ROLL OUT! JR S 11X Looks To Transform High-End Radios! pg.22

RC Heli

THE WORLD'S BEST-SELLING RC HELICOPTER MAGAZINE

CLOSE SHAVE

WALKERA LAMA 3 TAKES FLIGHT With FOUR BLADES!

TESTED:

- **MULTIPLEX** FUNCOPTER
- **AHF** AEOLUS 50 3D
- **JR** 11X 2.4
- **TT MINI TITAN** UH-1 CONVERSION
- **PCP** TILT-A-WHIRL

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- Understanding CCPM
- Preventing EMI
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- Use A Tap

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Titan X50

-TTR4855-K10 Includes Kit & Fiberglass Main Blades

-TTR4855-K11 Includes RL-53H Engine, Hi-Flow Muffler and TT V2 Carbon Blades

Specifications:

Full Length of Fuselage:	47.24" (1200mm)
Full Width of Fuselage:	7.87" (200mm)
Total Height:	15.75" (400mm)
Main Rotor Dia.:	52.95" (1345mm)
Tail Rotor Dia.:	10.24" (260mm)
Gear Ratio:	8.5:1/4.56
Total Fuel Capacity:	480cc
Fully Equipped Weight:	6.83 lbs. (3150g)

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- 10mm Hardened Main & 7mm Feathering Shaft
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Don't Fear THE FEAR

WHEN THE THOUGHT OF GETTING INTO RADIO CONTROLLED HELICOPTERS FIRST CROSSED YOUR MIND WHAT KEPT YOU FROM TAKING THE PLUNGE? Maybe you didn't hesitate at all and jumped right in. If this was the path you took, bravo. However most of us thought about the idea and consciously or subconsciously processed all the pros and cons about taking on the hobby. The "pros" are a long list, too long to list hear. However the "cons" are a much shorter list, in fact probably only two items occupy this side of the ledger. Those two items are more than likely "the cost" and "crashes." Aren't these the two for you? They were for me. You're afraid to crash because it costs money to repair. Along with the cost it sucks to fail. A crash is a failure, and given the skill set needed to successfully fly an RC helicopter you're probably going to crash. But, what if you could learn to fly without the fear of crashing. Well, maybe not crashing, but without the fear that every time you punt it into the ground your wallet's going to be sore? I know, that's what simulators are for. Simulators are great, every pilot should own one, however there's no replacement for actual stick time. What's gotten me on the topic is one of the review helicopters this month. The one I'm referring to is the FunCopter by Multiplex. It's a fix pitched helicopter however it's large enough to give you a very good feel of helicopter flight. The kicker is the FunCopter's durability. It's not quite crash proof, it will break, however it's durable enough to keep in one piece on most low altitude crash situations. You'll have to read all about it in the review. But during its testing period we put it in the hands of a half dozen different "pilots" with little or no flight experience. Dozens of crashes later the damage was mostly cosmetic and cost about 69¢ to repair. A very cool feature indeed.

I hope you enjoy this 50th anniversary issue. Not 50 years, but 50 issues! We're thankful for you our reader and always look to deliver you the highest quality reading experience possible. Thank you for being with us for our first 50! We look to delivery many, many more to you.

Thanks and Fly Safe,

Mike Velez
Publisher/ Editor-in-Chief
mikev@rchelimag.com

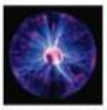
Art could use the Link Maker 9000.

RC Heli magazine

CHATTER BOX

WHAT DREAM FEATURE WOULD YOU LIKE EVERY HELICOPTER TO POSSES?

MIKE VELEZ - Publisher/Editor-In-Chief
A subscription to RC Heli, knowledge is power.



RYAN KEPHART - Associate Editor
A Plasma Force Field to protect my helicopter from the inevitable crash.

JIM INNES - Editor-At-Large
That's an easy one, an "auto crash-avoidance" system that only takes over when all hope is lost.

CHUCK BASSANI - Editor-At-Large
Anything that will minimize wires and electrical connections.

SHAWN KITCHEN - Editor-At-Large
A coupon for a lifetime's supply of free replacement parts from HeliProz or one of our other fine mail order advertisers or local hobby shop carrying RC Heli magazine.

ART KORAL - Contributor
Threaded rods and links pre-threaded and adjusted to length at the factory. Nobody likes threading ball links!

AARON SHELL - Contributor
An HD video downlink intergrated into the radio system with video recording to an SD card built-in and an output for a monitor off the tx.

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RADIKAL G20

PETROL ENGINE

"THIS GAS HELICOPTER IS A PERFECT OPTION FOR A PILOT LOOKING TO GET THE MOST OUT OF FLIGHT TIME WITHOUT HINDERING FLIGHT PERFORMANCE."
-RC Heli Magazine

G10 version with LT head shown. RotorTech 640mm Blades and Tuned Muffler are optional items.

Length: 1366mm
Height: 381mm
Width: 260mm
Main rotor diameter: 1435mm
Tail rotor diameter: 262mm
Main rotor blades: 600mm-660mm
Tail rotor blades: 95mm
Flight time: More than 30 mins w/consumption of 300 ml
Weight complete w/electronics and engine 4500g

"THE HELICOPTER FEELS LOCKED IN AND FLIES WITH AUTHORITY AND REMINDS ME OF A .60 SIZE NITRO MACHINE."
-Model Airplane News

"THE RADIKAL G20 WILL DO EVERYTHING A NITRO 50 WILL DO RIGHT UP TO 'HARD/CRACK' TYPE 3D."
-AllThingsThatFly.com

Since it's introduction, the Century Radikal G20 has dominated the 3D aerobatic gasoline performance market. Designed from the ground up with the latest manufacturing framework, we're proud to offer the latest generation of technologies which has been incorporated to produce this G10 and Carbon Fiber framed helicopter powered by the new Zenoah 20cc gasoline engine. The assembly goes together with ease and is simple to maintain yet doesn't sacrifice flight performance that you may expect from a gasoline powered helicopter. Whether you are an experienced pilot or just a beginner, the economic flight times and aerobatic flight performance of the Radikal G20 is a perfect choice for your first helicopter or a great addition to your current fleet. Don't take our word for it, listen to what others are saying about our Radikal G20.






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MINIATURE AIRCRAFT FURION 6

MA HAS A NEW HELI IN THE WORKS, AND WITH ITS LONG LIST OF FEATURES THE FURION 6 IS LOOKING LIKE ANOTHER HIGH SELLER. The Furion 6 carries over many of the quality feature of its nitro brother, the Fury 55. The Furion is a 600-size electric helicopter with the same style of rotor head, but with a completely redesigned main frame. The Furion 6 can be powered by both a 6S and 10S power system. The 6S system uses a single 6S, 5000mah battery pack mounted on top of the battery mount. The 10S system uses two 5S 4000-5000mah batteries that sandwiches the battery mount and allows the batteries to be in line with the tail boom.
The release date and suggested price has yet to be determined, but we'll let you know as soon as more information has been released.

WWW.MINIATUREAIRCRAFTUSA.COM

MA is working their way back to the top!

FUTABA RELEASES TRANSMITTER UPDATES

With new radio systems coming to market in the near future, Futaba is releasing a batch of new software updates for the 14MZ, 12FG, 12Z, and 8FG. These radios can be updated using an SD memory card and by downloading the updates from Futaba's website. The updates include the ability to change the constant speed rpm display to 2500 rpm instead of the 2200 of the previous version. Here is a list of some other features that were updated; stop switch can now be set, added minute increment alarm beeps, and an Hour mode up to 99hrs for engine maintenance. For a full list of updates for your specific radio, visit Futaba's website at:

WWW.FUTABA-RC.COM

JR VIBE FLYBARLESS CONVERSION

Do you have a Vibe series helicopter and want to get in on the flybarless action? JR has released a new flybarless conversion kit for all Vibe series helicopters, including the 500E, 50 3D, and 90SG. The conversion comes with all the physical components needed to convert your current rotor head to flybarless. All the components are made from aluminum and anodized black.

STREET PRICE:

- Vibe 500E: $95
- Vive 50 3D: $105
- Vibe 90SG: $120

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HOT DATES! SEPT 2010

03 | **HELI'S OVER ROCKFORD**
Rockford, IL
WWW.RVRCFLYERS.COM

03 | **COLLECTIVE RC FUN FLY**
Oklahoma City, OK

04 | **2010 ALIGN FUN FLY**
Taichung, Taiwan
FUNFLY.ALIGN.COM.TW/EN/

10 | **NOMAC RC HELI FUN FLY**
Avondale, LA
WWW.NOMACRC.COM

12 | **MICHIGAN WHIRLYBIRDS FUN FLY**
Goddells, MI
WWW.MICHIGANWHIRLYBIRDS.COM

24 | **ALBUQUERQUE HELI FUN FLY**
Albuquerque, NM
www.arcconline.com

27 | **NORTHEAST MODEL HELICOPTER JAMABORE**
Macedon, NY
WWW.RAMSRC.ORG

Do you want your event listed in Hot Dates? Email all the information at least 90 days prior to the event to **feedback@rchelimag.com**

Did you attened the IRCHA Heli Jamboree?

O.S. 55 LIMITED EDITION PACKAGE

Do you like the IRCHA Jamboree? I know we do, and apparently so does O.S. Engines. Just in time for the 2010 IRCHA Jamboree, O.S. has made a combo package deal for the folks who enjoy attending IRCHA. The combo includes a custom, black-and-silver anodized head and muffler. Both the head and muffler have "2010 Heli Jamboree Edition" etched on them. The included pipe is the brand new O.S. Boost Pipe, which is tuned to give the maximum power for the O.S. 55HZ. Expect a price tag of around $450 for the combo.

WWW.OSENGINES.COM

HITEC AURORA 9 USERS

With most radios featuring upgradable software, Hitec is extending this feature to its other hardware. They have recently released a set of updates to accommodate some new features for their telemetry systems. Along with some telemetry updates, Hitec has improved some additional functions of the Aurora 9. Among the updates are:

- **System Password Lock Function:** This keeps any unwanted hands from programming your radio
- **Quick Model Select:** This function allows you to change your model in the startup screen without having to transmit.
- **Low Voltage Receiver Alarm Warning:** This function allows you to set the variables for the alarm.
- **Touch Beep Activate/Deactivate:** Now you can select if you want the transmitter to beep or not when programming your radio.
- **Touch Screen Calibration:** You can now re-calibrate your touch screen for improved accuracy.

Check out Hitec's website for more info and improvements for your Aurora 9 and Optima Receivers.

WWW.HITECRCD.COM

YouTube CAT VS. HELI?

Found this little video online. We don't recommend flying any heli near an animal, however this is a cute video of a cat swatting an Air Hog out of the air. As far as we know, no kittens were harmed in the filming of this video.

TAKE A LOOK HTTP://TINYURL.COM/QFZP40

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NANO

NEW

HELICOPTER FOR BEGINNERS

NANO
Length:174mm
Height :47mm
Main Rotor Diameter:210mm
Weight:approximately 60g

E-500

NEW

HELICOPTER FOR ENTERTAINMENT

BIG LAMA
Length:427mm
Height :280mm
Main Rotor Diameter:460mm
Weight:approximately 408g

HONEY BEE CT

NEW

FLYBARLESS , 3BLADES
3D AEROBATIC

HONEY BEE CT
Length:525mm
Height :185mm
Main Rotor Diameter:490mm
Weight:approximately 440g

BELT-CPX

NEW

3D PRO AEROBATIC HELI

BELT-CP X
Length:650mm
Height :230mm
Main Rotor Diameter:680mm
Weight:approximately 670g

ESKY STATEMENT

Don't Be Fooled!

It's come to our attention that counterfeit ESKY brand products are being sold by unscrupulous vendors. These fake and shoddy products are not only causing a negative impact on our image of our commitment to quality, but threatening the safety and rights of ESKY consumers and users. To protect the lawful rights and interests of the authorized ESKY distributors and vendors as well as ESKY consumers and users, ESKY Co., Ltd makes the statement as below.

Please locate your local distributors or vendors from ESKY official website www.esky-sz.cn www.twf-sz.com

ESKY confirms that distributors publicized on ESKY official website are authorized distributors of ESKY original products. As for those unpublicized distributors and vendors, ESKY will check their distributor's qualifications within 3 months since the date of issuing of the statement. Only passing our distributors and vendors qualifications then will they be publicized on our official website. Your cooperation of eradicating ESKY fake products will be greatly appreciated.

In order to help consumers to authenticate genuine ESKY products and to take more efforts in fighting against the fake products, ESKY Crop is introducing new laser technology to mark an additional ESKY registered trademark on the surface of spare and accessory parts. All the parts sold after December 23rd, 2009 are laser marked with the additional ESKY registered trademark. For the convenience of all the consumers to authenticate the ESKY products, especially the tiny parts, please browse the Anti-Fake page on our website to check for the exact spots of our trademark on those tiny parts. It may require using magnifying glass to check the laser-marked trademark because those trademarks may be smaller than 1mm. Please find your local distributor from official ESKY website www.esky-sz.cn

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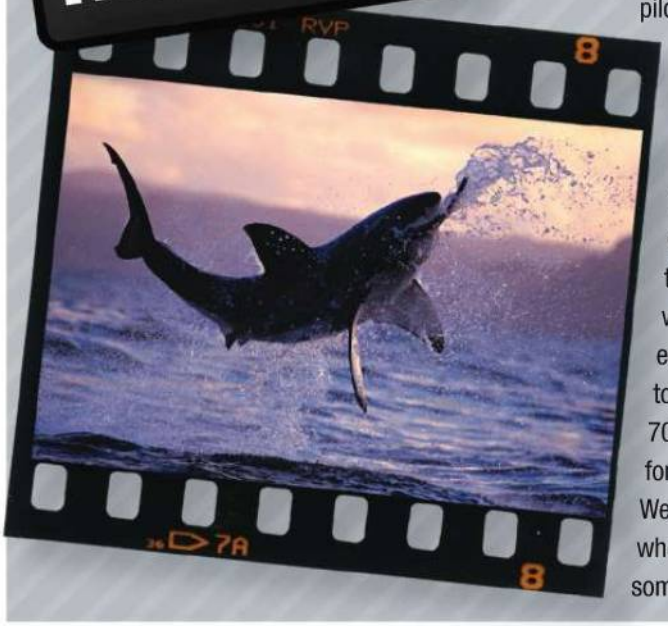
BEHIND THE SCENES



When he's not tearing it up during competition or showing you how it's done during an episode of SmackTalk RC, Bobby Watts is a camera ship pilot. Recently, he traveled to South Africa to film some great white sharks for National Geographic as they jump out the water and try to eat fake seals. He took three TREX 700 camera ships for the adventure. We'll let you know when you can see some of the footage.

AGGRESSIVE 3D NITRO OR ELECTRIC

X-cell FURY 55

FURY 55 SPECIFICATIONS

• Length:	47.875" - 1216mm
• Height:	16.625" - 422mm
• Rotor Span:	1365-1405mm - 600-620mm Blades
• Tail Rotor Span:	260mm - 95mm Blades
• Avg. Kit contents Weight:	5.4lbs - 2.45kg (includes painted canopy)
• Avg. Ready-to-Fly Weight:	7.3-7.5lbs - 3.31-3.4kg (less fuel)
• Main Drive Ratio:	8.538:1
• Tail Drive Ratio:	4.61:1
• Bearings:	4-Thrust Bearings, 1-German Heim Ball, 38-Ball Bearings, 2-Torrington One-way Clutch Bearings

X-cell FURION 6

FURION 6 SPECIFICATIONS

• Length:	47.37" - 1203mm
• Height:	15.125" - 384mm
• Rotor Span:	1365-1405mm - 600-620mm Blades
• Tail Rotor Span:	260mm - 95mm Blades
• Avg. Kit contents Weight:	3.75lbs - 1.7kg (includes painted canopy)
• Avg. Ready-to-Fly Weight:	6lbs-6.3lbs - 2.7-2.9kg (less batteries)
• Main Drive Ratio:	6S - 8.38:1 • 10S - 9.08:1
• Tail Drive Ratio:	4.15:1
• Bearings:	4 Thrust Bearings, 1 German Heim Ball, 1 Torrington One-way Clutch Bearings, 33 Ball Bearings

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LETTERS

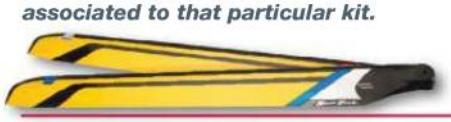
PUZZLING PURCHASE ADVICE

First off let me say I love your magazine and it's helped me out numerous times. I have bee thinking about getting a new heli and was considering the TREX 550E flybarless. I did note at the end of your article, that your estimated crash cost was $60? I was puzzled by this, because stock blades from my local hobby shop for this bird retail for $59. I guessing this was a misprint, and that the actual cost should be about $160 I'm basing this on the crash cost of my Align 500, which is around $100 unless I chew up a servo or really stuff it into the ground LOL.

