For power, I used a KDE Direct KDE700XF-495 brushless motor. This motor is rated up to 10,000 watts, which equates to more than 13 horsepower! Construction is top notch, having a steel outer casing with machined aluminum end bells. Integral to the rear end bell, is a centrifugal fan, which keeps the motor cool. Supporting the motor's shaft is a total of four ball bearings to handle the

immense loads that this motor can put out. One thing that I really like about this motor is that the wires exit the motor case with its own slot, and have been strain relieved with an rubber gasket. The motor leads have large 6mm bullet connectors already pre-soldered, and the mating connectors that go onto the ESC are included in the box. It has an extended 6mm shaft, which works nicely with the E720. Once the included 11T pinion is mounted, an auxiliary bearing block provides additional support to the motor shaft. This keeps the gear mesh consistent for better power transmission.

WE USED


Futaba 8FG Super heli

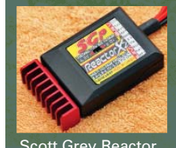

Futaba R6208SB S-Bus receiver


Futaba CGY750 flybarless controller


3X Futaba BLS451 brushless servos for swash


1X Futaba BLS251 high speed brushless tail servo


Hobbico LiFe Source LiFe 6.6V 2100mAh 10C receiver pack


Scott Grey Reactor X2 High Voltage Regulator


KDE Direct KDE700XF-495 motor


Castle Creation ICE2 120HV brushless speed control


FlightPower 6S 5000maH 30C LiPo Batteries

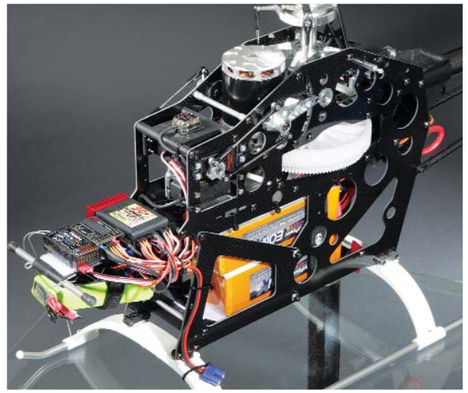

Mavrikk G5 Pro 690mm Flybarless wide chord main blades

The KDE motor was slightly too tall to fit totally underneath the canopy. To address this, I used my Dremel tool with a 1/2-inch sanding drum to increase the opening on the top of the canopy. I went slowly as to not over-do it, and ended up with an opening that looks completely stock.

Powering the KDE Direct KDE700XF-495, I used a Castle Creations ICE2 120HV ESC. This is the 2nd generation of high voltage controller from Castle. Configurable and upgradable from a PC computer, it includes data logging that is great for analyzing power setups. The case has been improved so that the capacitors are better supported and the case includes mounting lugs that allow the ESC to be screwed to the chassis. I originally was planning on mounting it to the side frames of the E720, but the E720 balanced better with the ESC under the front tailboom mount. I ran the wires that go between the ESC and motor outside of the frames, to allow the connectors to be separated to disable the motor during setup and maintenance.

For the cyclic servos, I used three Futaba BLS451 brushless, metal geared servos. Rated at 147 oz-in of torque and a speed .10s/60deg, they are both fast and strong, perfect for a flybarless helicopter. For the tail rotor control, I used a Futaba BLS251 brushless tail servo. It is also metal geared, rated at a lightening quick .06s/60deg. There are several benefits to brushless servos which aren't shown in the specs, such as faster acceleration and longer life, both great attributes in a helicopter servo.

Since I had the flybarless version of the kit, I need a flybarless controller. In keeping with the Futaba theme, I used Futaba's CGY750 flybarless unit. It consists of two parts, the sensor unit and the control box. The display is super bright, and the CGY750 easily programmed without a computer. Controlling everything, I used a Futaba R6208 S-bus receiver. It connects to the CGY750 using a single lead using S-Bus technology.



Knowing that a helicopter the size of the E720 will demand a lot out of the servos, it makes sense to have an adequate power supply. I used a Hobbico LiFe 2S 2100mAh pack, which feeds into a Scott Grey Reactor X2 regulator. Rated at up to 15 amps, the Reactor X2 regulates the voltage down to 6.0V for the swash servos and 5.1V for the tail rotor. It has heavy duty wiring between it and the battery, ensuring minimal losses between the two units.

THE LAST WORD

Thunder Tiger has really raised the bar with the introduction of the E720. Parts quality is first rate, and several innovative features such as the enhanced setup, helical gearing, and battery tray really sweeten the deal. The components that we used to complete the E720 were equally top notch, and they never missed a beat during the hardest of stunts. I'd highly recommend the E720 to anybody looking into a premium 700 class helicopter.

Links

Castle Creations, www.castlecreations.com, (913) 390-6939

Futaba, distributed exclusively by Great Planes Model Distributors, www.futaba-rc.com, (800) 682-8948

Hobbico, www.hobbico.com, (800) 682-8948

KDE Direct, www.kdedirect.com, contact@kdedirect.com

Mavrikk Blades, distributed by HeliWholesaler, www.heliwholesaler.com, (877) 454-9757

Scott Gray Enterprises Inc., www.scottgrayrc.com, (519) 208-0361

For more information, please see our source guide on page 105.