Thanks and keep up the great work with the magazine the information is invaluable to newbie's and rookies like me!

Jimmy R

Hi Jimmy, thanks for reading. The "Crash Costs" includes the cost of the main shaft, spindle, landing gear, flybar, torque tube, and tail boom. We don't include the cost of the blades because they aren't specific to most kits. The Crash Cost is meant to help as an aid in making a purchasing decision based on the costs associated to that particular kit.



Donut right anee ting ovar hear!

HEY BOYS!

HERE IS SOME INFO ABOUT MY HUSBAND'S ELECTRIC HELI IN THE PICTURE. IT'S AN ALIGN TREX 700E 3G FLYBARLESS SYSTEM. He bought it as a combo that included the following: Flybarless System FL760, 3 Align DS610 Digital Servos, 1 Align DS650 Digital Servo for tail rotor, RCM-BL 700 M 510 KU Brushless Motor, and 690D Carbon Fiber Blades. The other gear he's using is a JR X9503 2.4 9 Channel Radio, Kontroniks Jive 80+HU ESC, and it's all powered by 2 22.2 V 6S 5000 mAh Lipo batteries. He is thinking about purchasing a scale body by Century. He really likes the Bell 222 or Hughes 500.

Love your magazine,

Mike and Shannon Clabaugh
Woodsboro, MD

NO SCHOOL LIKE THE OLD SCHOOL

Gentlemen, Just thought I'd share a photo of my helicopters. Pictured left to right are my Schluter Champion (1986 model), Raptor 30, Raptor 50. I started flying RC airplanes in 1980 and RC Helicopters in 1986 beginning with a GMP Cobra then moving up to a GMP Competitor, Legend and Schulte Champion. My Champion still flies great and is on its 3rd engine. I fly my airplanes and helicopters on my Futaba 9CHP. I have a JR Galaxy that I used for 20 years and retired it this year. I've always been a weekend flier and enjoy doing loops, rolls and auto rotations. I leave 3D flying for the experts! I also like to help new pilots get started. I really enjoy your magazine as it's very informative and features great articles for all skill levels. Keep up the good work.

Sincerely,
Bob Chatting
Weatherford, OK

WANT TO SEE YOUR HELI IN THE MAGAZINE?

Send us pictures of your heli along with a description of what it's got. We prefer digital files (no zip files please) in a ***HIGH RESOLUTION,*** so be sure to flip that switch on your camera to the "fine" setting. One submission per month will receive a full-year subscription to ***RC Heli Magazine!*** **Void where prohibited. Subscription offer is valid for U.S. residents only!**

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RELY ON THUNDER POWER RC

When Power, Cycle Life, Reliability and Value Matter...

Since 2003 more pilots and drivers have chosen the #1 in Performance and Reliability for long-lasting power and performance over any other brand. And now Thunder Power RC is proud to announce **exclusive Generation 4 (G4) chemistry** that offers a realm of power delivery, cycle life delivery and ultra-fast charge rate capability never before seen. G4 series batteries offer up to **40% more power, 6-times better cycle life and the ability to be ultra-fast charged at rates up to 6C*** with no discernable loss of power or cycle life delivery. G4 cells are built using the highest quality Japanese-made materials, including the latest in super-fine substrate (nano) technology to offer the lowest possible internal resistance for the most performance and lowest cost per cycle. Plus Thunder Power RC batteries are **still proudly matched, assembled and supported in the USA** and backed by an **industry-leading full 1-year warranty and 50% off damaged battery replacement program coverage.**

G4 Pro Lite V2 20C Series Batteries

The world's lightest, high-performance batteries for sport and competition use. Offering the highest energy density and cycle life delivery available in their class, G4 Pro Lite V2 20C series batteries are proven performers with batteries lasting years and upwards of 400 – 500+ cycles. Capable of continuous discharge rates to 20C and fast charge rates up to 4C* while delivering up to 20% more power than previous generation batteries. Available in capacities from 250 to 6600mAh and configurations from 1S 3.7V to 10S 37.0V.

G4 Pro Power 30C Series Batteries

An excellent combination of power, performance and price, G4 Pro Power 30C series batteries are proven by world-renowned pilots and independent testers to deliver 300+ cycles in a wide variety of powerful airplane, EDF, 3D helicopter and other applications. Able to deliver up to 30% more power and 5-times more cycle life than previous generation batteries at lighter weight than most other lesser performing G3 20C to 35C batteries. Available in capacities from 320 to 5000mAh and configurations from 1S 3.7V to 10S 37.0V.

G4 Pro Power 45C Series Batteries

The world's most advanced, most powerful and longest lasting series of batteries – ever! G4 Pro Power 45C series batteries are the pinnacle in performance for high-powered airplane and helicopter applications. Delivering up to 40% more power, 6 times more cycle life (proven 300+ cycles even when charged at rates up to 6C) and ultra-fast charge rate capability up to 6C* means they surpass all other batteries on the market today. Available in capacities from 325 to 6500mAh and configurations from 1S 3.7V to 10S 37.0V.

G4 Sport Race 25C Series Batteries

Offering the highest capacities and maximum value for backyard bashers and weekend racers, G4 Sport Race 25C series batteries are the best choice for maximum run-time while also being a potent threat on the race track in 'spec' and 'stock' racing classes. They also last up to 4-times longer than other brand batteries and can be charged at rates up to 4C* for fast charge times of 15 minutes or less. Available in capacities from 2700 to 8000mAh and configurations from 2S 3.7V to 4S 14.8V.

G4 Pro Race 40C and 50C Series Batteries

The world's fastest and longest-lasting batteries for surface vehicles! G4 Pro Race 40C series batteries are the best choice for powering sport and race vehicles using 10.5T, 13.5T, 17.5T and other 'stock' motors, while G4 Pro Race 50C series batteries are the most powerful batteries ever made available for pro- and competition-level racing in the hottest 'mod' motor classes. Capable of being charged at rates up to 6C* and available in capacities from 3200 to 5200mAh and configurations from 1S 3.7V to 4S 14.8V.

Chargers and Balancers

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INSERT HEADLINE HERE

Insert paragraph here describing the caption in the bottom pic on page 56 of issue 49. Write something here witty and poking fun at the error.

Insert second paragraph here thanking the guys for a great magazine. Put a sentence here telling everyone to keep up the great work.

Insert closing here,
Sign name here
Type email address here

Seriously, great magazine guys. I look forward to it every month. By far the best articles and 'how to's' of any RC magazine period. Thanks again and keep up the great work!

Chris Hanson

Do you like how I was sure to put in plenty of letters that thanked us for being so awesome? Typos and mistakes getting past us is a problem we've been working on, and always try to do our best however some always seem to get threw ;) Love the Sarcasm!
Mike

PERFECT TIMING!

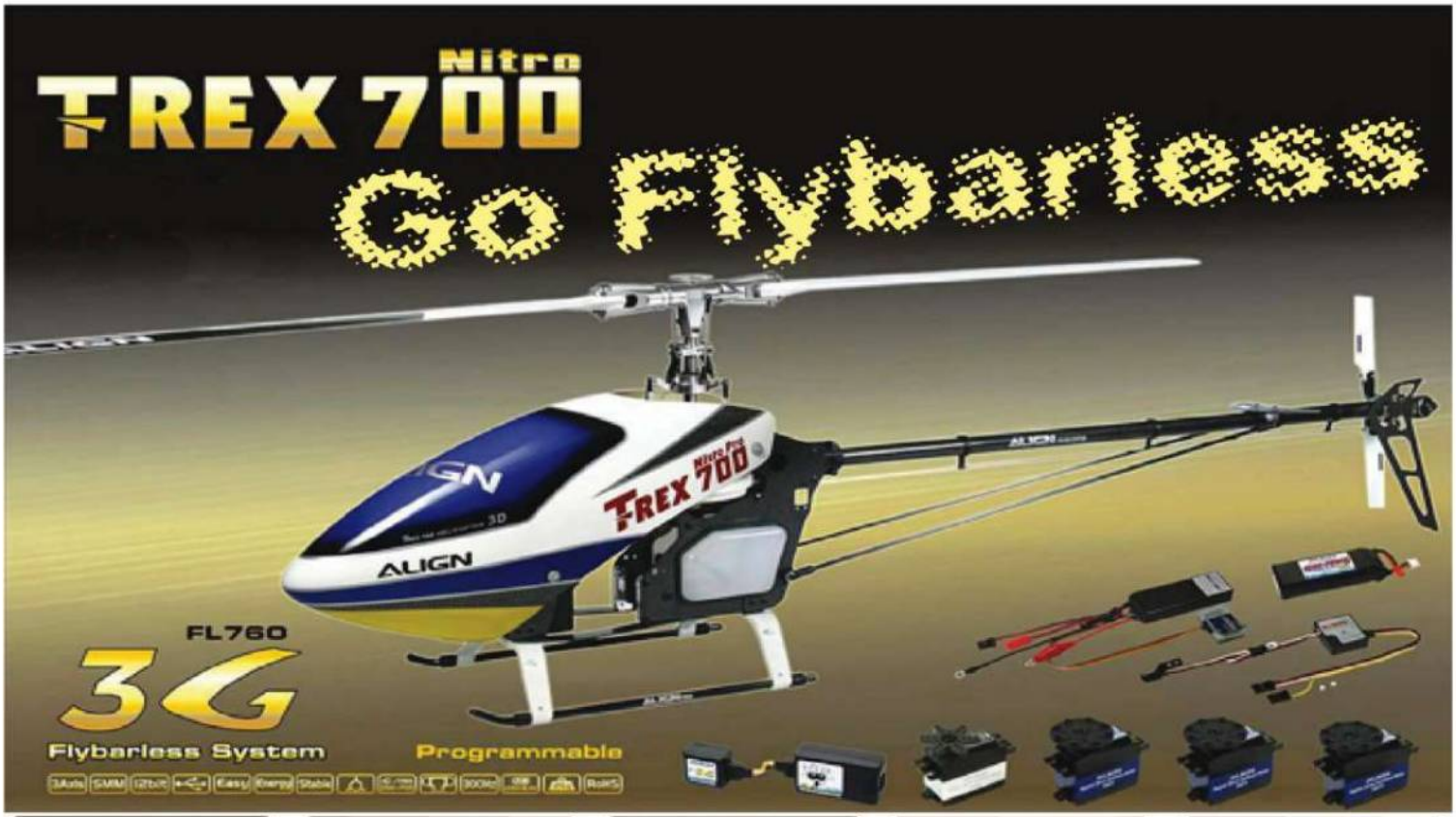
Your timing for printing the tail tuning was perfect timing for me. I fly an upgraded Blade 400 and have been having tail issues with it. I've yet to find anyone who could tell me the proper way to tune my tail. Using the full collective pump from a hover method was such a huge help. I still need to fine-tune it, but it is really close now. I learn so much from your magazine and look forward to it each month. On a side note, congrats to Brandon for joining the Air Force. I just retired from 21 years of service as a F-16 crew chief.

Cliff Solylo
USAF retired

Glad we could help and thank you for your service.
Mike

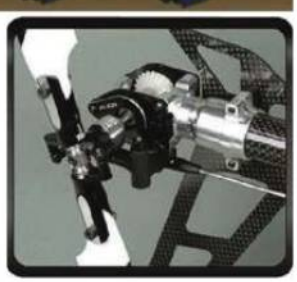
Nitro T-REX 700

Go Flybarless









Design Features:

*Simple and light weight design provides awesome flight performance.
*+-14 collective pitch is possible for extreme 3D performance.
*Heavy duty tail thrust bearings.
*Clutch, Fan and Bell assembly provide a very smooth operation even at high RPM.
*Forward mounted tail servo helps to keep exhaust oil from entering servo also improves the CG.
*Battery tray designed for easy and clean radio gear installation.
*Fuel Tank Capacity 630c.c.
*Heavy duty tail with thrust bearings.
*Torque Tube driven tail for incredible 90 Sized performance.
*Rigid frame design that can also handle hard crashes without damage.
*Super engine cooling system very efficient airflow to provide unequaled cooling and hourspower.
*New main gear with one-way bearing design for high torque.
*Ready to fly weight(no fuel) is an incredible 4.2Kg.

Specification:

*Length: 1335mm.
*Height: 450mm.
*Main Blade Length: 690mm.
*Main Rotor Diameter: 1562mm.
*Tail Rotor Diameter: 281mm.
*Motor Pinion Gear: 20T.
*Autorotation Tail Drive Gear: 150T.
*Drive Gear Ratio: 8.2:1:4.54(E:M:T)
*Flying Weight: 4.35kg

Accessories:

*T-REX 700 Nitro 3G Kits Set x 1
*690D Carbon Blades x 1set
*RCE-G600 Governor x 1
*2 IN 1 Voltage regulator combo x 1
*Flybarless System x 1set
*DS650 Digital servo x 1
*DS610 Digital servo x 3

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FREQUENTLY ASKED QUESTIONS

Q: HOW DO I SET UP THREE DIFFERENT HEADSPEEDS USING A FUTABA 10C AND A GV-1 GOVERNOR? –ROCKETMAN

1. Set the gov. menu to "SW. E" which will then show your three positions N, I1, I2.
2. Set N to 0%, Idle1 to 50%, and Idle2 to 100%.
3. Turn on the GV-1 and go to the RS1 screen. Increase the reading to 1500RPM with the switch in Normal mode.
4. Flip to Idle1 and the GV-1 will show RS2. Set that on the GV-1 to 1750RPM.
5. Flip to Idle2 and the GV-1 will show RS3. Set that on the GV-1 to 2000 RPM.

Now you have a range for the gov. menu settings. 0% = 1500 RPM and 100% = 2000RPM.

You can have what ever range you want by changing the values in steps 3, 4, and 5.

For example, if I want 1650 for Normal mode, I set the governor menu to 30%, and Idle1 for 1950 is 89%. **–kcgraves**

Q: I recently crashed my Raptor 50 Titan, and unfortunately it smacked the muffler side and broke part of my engine case next to the bolt hole. The damage did not look to bad, as just the flange broke off and it did not touch the cylinder section. I was wondering if I can repair this section with JB Weld? Should I fill the whole section and then re-drill the muffler bolt hole, or assemble everything and then patch it up? **–RaptorDude**

A: Although you may be able to fix the case temporarily, I would suggest looking for a replacement case. You should be able to find one new or used for a reasonable amount of dough. I would suggest that if you are going to attempt to repair the engine case, apply a thin layer of petroleum on the bolt going through the case and then apply a layer of JB Weld to both the engine case and the broken off section. After the JB Weld is fully cured you will have to remove the muffler and sand the flange down so it is extremely flat. You can use sandpaper attached to an aluminum block or something that is flat and won't flex. **–RKephart**

I tend to agree with Ryan in that the best course of action is to purchase another engine case. The fortunate thing for you is that 50-size engines are as plentiful as Wonder Bread, so you'll have no difficulty finding one for cheap. You should be able to snag one on any of the fine Internet forums like the RC Heli forum (shameless plug—the boss gives me a Klondike Bar every time I mention the magazine).

JB Weld is a fine product when used in the correct application, but I personally wouldn't trust it in a high temperature, high load area like a muffler mount. For the relatively low cost of a case, I just don't see the sense in "going cheap" on the repair. For as much money as it costs to build and fly an RC helicopter, the cost of a replacement case is just pocket change. **–ShawnK**

The do's and don'ts of the hobby.

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QUICK TIPS

SCREW SAVER

When performing maintenance, screws can become lost very easily. The solution is simple and is an old mechanic's trick. After removing the part from the helicopter, put the screws back into their respective location. This will prevent you from loosing them and even remind you what screw goes where.

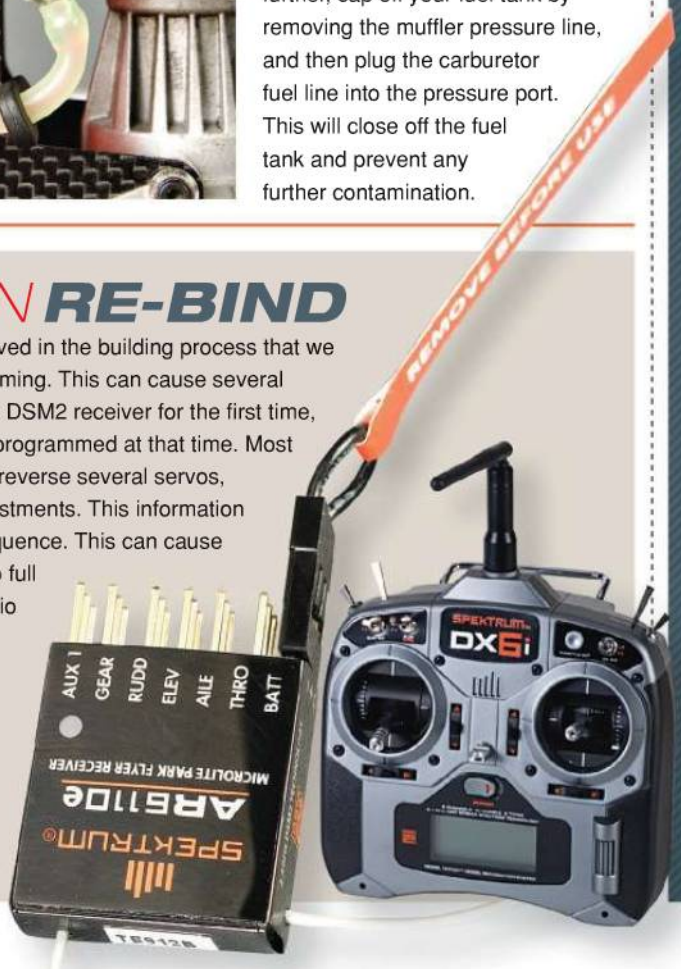
Betcha didn't know that!

KEEP IT SEALED

After a long flying season, you may find yourself storing your helicopter for a long period of time. It's always a good idea to fill your fuel tank up and then drain it. To take it one step further, cap off your fuel tank by removing the muffler pressure line, and then plug the carburetor fuel line into the pressure port. This will close off the fuel tank and prevent any further contamination.

BIND THEN RE-BIND

Often times we get so involved in the building process that we rush through radio programming. This can cause several problems. When you bind a DSM2 receiver for the first time, only the basic settings are programmed at that time. Most of the time you will have to reverse several servos, set the gain, and other adjustments. This information is not stored in the boot sequence. This can cause the helicopter to spool up to full power if you turn off the radio or loose the connection to the receiver. After you have completely programmed your radio, you should rebind the receiver to the transmitter so that the failsafe features can do their job.



EASY TUNE NEEDLES

Last month we mentioned using a hex driver to adjust your mixture, but this month we will show you another trick. Take an old servo arm and drill out the splines until it can fit over the needle valve. Then secure the arm to the needle using a screw threaded into the needle. This will allow you to easily see what position the needle is in and gives you something to grip while tuning.

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Pilots: The Smith Brothers

GIUSEPPE ROBERTONE DANNY SZABO

Lenght: 1180 mm **Height:** 420 mm
Main Blade lenght: 600/620 mm
Main Rotor Diameter: 1335 mm
Motor Pignon Gear: 11T

Autorotation Tail Drive Gear: 41T
Flying weight: 2,920 Kg (no fuel)
Fuel Tank Capacity: 490 cc
Main Frame: Carbon Fiber 2 mm

Ely.Q

UPGRADE YOUR EXPERIENCE

JR Radios 11X 2.4

New from head to toe.

WORDS: Chuck Bassani

Looks like a Transformer.

I T'S BEEN A WHILE SINCE JR HAS PRODUCED A NEW RADIO. Yes, the X9503 was introduced not very long ago, but it was merely a few incremental improvements over the X9303 – not really a new design.

With the introduction of the 11X, however, JR has delivered a brand new radio designed from the ground up. It sports advanced programming features, while at the same time introduces functionality improvements that make it easier to use. I think when you see what the 11X has to offer, you'll be pleasantly surprised.

WHAT YOU GET

The 11X is currently only offered as TX / RX package. Included with the system you'll get:

- 11X Transmitter
- 9.6v, 1500 mAh NiMH Transmitter Battery Pack
- R921 9-Channel DSM2 Receiver
- AD35M05 120v AC 60 Hz Input, 11.6v DC / 110 mA TX Output, 5.8v DC / 110 mA RX Output Wall Charger
- Instruction and Programming Manual

TRANSMITTER

When one sees the 11X for the first time, the comment always seem to be "that's different". And different it is. Appearance wise, it resembles something from a science fiction movie. Size wise, it looks big. The fact is, it really isn't that much larger than a JR X9503; it measures in at about 10% taller and 5% wider.

The 11X is a full featured system that offers virtually everything even the most demanding heli pilot could want. Without further ado, let's take an in-depth look at JR's latest offering.

GENERAL SPECIFICATIONS

- 11 fully proportional channels
- Dual ball-bearing gimbals
- 2048-step resolution, 22 mSec frame rate
- 30 model internal memory (unlimited model memory using optional SD cards)
- Up to six flight modes (Normal, 1, 2, 3, 4, and Hold)
- All the DSM2 benefits (DuaLink, ModelMatch, ServoSync)

PHYSICAL LAYOUT

As I already alluded to, the 11X's physical appearance is somewhat of a departure from the norm. But how does that departure translate into how well the system 'feels' in your hands?

Starting with the back of the transmitter, you'll notice that there are some deep finger recesses molded into the case. If you're a 'thumbs' type pilot, this makes for a very comfortable grip. On the other hand, "pinch" pilots won't realize any benefit from it. Also, on the back and towards the top of the case are two variable position lever controls. Again, these are positioned very nicely for "thumb" flyers. As a "pinch" flyer I find them almost inaccessible. Clearly the ergonomics of this radio are tailored to the "thumbs" folks. Also on the back you'll find the bind button and DSC jacks.

Looking at the top and front of the 11X, you'll see that it contains a generous number of 3-position switches; six all together. You'll also find two 2-position switches, and two digital trim type controls. Switch spacing is adequate, as I can comfortably rest my fingers between the top mounted switches while I'm flying. The dual ball bearing gimbals have an extremely smooth feel and center precisely every time. Stick length and spring tension are adjustable, although the latter requires you to remove the case back. The stick mode is not user changeable. Stick trims are digital, with the exception being the throttle trim. And yes, it does balance nicely when hanging from a neck-strap.

Looking at the rear of the 11X, you can clearly tell this radio favors 'thumb' type pilots.

You'll find the SD card slot inside the battery compartment. The battery must be removed (although not unplugged) to insert and remove the card.

SOME VERY NICE FEATURES

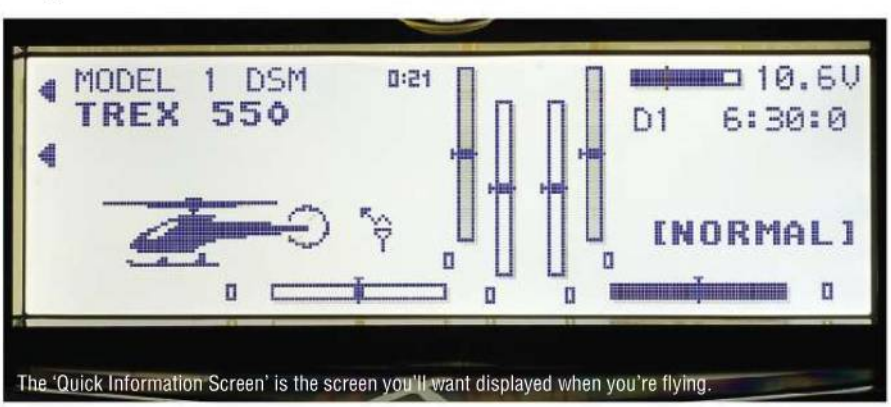
Quite a few of what I'll call "convenience" features have been implemented in the 11X. These include:

TRIM POSITION MEMORY • Ever wish you could return your trims back to exactly where they were before you messed around with them? Now you can. Using the roller, you can select a trim position display on the main screen and hold it down to put a marker at the current trim position. Now you can move the trim and still have a reference to the original trim position.

QUICK INFORMATION SCREEN • Accessed from the main screen by simply moving the roller, the Quick Information Screen displays all three timers, throttle stick position, throttle output position, pitch output position, flight mode, and battery voltage. You could also select any of the three timers with the roller for quick navigation to the Timer function.

QUICK EDIT MODE • When changing field values with the roller, you can hold down the lower left programming button to produce a coarser adjustment. Doing so will cause most values to change in increments of eight instead of one. Timer values will change in one minute instead of five second increments.

MY LIST MENU • This is a user customizable menu that allows you to populate it with up to fifteen of your most used System List or Function List menu



The 'Quick Information Screen' is the screen you'll want displayed when you're flying.

I think this is the best looking one of all!

items. Furthermore, the list is maintained on a "per model" basis, allowing you to tailor it to each model.

EASY SWITCH ASSIGNMENTS •

Using the Device Select function to assign functions to switches used to be done by selecting a function and then picking a switch from a list. Although you can still do it this way, the 11X also lets you to select the function and then just simply "flick" the switch you want assigned it to. JR refers to this as 'AutoAssign™'.

PROGRAMMING

The 11X includes programming for helicopters, airplanes, and gliders. Choosing a type switches in the features and functions that are specifically designed for it. In this review, I'm going to examine helicopter functionality.

New to the JR programming paradigm is an 'Initial Model Setup Guide'. This kicks in whenever you select a new model or erase an existing one. The guide walks you through a series of basic steps. You are first asked to select a model type. Selecting 'Helicopter' results in the system asking you to enter up to a 16-character model name. You're then asked to select a swash type. Finally, you're asked which channel should be the output for the gyro gain. When the guide is finished, the rest of the programming is performed in the usual JR manner; that is, with programming items segregated into separate System and Function lists. A welcome change here is the ability to access the System list WITHOUT turning the radio off.

I'd now like to go over what I believe are some of the 11X's "premium" programming features. These are of course in addition to the basic features such as servo reversing, end-point adjustments, dual rates / expo, etc.

IN THE SYSTEM LIST:

FLIGHT MODE NAME •

Should you decide to do so, you can assign meaningful names to each of your flight modes. Names may be up to six characters long. Separate 4-character short names that are displayed on various limited real estate screens can also be customized.

WARNING ALERT •

An audible warning may be enabled that will sound whenever the transmitter is turned on with a switch, stick position switch, and/or throttle stick position in a potentially dangerous or non-desired position.

TX SETTINGS •

We now have a way to customize many of the system's behavior settings. It has the usual stuff like adjusting the display contrast and setting the backlight to on/off/auto. However, we now also have the ability to turn on/off and adjust the tone of certain system sounds, such as those annoying beeps you hear while programming and making trim adjustments. Even the system's low battery voltage threshold can be adjusted here. Should you need to verify your system's firmware version – that's found here as well.

LATENCY AND **PERFORMANCE**

MEASUREMENTS PERFORMED BY JOHN KOS

DSM2 PROTOCOL / JR R921 RX (2048-STEP RESOLUTION):

Channels 2, 3, & 6 - Minimum: 24.3 mSec, Maximum: 48.8 mSec, Average: 36.2 mSec. Aileron and Elevator input latencies also fall within this range.

DSM2 PROTOCOL / SPEKTRUM AR7000 RX (1024-STEP RESOLUTION):

Channels 2, 3, & 6 - Minimum: 21.3 mSec, Maximum: 47.3 mSec, Average: 33.8 mSec. Aileron and Elevator input latencies also fall within this range.

Position updates for all 11 channels were observed in consecutive frames.

TRAINER •

The 11X may be configured as either a 'Master' or 'Slave' transmitter when used in a trainer environment. When used as a 'Master', you can select which of the primary flight controls (throttle, aileron, elevator, and rudder) get transferred to the student when the instructor relinquishes control.

STICK ALERT •

Allows you to activate an audible alert that will sound whenever the throttle stick passes over a user defined position. This can be used to let you know when you're collective goes though a given pitch.

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BLADE

#1 BY DESIGN

DEVICE SELECT • Many of the 11X's functions and channels are assignable to switches, trims, and levers. These assignments are done from here. You also have the ability to activate and deactivate additional flight modes as well as channels 5 and 7 – 11. Deactivating a channel is a convenient way to use it as a slave channel for mixing.

FLIGHT MODES • Any of the 11X's 3-position switches may be assigned to flight mode control. In addition to the Normal, Stunt 1, and Stunt 2 flight modes, you can enable two additional flight modes for a total of five (not including Throttle Hold). Remember, the name of each flight mode is customizable.

ASSIGNING / ACTIVATING GOVERNOR AND GYRO FUNCTIONS

• The 11X contains dedicated governor and gyro functions that can be individually activated and deactivated. These functions are user assignable to channels 5 and 7 – 11.

SWASHPLATE TYPE • The system handles just about every swashplate geometry out there. Six swashplate versions are available; 1-servo (normal), 2-servo (180°), 3-servo (120°), 3-servo (140°), 3-servo (90°), and 4-servo (90°).

IN THE FUNCTION LIST:

LIMIT ADJUST • Aside from the usual 'Travel' adjust, the 11X also features a 'Limit' adjust function. This allows you to set the absolute maximum travel for any given channel. You use this to prevent mixes from overdriving a servo.

SERVO SPEED • Channel speeds may be individually adjusted from full-speed all the way down to 15 seconds per 60 degrees of rotation. Separate speeds can be specified for each direction. Additionally, two sets of speeds (switch or flight mode selectable) may be programmed for each channel.

THROTTLE / PITCH CURVES • Separate pitch and throttle curves are available for each flight mode (with only a pitch curve available for Throttle Hold). Each curve can be customized to have as few as two points to as much as seven. The locations of all but the two end points are adjustable. An optional 'Exponential' function can be enabled to smooth out inflections at the points.

TAIL CURVE • For those using 'rate' (a.k.a. 'normal') mode gyros, the 11X has a dedicated 'Tail Curve' function. This function allows you to dial in separate tail rotor pitch curves for each flight mode. Up to seven adjustable points per curve are available. As is with the main throttle / pitch curves, an 'Exponential' function may also be applied to these curves.

GYRO SENSOR • A dedicated Gyro function allows you to control gyro gain using a switch (called 'manual' mode), a switch along with flight modes for up to three gains in each flight mode ('flight' mode), or one of three selectable gains via the flight mode switch ('automatic' mode). Along with the traditional JR way of setting gain (called 'Normal'), you now have the option of using 'Tail Lock' mode. Tail Lock mode lets you overtly select the operating mode (rate or tail lock) and specify the actual gain value. The function also enables you to apply a delay that will dampen transitions between tail lock and rate modes of operation.

GOVERNOR • A dedicated Governor function allows you to specify a separate RPM for each flight mode.

SWASH MIX • Along with the usual ability to set the aileron, elevator, and pitch authority and direction, the 11X features dedicated 'Aileron-to-Elevator' and 'Elevator-to-Aileron' compensation mixes that allow you to correct swashplate interactions. Additionally, this function provides an electronic cyclic ring to prevent overdriving the swash when combining aileron and elevator inputs are given. An exponential function can also be enabled that will compensate for the non-linear pushrod travel that occurs due to the rotational path scribed by the servo's output arm.

INDEPENDENT SPECIFICATION VERIFICATION

JR SUPPLIED TRANSMITTER SPECIFICATION:

TRANSMITTER CURRENT DRAIN: 180 mA (DSM2)

MEASURED TRANSMITTER SPECIFICATION:

CURRENT DRAIN (W/BACK-LIGHT OFF): 250 mA (DSM2)
CURRENT DRAIN (W/BACK-LIGHT ON): 260 mA (DSM2)
With the included 1500 mAh TX battery pack, you can expect to get about 5 ½ hours of use per charge.

JR SUPPLIED R921 RECEIVER SPECIFICATIONS:

WEIGHT
MAIN: 15.0 g / 0.6 oz
REMOTE: 3.0 g / 0.2 oz
SIZE
MAIN: 1.23" x 1.94" x 0.56"
REMOTE: Not provided
CURRENT DRAIN: 70.0 mA

MEASURED R921 RECEIVER SPECIFICATIONS:

WEIGHT
MAIN: 17.5 g / 0.62 oz
REMOTE: 3.5 g / 0.12 oz
SIZE
MAIN: 31.2 mm x 49.1 mm x 14.2 mm / 1.23" x 1.94" x 0.56"
REMOTE: 20.2 mm x 25.9 mm x 7.12 mm / 0.80" x 1.02" x 0.28"
CURRENT DRAIN (W/1 REMOTE RECEIVERS): 77.3 mA

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NOTE – *the 11X continues to suffer from the same issue that has plagued the JR X9303, X9503, and 12X. When Swash Exponential is enabled and Sub-Trim is used on any of the swash channels, the servos plugged into swash channels with subtrim dialed in will not track correctly. With that in mind, it's best to use as little subtrim as possible when Swash Expo is enabled.*

DEDICATED & PROGRAMMABLE COMPENSATION MIXES

• The 11X offers dedicated cyclic-to-throttle compensation mixes. It also has three normal programmable mixes and three multi-point (or curve) programmable mixes. Each of the three multi-point mixes may be configured to act as 'normal' programmable mixes if desired. The ability to turn the mixes on or off is quite flexible. Every position of every switch (including stick position switches) can be programmed to turn a mix on. If any one of the 'on' conditions is met, the mix is turned on.

MIX MONITOR

• You no longer have to go through all of your mixing screens to figure out how your mixes are performing. The 'Mix Monitor' screen gives you a quick view into all your mixes. From here you'll be able to see exactly which mixes are enabled. And for those that are enabled, you'll be able to see their master / slave assignments and whether or not the mix is on or off.

STICK POSITION SWITCH

• Two 'Stick Position' switches are provided. Each one may be assigned to any of the four stick controls. The trip point - as well as which side of that point is the 'on' state - is programmable. You can also configure a stick position switch as 'symmetrical', which allows you to program two trip points that essentially divide the control into three sections. You then program whether the 'on' state of the switch is in the center section or either of the two end sections.

TIMER

• There is one integrated timer and three general purpose timers per model. The timers appear on the 'Main' and 'Quick Information' screens. The integrated timer keeps track of the total time on a per model basis. Each of the other timers can be configured as a 'Stopwatch' or 'Countdown' timer. Timer on and off functionality may be individually assigned to the lower programming button, a physical switch, or a stick position switch.

Of course this isn't everything this radio does, but I hope it gives you a feel for how comprehensive the 11X's programming suite really is. For a complete description of all programming, the Instruction and Programming Manual is available on-line at: **www.jrradios.com**

USER UPGRADABLE FIRMWARE

As programming evolves, I personally consider user upgradable firmware to be a deal breaker when selecting a new radio. Not only does it facilitate a quick and easy way to distribute bug fixes, but it also allows new features to be added. I'm happy to report that the 11X is the first JR radio to support this feature.

As a matter of fact, JR has already released a firmware update that addressed a bug in the heli software. When I received the radio, I noticed that the throttle trim affected the throttle curve in all flight modes. The documentation clearly states that it should only affect the curve in 'Normal' flight mode.

I downloaded the firmware update from Horizon Hobby's website and performed the firmware update as per the provided instructions. The procedure went without a hitch and the throttle trim issues is now resolved.

RECEIVER

The 11X ships with the proven R921 receiver. This is a 9-channel, full-range receiver that utilizes two internal and one satellite receiver. Optionally, it supports the use of one additional satellite receiver. Capable of 1024-step and 2048-step resolutions, it operates in 2048-step resolution when used with the 11X.

The receiver also supports two modes of fail-safe operation; 'SmartSafe' and 'Pre-programmed Fail Safe'. It also supports use of the JR or Spektrum Flight Logs for gathering data link performance metrics.

THE GOOD

- Extensive programming features
- Very smooth dual ball-bearing gimbals
- Beautiful four gray-scale, back-lit display
- SD Card slot for additional model memory and firmware upgrades

THE BAD

- Rear lever controls are practically inaccessible to "pinch" type pilots
- Essentially no performance improvement over the X9303 / X9503
- Inconsistent swash servo throws when Swash Expo is enabled and Sub-Trims are used

CONNECT

MANUFACTURER:	JR Radios
WEBSITE:	www.jrradios.com
PART NUMBER:	JRP1100
STREET PRICE:	$749.99

CONCLUSION

With a street price that's about $200 higher than that of the X9503, I'd argue that when comparing the two, the 11X is indeed a better value. In fact, I think the SD card support (read programming back-up and unlimited model memory) and the fact that it allows for user upgradable firmware alone are worth the additional scratch. Then, factor in a plethora of new programming and convenience features, good performance, and a 3-year warranty that is backed by Horizon Hobby, and you have one hell of a radio at a very reasonable price point.

Happy Flying ... RCHL

Castle engineers Jonathan Feldkamp (left), and Richard Hofer (right) with Tim Jones, testing a Castle Vertigo Motor prototype.

Tim Jones Beast: 700mm blades, jaw dropping power, 2300 rpm headspeed. Ballistic performance, governed to +/- 25 rpm by Castle Phoenix Ice controller and software.

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Class	Helicopter	Motor	Castle ESC Recommendations	Lipo Cells	Pinion	Flying Style
250	Align 250	Align BL250	Phoenix-25	3	15t	3D
	Gaui 200	Gaui GM-811-4800KV	Phoenix-25	2, 3	9t - 15t	Sport, 3D, Extreme 3D
450	Align 450	Align BL 430SP	Phoenix Ice Lite 50	3	13t	3D
		Scorpion HK 221-8	Phoenix Ice Lite 50	3	13t, 14t	3D, Extreme 3D
	Rave 450	Next D (Scorpion) 221-6	Phoenix Ice Lite 50	3	11t	3D
		Scorpion 221-10	Phoenix Ice Lite 50	4	13t	Extreme 3D
500	Trex 500	Align BL 500L	Phoenix Ice 75 or 100	5, 6	12t, 13t (6s), 14t (5s)	Sport, 3D
		Scorpion HK 3026-1600	Phoenix Ice 75 or 100	5, 6	14t, 15t (5s), 13t, 14t (6s)	Sport, 3D
550	Mikado 500	Scorpion 4025-890	Phoenix Ice 100	8	14t, 15t, 16t, 17t	Sport to Extreme 3D
		Scorpion 4025-1100	Phoenix Ice 100	8	16t, 17t, 18t	Sport to Extreme 3D
600	Trex 600	Align BL650L	Phoenix Ice 100	8	14t, 15t, 16t, 17t	3D
		Neu 1515H/2.5D-1650Kv	Phoenix Ice 100	6	12t, 13t	3D, Extreme 3D
700	Trex 700	Align 700M-510Kv	Phoenix Ice HV 80 or 120	12	12t	3D
		Neu 1915H/1.5Y-450Kv	Phoenix Ice HV 80 or 120, PH-HV110	12	18t, 19t, 20t	3D

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Thunder Tiger MINI TITAN E325 UH-1 SCALE CONVERSION KIT

Mini Titan meets Mini Huey!

WORDS: Dan Goldstein | **PHOTOS:** Mark Schneider

Normally, it would take several weeks of prepping, masking, painting and scale parts crafting to accomplish what Thunder Tiger has done for you in this quick build conversion kit. Attractively priced and easy to install, this conversion kit will turn your Mini Titan into a mini scale wonder!

FEATURES

This conversion kit features a fully painted light PVC fuselage with panel lines, weathering and dimples for drilling holes. Thunder Tiger included a complete set of scale accessories ranging from handrails and radio antennae to cable cutters and windshield wipers. The label sheet is high quality and comes with a diverse set of markings. To make battery access easy, the front of the fuselage features a magnetically secured cabin that tilts open. Completing the authentic scale look, an angled tail rotor conversion is included. The kit is available in two painted schemes (US Marines Search and Rescue or German Army) or paint-your-own clear.

BUILDING

To start off, I had to convert and modify my stock Mini Titan airframe to accept the scale accessories. The manual is highly detailed and very easy to follow. I began by converting the tail section to the angle driven version. This was very easy and straightforward. When I installed the belt, I made sure to have the belt twisted correctly as per the manual. In addition, since it is a longer belt, I also set the tension accordingly.

The tail case, receiver mount, and battery tray required some trimming. The fuselage stand-offs installed quickly utilizing existing screws. I attached the separate landing gear base plate in the place of the original landing gear. I then assembled the scale landing gear struts into their skids and was extra careful to not over tighten any of the fasteners. At this point, I was set to change the mixing and radio settings for scale flying.

Depending on what your existing setup is for your Mini Titan, you may want to move the mixer balls in on their arms for more stability, tone down the cyclic

INFO

- Conversion kit for your Mini Titan E325 model helicopter.
- High-position tail rotor mechanism.
- Exclusive quick-open hatch for battery access.
- Scale antenna set, horizontal tail-plane, scale landing & tail skids, handrails & rocket launchers (Army version).
- Light PVC fuselage, easy for assembling.
- Available in two great painted schemes or clear fuselage.
- Pre-weathered (painted schemes versions only).

SPECIFICATIONS

GEAR RATIO: 1:11.5:4.4

FULL EQUIPPED WEIGHT: 32.8 oz. / 930 g.

EQUIPMENT USED

MOTOR: Thunder Tiger OBL 39/35-10H

ESC: Thunder Tiger BLC-40

CYCLIC SERVOS: Thunder Tiger C1016

TAIL SERVO: Ino-Lab HGD-201HB

GYRO: Spartan RC Quark

RECEIVER: Futaba R6106HF

BATTERY: PowerEdge RC 3s2200 30C

MAIN ROTOR BLADES: Thunder Tiger 325mm wood

Too bad they can't make it turbine.

throws, add more expo, change to a hover-at-half-stick pitch and throttle curve and re-gear the drivetrain to reduce head speed to 2400-2500 RPM. This will help soften up the model's response, making it feel and fly more smoothly as a scale model should. To test the airframe, I flew it without the fuselage to make sure that everything was working properly. This ensured that I wouldn't damage the fuselage if I had a setup problem.

After getting the airframe trimmed out, I went ahead and worked on getting the fuselage ready to for final installation. I separated all of the plastic scale accessories from their sprue and attached them to a piece of cardboard. I poked holes in the cardboard with a push pin for the miscellaneous antennae and cable cutters. Then I took this setup outside so that I could paint everything with white spray paint. I applied four light coatings and let everything dry overnight.

This version of Thunder Tiger's Huey conversion kit came painted and dimpled for drilling the accessory and mounting holes. I used a push pin to start all of the holes. The pin actually made the holes just large enough to hold the plastic scale accessories in place so they could be glued. It's best to use a low-fume or plastic rated CA glue to prevent clouding of the fuselage plastic. For opening up the mounting screw holes, I used a 5/64" drill bit in a pin vise. I used a 5mm drill bit to open up the holes for the tail horizontal wings.

A high quality set of labels is included to mark the fuselage. Some of the labels and accessories will cross over the two halves of the fuselage, so it's best to apply them last. I installed a grommet into each half of the fuselage for the standoff on the airframe. Once the grommets were installed, I attached

Looks like it needs some ventilation holes.

the fuselage halves to the airframe. I screwed on the tail fins and installed the screws that retain the fuselage to the tail housing. I then made sure to align the seams before using a push pin to make holes for the small black Phillips screws that hold the halves together.

I then installed the landing gear and the rest of the scale accessories and labels. The last thing I did was to install the cool battery door. A portion of the front cabin is secured with magnets and tilts forward to allow access to the battery. Installing the magnets was a little tricky, but I managed to not get too many of my fingers glued together in the process. I put a fine line of thick CA on the magnet, then used my finger to position it on the inside edge of the front opening. I stuck the metal strip on the outside to hold the magnet in place to dry. I repeated this for each of the remaining three magnets. After the magnets were dry, I attached the metal strips to the cabin door. After all the glue was set, I installed the hinge. Once completed, with the cabin closed you could barely notice that it's a separate piece, a really functional and trick feature!

The assembly was all set, now all I had to do was pop in a charged battery and haul this hog out to the field! Once at the field and plugged in, the model spooled up with no vibrations. In the air, the model flew in a very smooth and stable fashion. I flew some circuits and hovered around for four minutes. After landing, I pulled the battery and noticed quite a bit of heat inside the model. Granted, it was about 90-degrees outside, so if you're in a warm climate keep an eye on your temps.

CONCLUSION

This conversion kit allows you to easily morph your Mini Titan into a convincing and beautiful mini Bell Huey. The factory really went all out in terms of the details, accessories and ease of construction. The only thing lacking is the punctuated "thowmp-thowmp" like the full-scale version. The scale rendition will stir your imagination and you may just be inclined to send the Huey on missions to rescue your friends' downed planker pilots. RCHI

THE GOOD

- Highly detailed scale fuselage and accessories
- Ease of assembly
- Low price

THE BAD

- Poor airflow through fuselage

CONNECT

MANUFACTURER:	Thunder Tiger
WEBSITE:	www.acehobby.com
PART NUMBER/ STREET PRICE:	TTR3901-R (US SAR Team) $99.99, TTR3901-G (German Army), TTR3901 (Clear, unpainted fuselage) $83.99

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Heli WHOLESALER

Prontow Custom Products TILT-A-WHIRL

A new amusement ride

WORDS: Ryan Kephart

PRONTOW CUSTOM PRODUCTS CAME ABOUT FOR THE SIMPLE REASON TO DEVELOP THE TILT-A-WHIRL HELICOPTER STAND. The stand was created to help the pilot work on his helicopter without taking up space on the bench, and allowing the helicopter to tilt to reach areas without holding the helicopter in your hand. Prontow is devoted to making tools, parts, and other tuning items to make your job easier.

FEATURES

The Tilt-A-Whirl features sturdy aluminum and steel construction. It's designed with three major parts: the tripod base, the steel head, and a plastic tool and parts tray. The base is constructed using a tripod arrangement like you would find on heavy-duty lighting. The tripod is painted in bright orange and has been modified to support even the heaviest helicopters. A plastic tray is then mounted to the tripod using a clamp. The tray itself is molded with holes and slots for your ball link drivers and pliers. The tray also has two molded recesses for parts and screws. A third recess allows you to store a drink or additional parts. At the top of the tripod, a helicopter mount is attached with a plug and is secured to the base with a machine screw. The head is fully adjustable and allows you to mount virtually any helicopter on the market. The head features quick adjustment handles, steel construction, and foam padded skid holders.

HOW IT WORKS

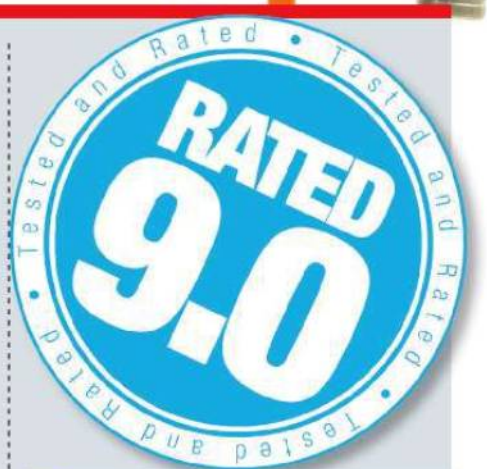
Testing: We tested the Tilt-A-Whirl with various helicopters. Installing the helicopter to the Tilt-A-Whirl is a cinch. To adjust the size of the mount, a simple twist of a thumbscrew and slide of the skid mount is all that is required. After you adjust the mount, the helicopter is secured with four Velcro straps that are permanently attached to the Tilt-A-Whirl. The height can be adjusted using the base's telescoping shaft. In most cases only the lower adjustable section needs to be raised, as this will put your helicopter just below eye level.

We performed several tasks on the Tilt-A-Whirl to compare how much easier it was to work on the helicopter on the stand than on the ground or workbench. Simple tasks like checking the blade pitch became much easier by lifting the helicopter up to eye level and moving the stand away from obstructions. This allowed us to rotate the main rotor blades without hitting the wall or getting down on the ground to eyeball the pitch. We also performed basic maintenance on the helicopters, including removing the engine, rotor head, and tail to inspect and lube bearings. The Tilt-A-Whirl made this process clean and easy.

The Tilt-A-Whirl proved to be a rugged and useful tool around the shop, and it even folds up small enough to take to the field. Overall, this product made life easier, and kept everything organized while we worked. Who doesn't want that?

CONCLUSION

If you're looking to make helicopter maintenance faster, easier, and more organized, then the Tilt-A-Whirl would be a great addition to your shop. The Tilt-A-Whirl is portable, so you can take your shop on the road and work on your helicopter anytime, anywhere. The construction is sturdy and will surely last a lifetime. RCH



THE GOOD

- Sturdy Construction
- Makes tasks easier
- Multiple positions

THE BAD

- A bit Pricey

CONNECT

MANUFACTURER:	Prontow Custom Products
WEBSITE:	www.prontow.com
PART NUMBER:	Tilt-A-Whirl
STREET PRICE:	$150.00

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REGULAR GUY INTERVIEW:

RAYMOND McFAUL

WELCOME TO THIS MONTH'S "REGULAR GUY" INTERVIEW. EACH MONTH WE INTERVIEW AN UNKNOWN, NON-SPONSORED PILOT WHO IS ONE OF THE "GOOD GUYS" AT THEIR LOCAL FIELD. We hope to shed some light on what I consider the lifeblood of this hobby - those pilots who day-in and day-out train and help new pilots succeed and do so with no fanfare or payment. We are always looking for more of the unsung heroes in the hobby. If you know of such a person we could interview, please email me at rchelijim@gmail.com.

PILOT INTRO

This month our Normal Guy travels bring us to Sweetwater, Texas, and the home of Raymond McFaul. One of Raymond's flying buddies, William Lain, contacted me and told me his story. William described how he was on the brink of quitting the hobby when he met Raymond. Raymond took William under his wing and shared his love and passion for the hobby. Raymond travels 40 miles each week to Abilene so that he can teach and fly with fellow rotor heads there. Thanks to Raymond's help, William and many others in Abilene, TX have been able to succeed. Let's learn more about this "regular guy."

RCH: TELL US A LITTLE BIT ABOUT YOURSELF. WHAT DO YOU DO? WHERE DO YOU LIVE?

RAYMOND: My name is Raymond McFaul and I live in Sweetwater, Texas. I work for a company called Eljen Technology. We manufacture organic plastic scintillator and use it to make radiation detectors.

RCH: HOW DID YOU GET STARTED IN RC HELIS?

RAYMOND: I have always loved things that fly. The first time I thought about getting into RC I was looking at planes. My town does not have an RC club and as we all know, you need a runway to fly planes. I had a friend who bought anAirhog Havoc Heli. We played with it one evening and I fell in love. I went out and bought one the next day. It didn't take long for me to grow bored with the lack of control, so I purchased the Esky Belt CP RTF. I had no idea what I was doing, but with the help of "Finless" Bob on Helifreak and a few crashes, I got the setup figured out and the fun began.

RCH: WHAT ARE SOME OF THE MANEUVERS YOU ARE CURRENTLY WORKING ON? WHAT ARE YOUR FAVORITES?

RAYMOND: I have only been flying for 2.5 years, but I spend a lot of time on the simulator. I'm practicing piro funnels on the sim a lot these days, and nearly have them down well enough to try in the real world. I love to fly big; my favorite maneuver is the backwards inverted Hurricane. However, I can never resist a chance to do four-point Tic-tocks.

RCH: WHAT ARE YOUR TOP PIECES OF ADVICE FOR NEW PILOTS?

RAYMOND: Buy a good simulator and practice. I always tell them that the first time you fly on the sim and crash the helicopter, the sim just paid for itself. After

about two or three months on the sim you'll know if you're ready to purchase a real RC helicopter.

RCH: WHY DO YOU FLY HELIS NOW, AND WHAT ARE YOUR FUTURE PLANS WITH THE HOBBY?

RAYMOND: I fly RC helicopters because I love it; you can never get bored with them. There is always something new to learn.

I spend a lot of time watching different pilots on video and trying to figure out the maneuvers they are flying.

I hope to keep flying and improving. I hope to introduce more new pilots to the hobby and help get them flying sooner and easier than I had a chance to. Being self-taught, I see the advantages of having an experienced pilot to help get you on the right track. I also hope to compete at a respectable level in the next year or so in some funfly 3D events.

RCH: THANKS FOR YOUR TIME, RAYMOND, AND FOR YOUR DEDICATION TO HELPING OTHERS IN THE HOBBY!

CONCLUSION

You can tell from Raymond's responses how much he loves RC helicopters. He's excited about the hobby, and more importantly he's willing to share that excitement with new pilots. Though he has only been flying for a couple of years, he has made a great impact for those who he has helped succeed. Keep up the good work Raymond, and we'll see you at the field! RCH

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TAP & DIES

Give your helicopter a little "tap", don't let it "die" out

WORDS: Ryan Kephart

TAPS AND DIES HAVE BEEN AROUND FOR OVER A CENTURY, dating back to the 1800's. During the early years taps and dies were custom made to create bolts and nuts from wood. Over the years, taps and dies evolved to replace the once common wooden bolts with metal. Taps and dies were standardized as the international standard screw sizes were established. Today taps and dies are easy to use and are common in local hardware shops.

We got our set at Harbor Freight.

WHAT IS A **TAP?**

A tap is no more then a hardened piece of steel with cutting edges and flutes. The tap is used to cut an inside surface which will function like a nut. A tap is used on many helicopter parts, including the bearing blocks and motor mounts. Several different styles of hand taps are available for various different projects.

BOTTOMING TAP: The bottoming tap does exactly as its name implies. The tap has almost no taper to it and will cut threads all the way to the bottom of a hole. This allows the screw to reach a maximum depth without running out of threads. Although this tap although allows the threads to go all the way down, it does not allow you to start the tap easily. This is where the other two styles come in handy.

INTERMEDIATE TAP: The intermediate tap—or secondary tap—is one of the most common taps to use for larger bolts. The tap is slightly tapered during the first three to five threads. This allows the tap to ease into cutting threads and still can cut almost down to the bottom of the hole.

TAPER TAP: The taper usually ranges from eight to ten threads and allows for a clean hole to ease into the actual cutting of the threads. Although this tap is easier to start, the bottom of the threads will not be completely cut, preventing a screw from threading to the bottom. Either drilling a deeper hole or using a secondary tap can overcome this.

WHAT ARE **DIES?**

Dies, although not as commonly used in our hobby, do the same thing as a tap but in reverse. A die cuts threads into an outside surface like a bolt. The dies can be held in a special tool that locks the dies in place as you cut the threads. Dies can come in handy for cleaning up threads on an old bolt. Die nuts are made from hexagonal bar, so a common wrench can be used to turn them.

HOW TO USE **A TAP**

Using a tap can be somewhat confusing at first, but after a few goes you will quickly learn the fine art of tapping. When purchasing a tap set you will find that the taps specify a specific size of drill bit for each tap. This drill bit will make the proper size of hole for the tap to cut. This drill is usually the same size as the inside diameter of the thread. A tap or "T" wrench is used to chuck the tap and give the user a stable and strong grip.

Start by inserting the tap into the pre-drilled hole and slowly turn the tap until the threads start to grab. As the tap turns it will cut into the metal, leaving a rough-cut thread. After 4-5 threads you must reverse the direction, which will break off any metal chip during the cutting process. This will prevent crowding, which can lead to a broken tap.

A tap can be used for multiple purposes. You can use the tap to clean up some threads and remove old thread locking compound, or the tap can be used to add an additional screw to hold down an accessory. Another useful and sometimes necessary task is rebuilding threads that have been stripped. This process can be done by going to the next size up and re-drilling the hole and tapping new threads. When using a tap for any process involving aluminum, lubricant must be used to keep the tool clean and cool as it cuts. WD-40 or 3-In-One is a great lubricant when cutting this type of metal.

CONCLUSION

If you're in the hobby long enough you will find yourself in need of a good tap set. Eventually, a thread will become stripped, clogged, or simply worn out. The tap will come in handy and will allow you to repair the threads and extend the life of your helicopter. This may be your only option if you have an older helicopter and parts are not available. RCH

BRUSHLESS MOTORS

PUMPING ELECTRONS

WORDS: Shawn Kitchen

EVEN FOR A DIE-HARD NITRO GUY LIKE MYSELF, IT'S HARD TO DENY THE GROWTH AND PROMINENCE OF ELECTRIC POWER IN THE HELICOPTER WORLD. Electric helicopters offer scintillating performance and require no messy nitro cleanup after a flight, while at the same time the price of batteries is going down and availability is going up. Electronic power is a permanent fixture on the model heli landscape.

No discussion of electric helicopters is complete without an examination of brushless electric motors, which is the topic of this Heli Anatomy.

Brushless motors can be found in large scale applications as well.

WHAT IS A BRUSHLESS MOTOR?

In order to better understand what a brushless motor is, we need to compare it with its relative – the brushed motor. In brushed and brushless motors, there are a couple of key components:

WHAT MAKES A BRUSHLESS MOTOR DIFFERENT?

How is a brushless motor different than a brushed motor, and why is it better? Quite simply, the difference is – as you may have guessed – whether or not the motor uses brushes. What's a brush, then?

When you have an electric motor where part of it is spinning and part of it isn't, there's the issue of making the electricity move the part that needs to move. In a brushed motor the armature becomes an electromagnet, which spins inside the can. Since the electromagnets need electricity to make them work, the problem is applying the electricity to the spinning armature. This is where the brush comes in.

Brushes are small metallic tabs (usually made of a relatively soft metal like copper), which rub against a special portion of the armature called a commutator. The commutator is attached to the armature and split into several different sections (depending on the number of lobes on the armature), and each section of the commutator is wired to a different set of electromagnets on the armature.

When electricity is applied to the brushes, the electricity flows across the brush and through the commutator, which then energizes a section of the armature. This causes that portion of the armature to become attracted to the permanent magnet inside the can (which is of the opposite polarity), and tries to pull the two magnets together. As the armature rotates, the brush comes into contact with a different section of the commutator, which energizes a different section of the armature, which keeps the motor spinning.

In a brushless motor, there are no brushes and no commutator. Instead, an Electronic Speed Control (ESC) is used to control electronic pulse timing. Since the electromagnets are stationary in a brushless motor, there's no need to have a commutator. The ESC controls the speed of the motor by varying the timing and length of charge of each of the stator's sections. This energizes the electromagnets, which attracts the permanent magnets on the rotor, which makes the rotor spin. An outrunner brushless motor uses the same principle, but the electromagnets are on the rotor (inner portion), the permanent magnets are on the can (outer portion), and the can of the motor is what spins.

Once again, you can almost think of a brushless motor as a brushed motor turned "inside out." A brushed motor applies electricity to a spinning electromagnet which is then attracted to a stationary permanent magnet, while a brushless motor applies electricity to a stationary electromagnet that attracts a spinning permanent magnet. Confused yet?

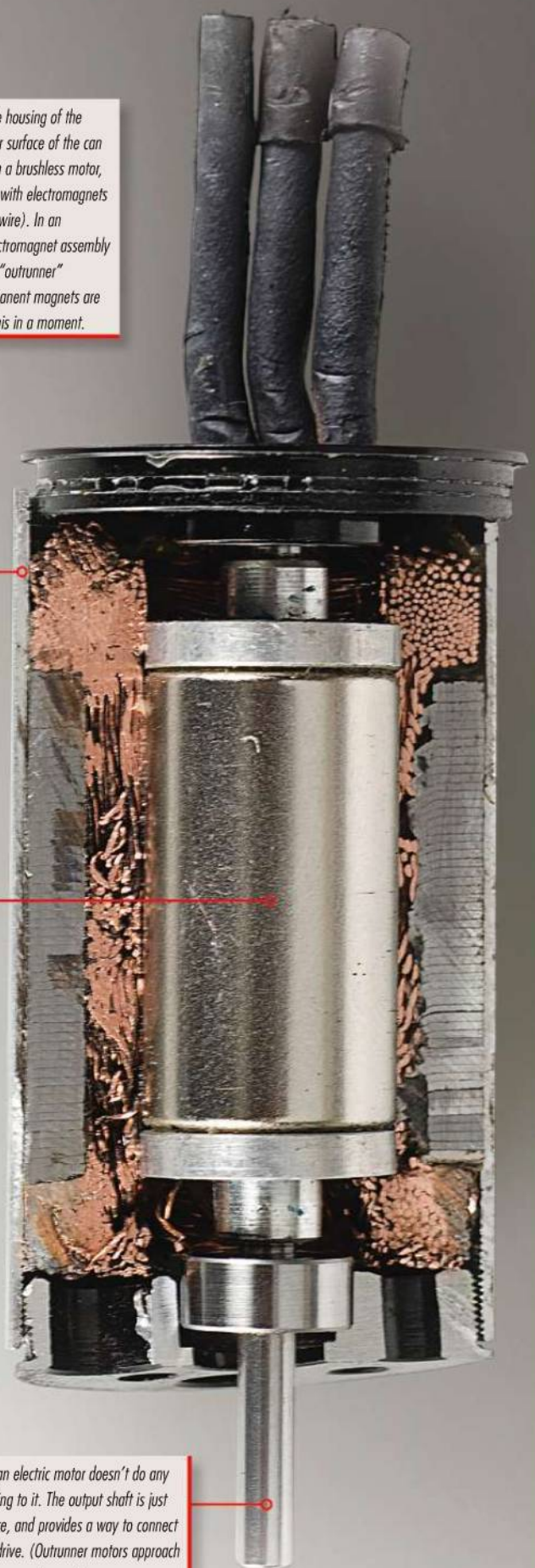
WHY BRUSHLESS?

It's difficult to find a brushed motor in a model helicopter these days. Brushed motors have three major disadvantages compared to their brushless counterparts – decreased efficiency, increased likelihood of RF interference, and higher wear. On a brushed motor, the brushes slowly wear out as they rub against the commutator. As they do, the likelihood of electrical arcing increases, and any time you have a brush arcing on the commutator you have a source of RF interference. There's also the issue of efficiency – at lower speeds, brushed motors are typically less efficient than brushless because of their fixed timing.

Brushless motors overcome these obstacles because they have no brushes to wear out, and consequently they have less potential for RF interference. They're also more efficient at lower RPMs, because the nature of an ESC allows the motor timing to be adjusted for the motor's speed, rather than relying on a fixed timing setting.

THE "CAN" - *This is the outside housing of the motor. In a brushed motor, the inner surface of the can is lined with permanent magnets. In a brushless motor, the inner surface of the can is lined with electromagnets (magnets surrounded by electrified wire). In an "inrunner" brushless motor, the electromagnet assembly is referred to as the "stator." In an "outrunner" brushless motor, however, the permanent magnets are on the inside of the can. More on this in a moment.*

ROTOR / ARMATURE - *This refers to the center part of the motor. In a brushed motor, the center portion is called the "armature," and is made up of a series of stamped metal stacked on a shaft; the "stack" has wire wrapped around it and when energized it becomes an electromagnet. In an inrunner brushless motor, the center portion is called the "rotor," and houses the permanent magnets. In this regard, you can think of brushless motors as being a brushed motor turned "inside out." A brushed motor has a fixed permanent magnet and a rotating electromagnet, while a brushless motor has a fixed electromagnet and a rotating permanent magnet.*



OUTPUT SHAFT - *Obviously, an electric motor doesn't do any good unless you can attach something to it. The output shaft is just an extension of the rotor or armature, and provides a way to connect the motor to the object it needs to drive. (Outrunner motors approach this a little differently – see sidebar on next page.)*

OUTRUNNER MOTORS

In an inrunner brushless electric motor, the motor can is attached to a stationary object, and the rotor spins inside the can. In this way, the motor can get work done. An outrunner motor uses a slightly different principle. In an outrunner motor, the rotor is permanently fixed to the stationary object, and the outer can is what moves. As such, there's no traditional output shaft on an outrunner motor, because the exterior of the can is attached to the part that needs to be moved, rather than the rotor.

The primary benefit to an outrunner motor is torque. Because the motor can is further away from the center of the motor than the rotor is, the can provides a longer lever arm on which to exert force. Since torque is directly related to leverage, an outrunner motor can provide more torque than its inrunner counterpart. The mass of the can and the permanent magnets also help to smooth out the power delivery.

CONCLUSION

You can spend your entire heli career learning the finer points of how brushless motors operate (and many companies do), but hopefully this installment of Heli Anatomy has given you some insight into the technology that makes electric helicopters such a popular segment of our hobby. Clean, efficient power that requires no messy cleanup afterwards...what's not to like? RCH

This all sounds very familiar.

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Thunder Tiger Raptor 50 2.4GHz Super Combo **$949.99**

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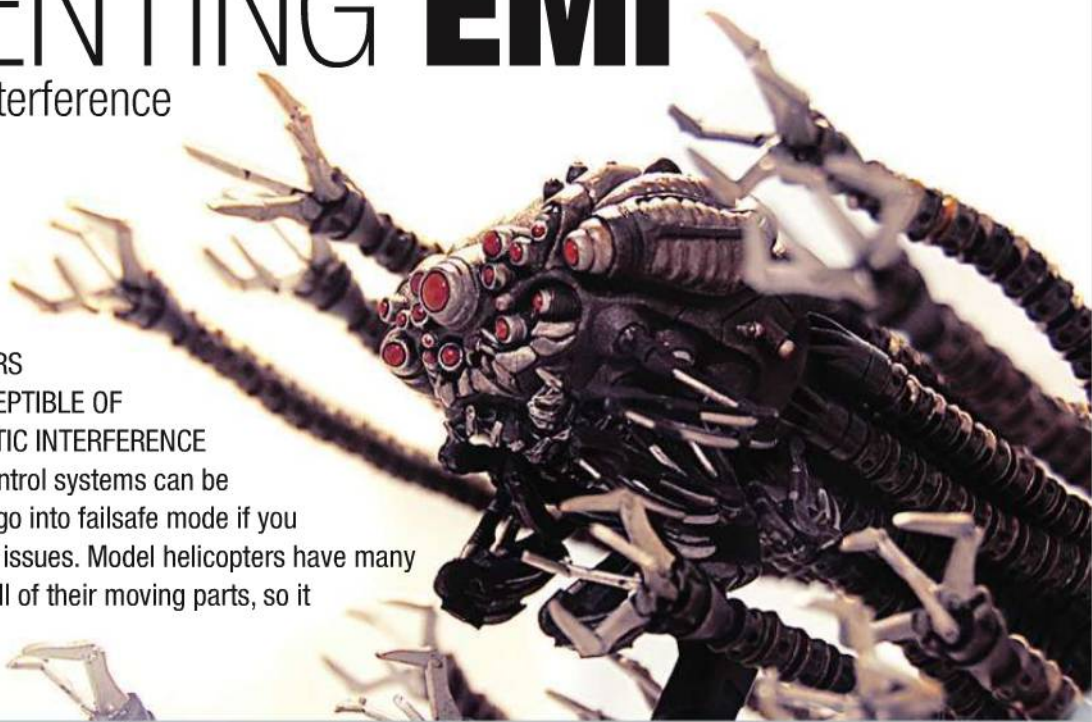
FLY HARD! Heliproz has the parts!

PREVENTING EMI

Electro-Magnetic Interference

WORDS: Aaron Shell



MODERN 2.4GHZ RADIO SYSTEMS HAVE IMPROVED THE RELIABILITY OF CONTROL, BUT HELICOPTERS THEMSELVES ARE STILL SUSCEPTIBLE OF GENERATING ELECTROMAGNETIC INTERFERENCE (EMI). Even the best 2.4GHz control systems can be swamped by interference and go into failsafe mode if you don't pay attention to potential issues. Model helicopters have many potential sources of EMI with all of their moving parts, so it is worth learning all you can about the topic.

The Sentinenl will wreak havoc on your electronics.

» SKILL LEVEL

SCALE RATING: 1=EASY 5=ADVANCED

3.0 RC Heli

» TIME TO COMPLETE

30 Minutes

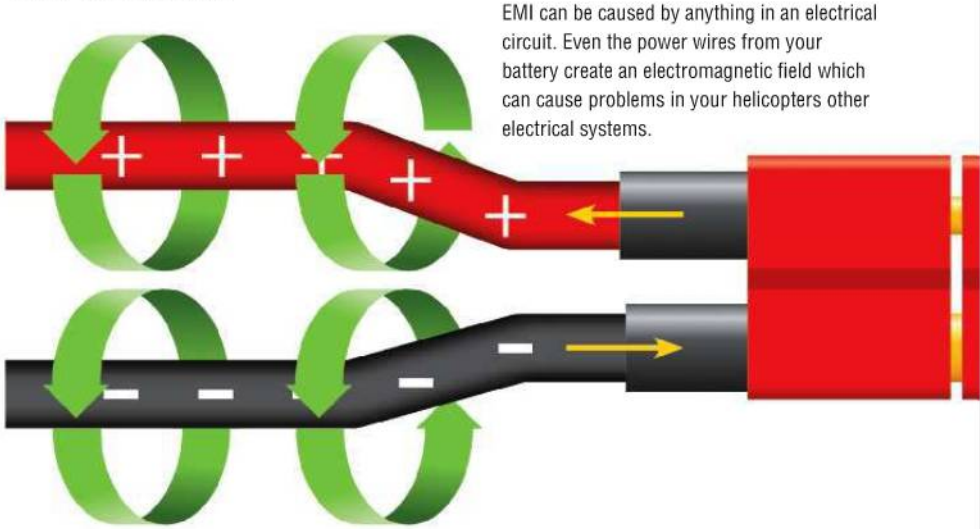
» TOOLS NEEDED

- ANTI-STATIC SPRAY
- MULTIMETER
- INSULATED WIRES
- SELECTION OF RESISTORS (OPTIONAL)
- STATIC WICK (OPTIONAL)

WHAT IS EMI?

EMI could be any disturbance affecting the normal operation of a circuit. It can be caused by electromagnetic radiation (which does not require physical contact), or by electromagnetic induction. Electromagnetic induction is defined as the flow of electrons in a conductor due to the conductors movement through a magnetic field. EMI can affect any circuit, not just receivers. It's possible to pick up EMI in servo leads that will affect only one servo, or in power leads that could affect everything in the system by virtue of a common power bus. Electronic components themselves can be a source of EMI. For instance, a speed control could cause EMI if it's not properly installed or if a component (such as the input capacitor) is damaged. EMI affecting the reception of your receiver is only one potential problem area. Any circuit on your heli could be affected by EMI of different forms.

EMI can be caused by anything in an electrical circuit. Even the power wires from your battery create an electromagnetic field which can cause problems in your helicopters other electrical systems.



WHAT IS **STATIC?**

"Static electricity" refers to the buildup of voltage differential on common everyday objects. We experience static when the voltage differential finds a path to ground and neutralizes, often producing a shock or even a visible spark. When this discharge happens, EMI is generated. Two of the four types of static electricity—triboelectric and electrostatic—could affect your model helicopter. In simple terms, the triboelectric effect is caused by friction, and electrostatic induction can happen when you pass an electrically neutral object by a conductor.

There is a classic example from high school science class everybody should remember; to demonstrate the electrostatic effect, the the Van de Graaff Generator would be pulled out. Van de Graaffs in science class continue to amaze students today with giant sparks and student's hair standing on end. A simple version using the triboelectric effect can be built. For industrial applications or for large scale science experiments, a Van de Graaff generator using electrostatic induction can produce enough voltage that they are commonly used to power particle accelerators.

A Van de Graaff generator is an electrostatic generator capable of producing extremely high voltage on its hollow metal globe. When voltage potential is built up on the globe, a spark will jump to ground through any path it can find, such as through a student's body. The Van de Graaff uses a belt on two pulleys; electrodes glide on the belt to provide a connection to ground at the bottom and a connection to the hollow metal globe at the top. When the pulleys are turning, a charging current travels along the belt and produces a voltage differential along the surface of the metal globe. Ironically, the belt must be non-conductive to produce the charging current. The problem—and the reason I've been speaking about the Van de Graaff generator so much in this article—is that we frequently do a good job of recreating some of its effects on model helis.

Johnny-Five was brought to life through EMI.

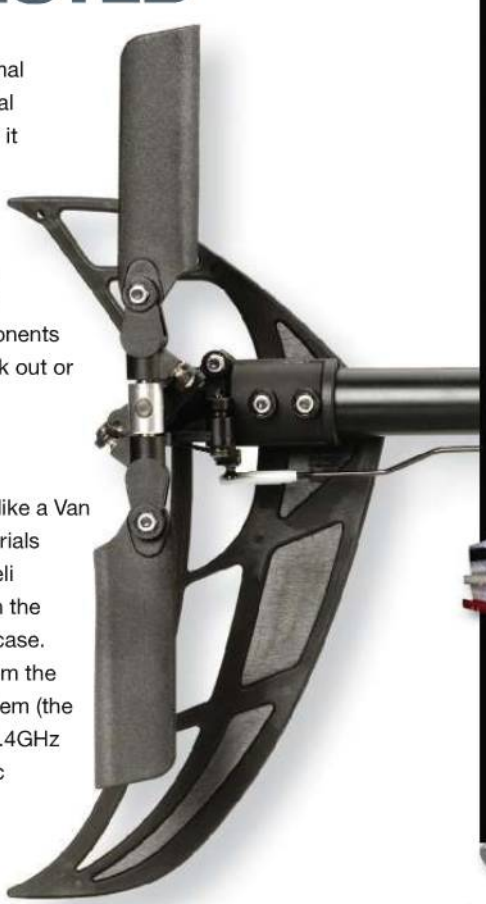
HOW DIFFERENT DESIGNS **CAN BE AFFECTED**

TORQUE TUBE

With a shaft drive tail system there are minimal opportunities to produce a voltage differential between different parts of the heli. However, it does pay to monitor the condition of your bearings. Although the vibrations they produce are at a low enough harmonic to avoid causing a problem for your 2.4GHz sometimes 72MHz systems are susceptible. Excessive vibration can also damage components inside the electronics that could cause a lock out or system failure.

BELT DRIVE

Helis with belt drive tails can potentially act like a Van de Graaff generator. Depending on the materials used and the design of the tail drive, your heli could produce a voltage differential between the belt and the frame or the frame and the tail case. If this happens, sparks can actually jump from the frame to the onboard electronics as the system (the heli) tries to neutralize itself. Even the best 2.4GHz systems can be swamped from severe static discharge and go into failsafe mode.

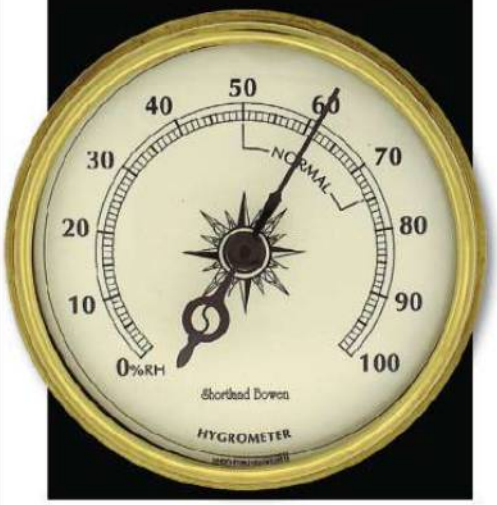


ELECTRONICS

Some of the electronics on your heli have the potential to produce EMI. If you have a brushless motor with wires that are shorting out at the connectors, a faulty speed control, or a defective BEC, you could experience EMI. Heck, even perfectly good motors, ESCs, and BECs (switching type) will produce EMI. If you have some accessory installed for a scale detail or as an extra feature, this could be a source of EMI. Brushed motors produce EMI during normal operation, so it pays to keep distance between them and any other electronics if you use one for a winch or other feature.

CLIMATE

Your local climate can play a huge role in how much potential there is to produce static electricity. In very arid areas the potential is great, and very humid areas have a moderate potential to produce static. Relative humidity levels around 55-60% have the lowest potential for generating static electricity.



PREVENTION

CONDUCTIVE SPRAYS

By spraying an anti-static product on your tail belt you can increase the conductivity of the belt and reduce the ability to produce a charging current. Conductive sprays bind the whole system together and eliminate any voltage differential. Conductive sprays help reduce static build up, but after a half dozen flights you have to re-apply. As the conductive spray wears off, you could begin to generate static.

GROUNDING SYSTEMS

It's possible to build a complete grounded system to eliminate the potential of any voltage differential. To take it to extremes, each sub-system should be linked to a common grounding point via leads of identical resistance (either identical length, or use resistors on each lead to make the final resistance of each lead identical). Sub-systems to be grounded would include any system with moving parts or conductive surfaces. The motor, belt, rotor head, tail rotor, and frame should all be electrically bonded to a common grounding point. Its arguable whether any connection to the electronic's ground should be made, I prefer to keep my


STATIC WICK

electronics entirely isolated. The grounding point on a helicopter can be a conductive surface, or even better, a static wick (one is available from G-Force for this purpose; part # GFA7088) which can dissipate any voltage differential into the atmosphere. A less stringent approach still uses a grounded surface or static wick, but only daisy-chains the sub-systems together to ground everything. Having sub-systems daisy-chained (in series) for grounding is not optimal from an engineering perspective, but its much simpler to implement, and it has solved all static related issues for this author.

In order to ground the belt, any electrode touching the belt and electrically connected to the grounding point will work. I prefer a connection through a bearing for all moving parts. If your heli has metal pulleys or can be upgraded to have metal pulleys this is the easiest option. Then I make an electrical connection between the non-moving part of the bearing and the grounding point with a wire. Grounding the tail rotor and rotor head is as simple as tapping into one of the bearings supporting the shaft and connecting it to your grounding point. Use a continuity checker on a multimeter to make sure there is continuity between the surface of the roller that will touch the belt and the grounding point, or the rotor shaft and the grounding point.

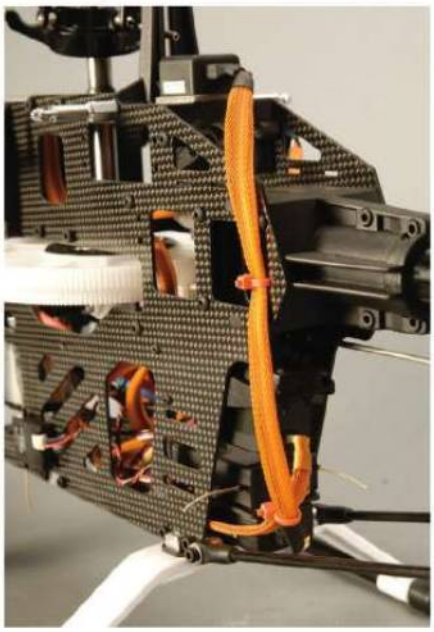
TOROIDS

Toroids are commonly found on the servo lead from the speed control. A toroid is a ferrite core ring which you can wrap wires around to help filter out EMI. If your speed control has a toroidal coil on the lead, leave it there and if you notice glitches or have motor cut-out issues, you might want to try adding at least five (5) wraps of your servo lead around a toroid. The easiest method to add a toroidal coil is to gently lift the plastic tabs on the servo connector to pull off the plastic part of the connector (make sure nothing is powered up when you do this). With the plastic piece off, it should be a snap to wrap the coil.

Actually Johnny-Five was struck by lightening.

CLEAN WIRING

Doing your best to keep the wiring clean and uncluttered on your model will help prevent EMI. If you have your servo wires, battery wires and everything else cluttered together with your antenna, you could be introducing trouble. Even if you are sure the components on your heli play well together, its possible to miss problems if your wiring is a mess. Frayed wires are one potential source of a problem if they brush against a metal surface, other exposed wiring, or even if they are close to a source of EMI. The biggest risk posted by frayed wires is creating a short in the system, which could cause a complete loss of control. Keeping servo leads as far away as possible from potential ources of EMI (motor, ESC, bec) also helps a great deal.



DAMAGED ANTENNAS

While not exactly an EMI issue, I'm including damaged antennas in this article because the issues they present could lead one to think EMI is the cause. If you notice glitches or have temporary lockouts during flight, be sure to carefully inspect your antennas. On some 2.4GHz control systems, a short length of wire at one quarter wavelength (approximately 30mm) is used for an antenna directly off the receiver. Other 2.4GHz systems use a length of RG 316 coax cable, and the outer shielding is cut back to expose the center driven element. The length of the center driven element sticking out of the coax is also one quarter wavelength. The issues arise when one of two things happens: if the length of the driven element is compromised (either cut off entirely or severed inside the insulation) or if the outer coax shielding is damaged. At 2.4GHz, the wavelength is so short that the antenna becomes much more critical than antenna length for 72MHz. While you may have had no problem with a slightly damaged receiver antenna on 72MHz,, even a tiny nick in the coax shielding on your 2.4GHz receiver antenna could cause a complete lockout. If your antenna can touch any grounded point, it's extremely detrimental to the signal and is tantamount to just cutting off the whole antenna, so keep your antennas insulated!

POOR SOLDER JOINTS

Often called "cold" solder joints, a poorly soldered component could lead to EMI issues. Cold solder joints are notorious for acting like radio detectors, injecting unwanted signals directly into the system. A cold solder joint happens when both surfaces aren't heated sufficientsly to produce a good flow and subsequent bond. They can also happen when the surfaces aren't clean of contaminants. A good solder joint should be shiny and smooth, a cold solder joint looks rough and dull. Cold solder joints appear sometimes in music systems, where one poor connection can pick up unwanted AM radio signals that make it all the way to the speakers. A cold solder joint can amplify minor EMI issues and create a real problem; for instance, all speed controls create some level of EMI due to their switching circuitry. Usually this isn't a problem, but if you have a cold solder joint on a connector near the speed control or even inside one of your components (it can happen on a rare occasion from the factory), a lockout could result. Often, cold solder joint problems don't appear until operation; vibration tends to amplify the problems, so sometimes it helps to go over your model and gently tap any suspect wiring and connectors.

NOTHING IS FOOLPROOF

While 2.4GHz control systems are a significant improvement to the control reliability of model helis, they aren't entirely immune to EMI issues. Any electronic component on your heli could pick up or cause EMI, so glitches, lockouts and other issues may not have anything to do with your radio. Looking for any potential problems before they crop up is always a good thing. It pays to look for any issue in advance. If you come across a damaged antenna or a cold solder joint, consider your bird "grounded" (pardon the pun) until you either repair it yourself or send the damaged component back to the factory for repair. RCH

Sources:
G-Force technologies: gforceheli.com

Ultra Compact Frame TECHNOLOGY

LENGTH : 1220MM
HEIGHT : 378MM
WIDTH : 203MM

Outrage VELOCITY 50

- Canomod's Canopy
- Torque tube tail drive
- Full metal tail unit
- Full programmable rotor head
- Precision CNC Engineered
- 3.6Kg ready to fly
- Ultra rigid compact frame design

- Main Rotor Blade Size 600-630mm
- Main Rotor Diameter: 1355mm -1415mm
- Tail Blade Length: 95mm
- Tail Rotor Diameter: 250mm

- Main Gear ratio: 8.6:1 (8.8:1 Optional)
- Tail Rotor Ratio 4.583:1
- Approximate Flying Weight with Fuel: 3.6kg / 7.936 Lbs. (depends on equipment used)

www.outragerc.com

CCPM or is it "eCCPM"?

CCPM

It's What Drives Your Swash

WORDS: Jim Innes

BACK IN 2006, I WROTE A PIECE DISCUSSING CYCLIC COLLECTIVE PITCH MIXING (CCPM). At that time, the amount of CCPM helis on the market was about equal to those using Single Servo Mechanical swash setups. My, how things have changed in a few short years! Nowadays, the vast majority of helis are CCPM models.

EXPLANATION OF CCPM

CCPM (or eCCPM as it's often called) can be defined as multiple servos working together, interdependently, to execute all the control movements (collective, aileron, and elevator) of the swashplate. The most common CCPM arrangements use either three or four servos, for this discussion let's stick to what the majority of the CCPM helicopters still use: a three servo, 120 degree setup. With this arrangement, your radio mixes all three servos together to complete the control movements. For example, when the collective stick on a radio is moved, all three servos will flow in unison to raise or lower the entire swashplate accordingly.

The other method of swash control, historically called Single Servo Mechanical—but now often referred to as mCCPM—uses a single servo for each control movement, and these servos are completely independent of each other; each has a duty on the swashplate that is distinct. In a Single Servo setup, you will have a servo that only does collective duties, another that will only do aileron, and the last handling just the elevator functions.

In viewing a CCPM arrangement next to a Mechanical setup as shown here, the differences are very apparent. Notice on the mechanical setup how each servo is connected to a single movement of the swash while the CCPM bird uses all three to do the job.

The main difference between these two types of swash control is that in CCPM arrangements, all the swash servos must operate together to perform any function while in Single Servo setups, the servos are independent of each other in their duties.

THE DEBATE

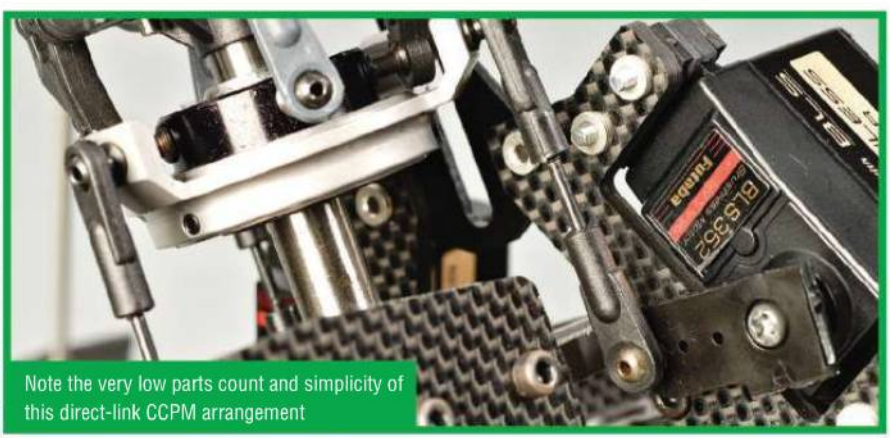
When I initial wrote on this topic, it stirred quite the debate on an online forum regarding the reasons for the conventions used to describe CCPM (eCCPM) and Single Servo Mechanical (mCCPM) setups. While the terms CCPM and Single Servo Mechanical are the more historically accurate terms, the terms eCCPM and mCCPM have become the commonly accepted terms in the industry. I am still a purist in this regard, and anytime I say the term CCPM I am referring to eCCPM models. I often just say "mechanical" to describe a Single Servo Mechanical (mCCPM) setup. Regardless of which terms you choose to use, the end result is the same: we are describing the two distinct methods of controlling a moving swash.

PROS AND CONS TO CCPM

There is some debate on what the true advantages and disadvantages are for using CCPM over Single Servo. In my experience I have observed the following:

SOME OF THE ADVANTAGES OF USING CCPM INCLUDE:

- Easy mechanical setup, usually less linkages and hardware. Less complicated from a design aspect for heli manufacturers.
- Slop can be reduced due to the lower parts count, as long as good servos are used.
- CCPM helicopters often weigh slightly less.
- More torque is applied to swash movements, as multiple servos share the workload of each command.
- Making changes to all pitch ranges (collective and cyclic) is as simple as a percentage change in the radio.



Note the very low parts count and simplicity of this direct-link CCPM arrangement

SOME DISADVANTAGES OF CCPM MAY INCLUDE:

- Interaction: this is evidenced by the "dance" a CCPM swashplate does on occasion, especially when it is moved quickly. Its cause lies in the basic geometry of the system (one servo has to travel a little more than the others to move the swash the same distance) and in the inherent, minute speed and wear differences between servos. Modern radios do a pretty good job at taking this into account and rectifying the situation, but some interaction can still remain. Note that this applies mostly to 120-degree setups; 140-degree CCPM arrangements are designed to equalize servo throw, which removes most interaction issues.
- CCPM helicopters that use direct links from the servos to the swashplate can leave the servos more susceptible to damage in a crash., Also, any slop in direct-link swash servos will be greatly amplified at the swashplate.
- In a CCPM heli, when one servo dies in flight all basic swash control is lost. This slightly lowers the chances to save the heli as compared to losing just one function. However, the fact remains that a lost swash servo with either system will be difficult to recover from.
- CCPM generally requires the use of higher quality servos that are of the same make, model, and age. Mixing servos or penny pinching here will cause some headaches in setup and in flight.
- Though CCPM control has improved dramatically over the years, there is an inherent stability and preciseness found in Single Servo setups that many CCPM helis just do not match. Many high-end FAI birds still use mechanical setups over CCPM.

It is imperative when building a CCPM bird that the swash servos all be the same make and the same age whenever possible. The more alike these servos are, the more precise your swash will be.

A direct linkage has less slop, but requires stronger servos.

MECHANICAL AND RADIO SETUP

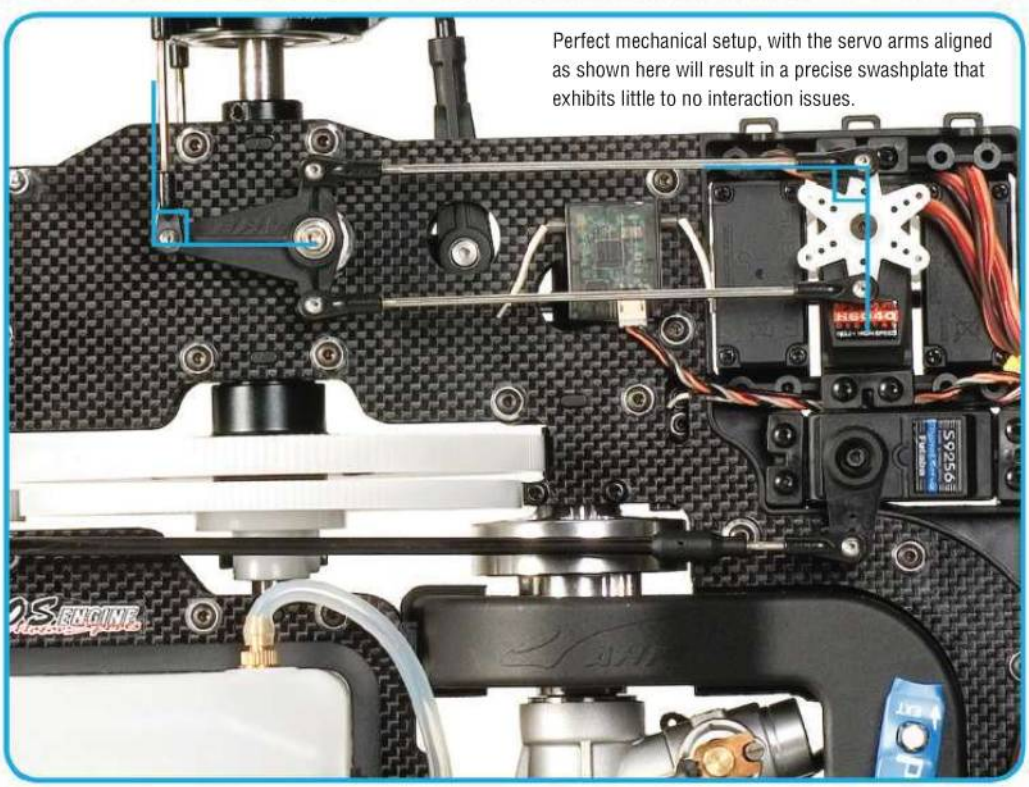
The mechanical setup of a CCPM heli is extremely important, just as on Single Servo Mechanical machines. Performing proper setup in the beginning saves time and prevents troubles later on. It's important to follow the manufacturer directions as closely as possible (as long as the manual is written correctly). The crucial thing to remember with a CCPM setup is symmetry and right angles. The radio setup is also included in this section, as they are intertwined.

In a CCPM bird the "rear" servo always uses the same channel while the side servos can use either of the other two swash channels with simple radio changes. Don't get too hung up on which swash channel to use for these two servos, just pick and move on.

1. Build the helicopter per the instructions, setting all linkages (and bellcranks if applicable) to the correct lengths. Now, install the servos and plug them into the proper channels. Many pilots get stuck at this stage, deciding which servo plugs in where can be confusing. There is a simple way to do this.

First, plug the servo that controls the ball that is inline with the frame of the heli (the ball that sits directly behind or in front of the mainshaft) into the elevator channel of the receiver. Then, plug the other two swash servos into the aileron and pitch channels.

2. Turn on the transmitter and set it to 120-degree CCPM in the swash type menu (or 140-degree if the heli requires it). Center all the trims, get rid of any sub-trim, and make sure that all endpoints are at 100% for the three swashplate servos. Use a linear pitch curve (0, 50,100) to do the initial setup. Please note that some radios have an expo function for the swash mixes in CCPM. The expo function helps counteract interaction and it is generally recommended that expo be used for a smoother swashplate. Other radios have advanced sub-menus that can be used to further tune out interaction if needed.



Perfect mechanical setup, with the servo arms aligned as shown here will result in a precise swashplate that exhibits little to no interaction issues.

3. With the servos centered, try attaching the control arms to the servos so that the arm is lined up either parallel with the servo, or exactly 90 degrees to it depending on the heli. It's important that you get this as close to perfect as possible; try various servo wheels and arms until one is found that fits the bill. If necessary, use a small amount of subtrim to center the arm, but only as a last resort. It's best to do as much mechanically with the arms and links as possible. Once the three "perfect" arms have been found, install the ball links at the distances instructed in the heli manual and install the arms on the servos. Remember to keep the radio pitch output at its center point during this step.

Precision is the name of the CCPM game.

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* OF THE SAME WEIGHT

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4. Now, let's get the 3 servos moving in the right directions. This can be a difficult and trying task for a new pilot, but there are some well-known tricks that make it easy. Remember that servo reversing in CCPM is used to set the relation between the servos, meaning that they move oppositely or together when they should. Servo reversing is not used to reverse a function's direction such as pitch or cyclic—for this, adjustments in the swash mixing menu will be made.

Before connecting the swashplate to the servos, make sure that the servos are moving properly in relation to each other. Use the servo reversing menu to do this. The two side servos (the pitch and aileron channels) are set up first using the reversing menu. Set them so that the two servo arms move in opposite directions when a left/right cyclic command is given, i.e. one arm moves up and the other moves down. Set the elevator servo so that its arm moves in the opposite direction as the other two servos when a fore/aft cyclic input is given; the other two servos will move together with fore/aft swash movement. Only reverse the elevator servo to fix the fore/aft direction, leave the aileron and pitch servos at the settings set in the left/right setup above.

5. Now, move on to getting the servos moving in the correct direction in relation to the helicopter. Center the controls and connect the swashplate, making sure that it's level and in the EXACT center of its travel range by adjusting the linkages. Move the throttle/pitch stick up; if the swash is moving in the proper direction (inducing positive pitch) then this function is working properly. If the swash is giving negative pitch when positive is expected, use the swash mix menu to reverse it by changing the value for Pitch in this menu from a positive to a negative (retaining the same number value). For example, if the number next to Pitch in the radio was +70, setting it to -70 will reverse the pitch function and make the swash move in the opposite direction. Do the same thing with the Aileron function (left/right cyclic) and the Elevator function (fore/aft cyclic) , using the mix numbers to reverse the direction if necessary. Remember to leave the servo reversing menu alone in this stage.

6. Once the swashplate is moving in all the proper directions in respect to the control stick, it's time to set the travels and prepare for flight. Use the values found in the swash mix menu (the same ones used earlier to change the pitch, aileron, or elevator function direction) to increase or decrease the travel for each movement. Always check for binding during this process. If more pitch is needed, simply increase the Pitch value to add more travel. Do not change the "+/-" found in front of the value, only the number itself. For example, if more pitch is needed and the Pitch value in the Swash Mix menu is -60, changing the number to -70 would add more travel, and likewise, if the Pitch value was +60, changing it to +70 would add more travel. Time spent using the radio and seeing the effects of each change will help CCPM setup make more sense.

140° VERSUS 120°

There is a growing number of helis out there that are offered in a 140°/135° CCPM version. The huge advantage a 140° system has over a 120° is that the geometry is evened out between the two side servos and the "front" servo. This creates more even servo travel needs all the way around. The only drawback is that there are still some radios that don't offer 140° mixing. Luckily, a radio with a 120° program can be made to work with a 140° setup with some simple mixes. RCH

TRIM ADJUSTMENTS

With the mechanical setup done properly, the helicopter should have equal positive and negative pitch and equal cyclic throws. Finish by setting the pitch curves and getting everything else ready to go. If small adjustments are needed after testing to get a "hands-free" hover, it's okay to use the radio trim and then make mechanical adjustments after the flight to match the change that the trim added. CCPM helis work best when the mechanical setup is near perfect, and the less trim used the better. In a perfect world, all trim adjustments are done on the heli, leaving the radio setups centered, but in the real world a little sub-trim is often needed to get things just right.

A perfect mechanical setup will greatly reduce the need for sub-trim, sometimes even removing the need for it at all.

CONCLUSION

Though it may appear complicated on paper and in theory, setting up a CCPM heli is really no more difficult than setting up a Single Servo Mechanical one. The trick is to be exact in the mechanical setup and understand the difference between servo reversing and swash function reversing. If a pilot needs more help setting up their first CCPM heli and can't find a local heli pilot or club, visit the RC Heli Magazine forums at ***www.rchelimag.com*** and ask for it. Or you may always email the author at ***rchelijim@gmail.com.*** CCPM helicopters have become the norm in the hobby, so it is almost a prerequisite that heli hobbyists understand how it works.

See you at the field!

CCPM is quite easy once you understand your radio.

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DITCH THE REGULATOR

Yea that's right; we don't need no stinkin' regulator!

WORDS: Chuck Bassani

IS IT POSSIBLE TO CONFIGURE OUR HELI WITHOUT USING A VOLTAGE REGULATOR AND STILL GET PERFORMANCE? With high-voltage servos going mainstream, a far less complex yet high powered system for your aircraft is indeed possible. Let's take look at some of the power options available today.

» SKILL LEVEL

SCALE RATING: 1=EASY 5=ADVANCED

2.0 RC-Heli

» TIME TO COMPLETE

15 Minutes

» TOOLS NEEDED

■ YOUR BRAIN

"I thought it was "We don't need no stinkin' Nachos"

FIRST, WE NEED A POWER SOURCE

There are many choices when it comes to power sources. Many people have the tried-and-true 4S and 5S NiCad / NiMH packs, which have 4.8V and 6.0V respectively. We generally supply power directly to our on-board system when using these packs. Next, there are the ever popular 2S LiPo packs. These packs produce a nominal 7.4v output. It's common practice when using a 2S LiPo to place a voltage regulator between it and the on-board system in order to reduce and dynamically control the voltage supplied to the system. A quite popular setup as of late is the 2S LiFe packs (a.k.a. A123 and Lithium Iron Phosphate). These packs feature a 6.6v nominal output. LiFe packs open up yet another realm of power options.

One thing we need to keep in mind is that all of these packs are rated at their 'nominal' voltage. 'Nominal' voltage is the pack's average voltage output during the useful part of its power curve. Note, however, that when a pack is fresh off the charger its output voltage can be quite a bit higher than its nominal rating. For example, a freshly charged 2S LiPo pack will output in the order of 8.2 volts. As I am about to explain, knowing this will become an important part of planning your installation.

Battery Chemistry	V (Nominal per cell)	V (Fully Charged per cell)
NiCad	1.2v	1.4v
NiMH	1.2v	1.4v
LiFe	3.3v	3.6v
LiPo	3.7v	4.2v

This table details the nominal and fully charged voltages of commonly used battery chemistries.

NOW WE MUST ADDRESS THE OPERATING VOLTAGES

When planning our power system, we need to determine the operating voltage range of each component.

Every one of your components has a maximum operating voltage. You need to know what that is.

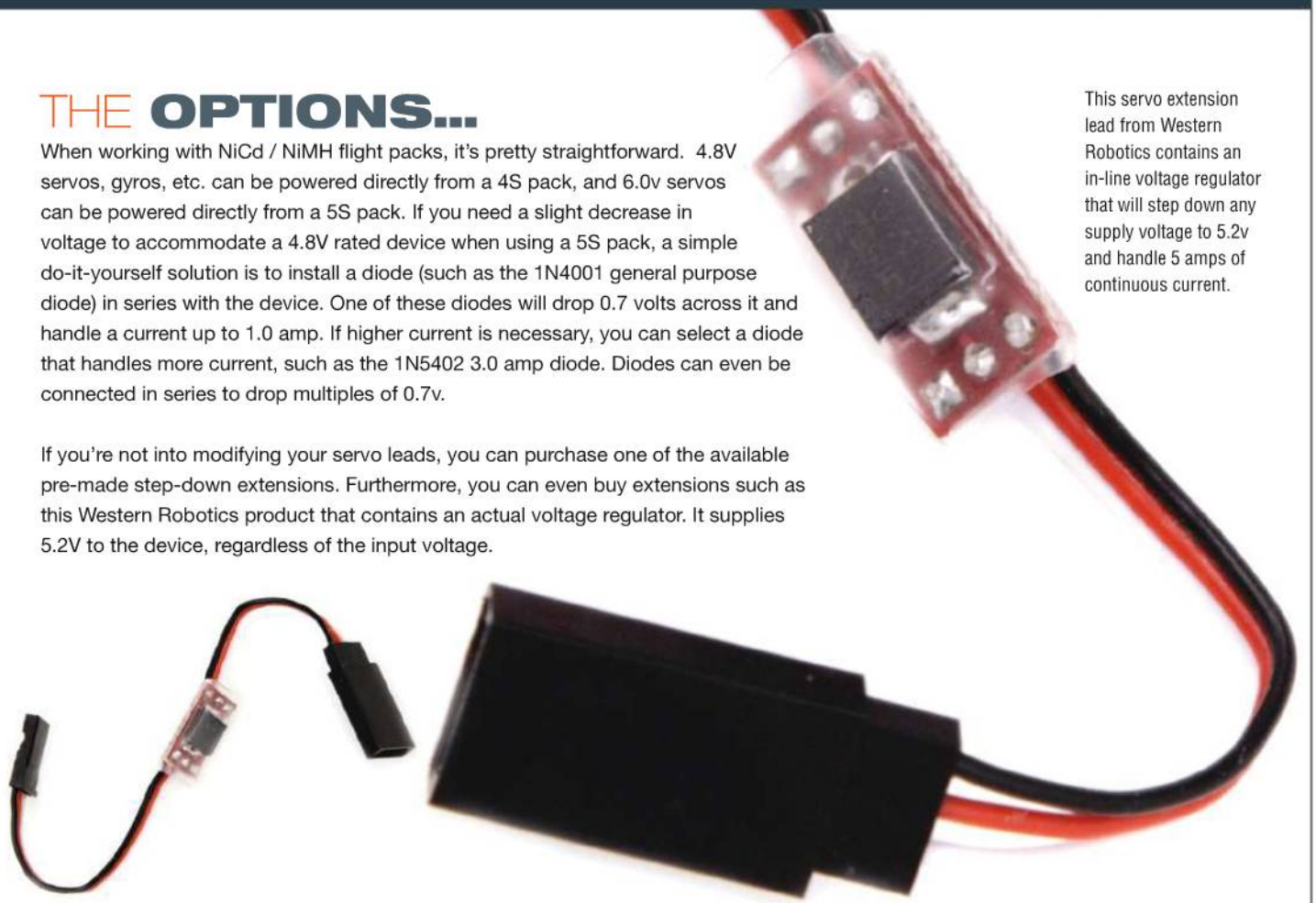
Fortunately, most receivers these days have a fairly wide operating voltage range and therefore do not present a problem. For example, one particular popular receiver (the Spektrum AR7000) has an operating voltage range of 3.5V to 9.6Vv. With a voltage range like that, we can power it directly from any of the above mentioned packs.

Servos, gyros, governors/limiters, and flybarless control units, on the other hand, may or may not present a problem. Servos are commonly rated at 4.8V, 6.0Vv, and 8V nominally. As such, we expect a servo rated at 4.8V to be tolerant of the approximately 5.8 volts that a fully charged 4S NiCd pack will output. Likewise, a servo rated at 6.0V will tolerate the 7.2V output of a fully charged 5S NiCd pack. High speed rudder servos and gyros often have a lower maximum voltage. Obviously, these ratings vary by manufacturer and model so it's always wise to check the specification. It's not uncommon to find a maximum operating voltage of 5.2V for many of these devices.

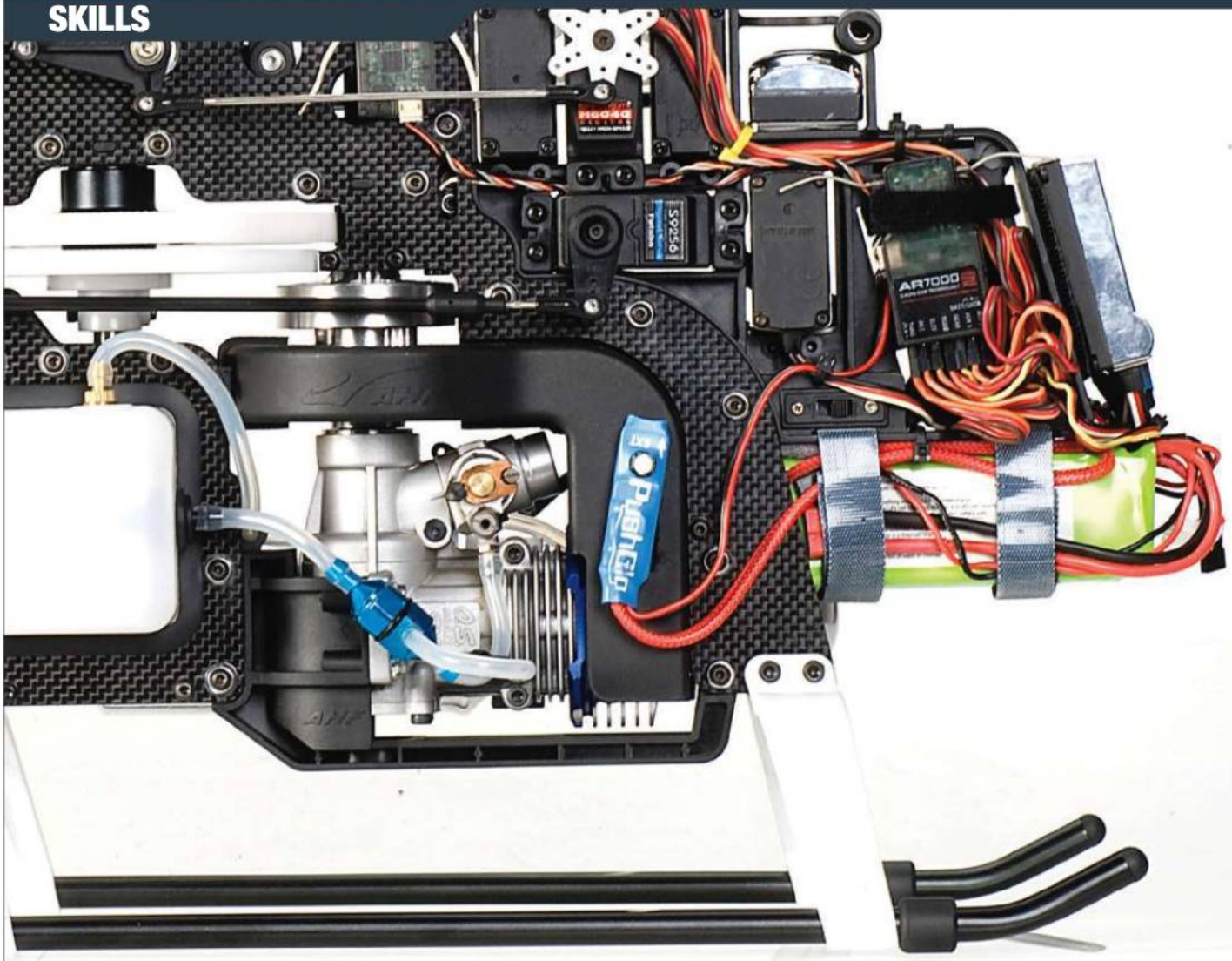
THE OPTIONS...

When working with NiCd / NiMH flight packs, it's pretty straightforward. 4.8V servos, gyros, etc. can be powered directly from a 4S pack, and 6.0v servos can be powered directly from a 5S pack. If you need a slight decrease in voltage to accommodate a 4.8V rated device when using a 5S pack, a simple do-it-yourself solution is to install a diode (such as the 1N4001 general purpose diode) in series with the device. One of these diodes will drop 0.7 volts across it and handle a current up to 1.0 amp. If higher current is necessary, you can select a diode that handles more current, such as the 1N5402 3.0 amp diode. Diodes can even be connected in series to drop multiples of 0.7v.

If you're not into modifying your servo leads, you can purchase one of the available pre-made step-down extensions. Furthermore, you can even buy extensions such as this Western Robotics product that contains an actual voltage regulator. It supplies 5.2V to the device, regardless of the input voltage.



This servo extension lead from Western Robotics contains an in-line voltage regulator that will step down any supply voltage to 5.2v and handle 5 amps of continuous current.



Let's leave 'regulation' to the government.

LiFe packs have a nominal voltage of 6.6V and a fresh-off-the-charger voltage of around 7.2V. So as you can see, it's perfectly fine to use a 2S LiFe pack to directly power devices rated at 6.0V. Recall that 6.0V rated devices can tolerate up to 7.2V. This is, in fact, how I configure my helis. I use JR DS8717 servos (rated at 6.0V) on cyclic. I also use a Spektrum AR7100R receiver powered directly from a 2S LiFe pack. What's nice about this receiver is that it contains two internal power distribution buses—one that feeds the full battery voltage directly out and one that supplies power from an internal 5.2v regulator. This regulated bus is useful for providing power to my lower voltage devices (such as the gyro, throttle servo, and rudder servo). When not using a specialty receiver such as the AR7100/R, you can use a diode or stand-alone voltage regulator to supply power to any lower voltage devices.

When using a 2S LiPo pack, your options become somewhat limited. The only servos that can safely handle a 2S LiPo directly are 8.0V rated high-voltage servos. Short of using those, you WILL have to use a voltage regulator between the battery pack and the receiver in order to bring the voltage down to 5.0-6.0V (depending on your application).

There is, however, a benefit to using a regulator: consistent performance. A voltage regulator will ensure that your system receives a constant voltage (regardless of load) during the majority of the pack's discharge curve. This is in contrast to the voltage curve of an unregulated power source, which decreases over the period of a discharge cycle.

CONCLUSION

It takes a little time to plan your onboard power distribution. Understanding the difference between 'nominal' and 'maximum' ratings will help you chose the right components. If you choose the right stuff, you really can "Ditch the Regulator".

Happy Flying ... RCH

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50 ISSUES

What was on the cover???

A QUICK LOOK AT WHAT'S GRACED OUR COVERS OVER THE YEARS

SCALE: 5
POD & BOOM: 45
CENTURY HELICOPTERS: 9
THUNDER TIGER: 9
ALIGN: 8
KYOSHO: 5
HIROBO: 3
HOT MODELS: 22

PRO PILOTS:
- Erich Stoltz x 2
- Danny Szabo
- Matt Botos

CELEBRITIES: Bruce Jenner

Fifty issues fly by pretty quick. Our first issue debuted back in October of '05. Since then RC Heli has become the world's leading and best selling RC helicopter magazine. Thanks for helping out!

No, that's not Mike Velez on the cover, it's early contributor Yama Tanomand.

How many ways can you shoot a helicopter? Not too many I guess.

It looks like a lot of fun.

Multiplex FUNCOPTER

Fun with a capital F

WORDS: Ryan Kephart | **PHOTOS:** Jason Boulanger

It is like a big Havoc

SO YOU'VE BEEN FLYING YOUR FUNJET FOR THE LAST FEW YEARS AND YOU WANT TO CHALLENGE YOURSELF BY STEPPING INTO THE HELICOPTER REALM. What better way to get started than by sticking with a known brand that offers great crash resistance and the same EPP foam body you have grown accustomed to? Multiplex has the design and the distribution transition into helicopters with their new FunCopter. The question is, does it live up to its name?

» AT A GLANCE

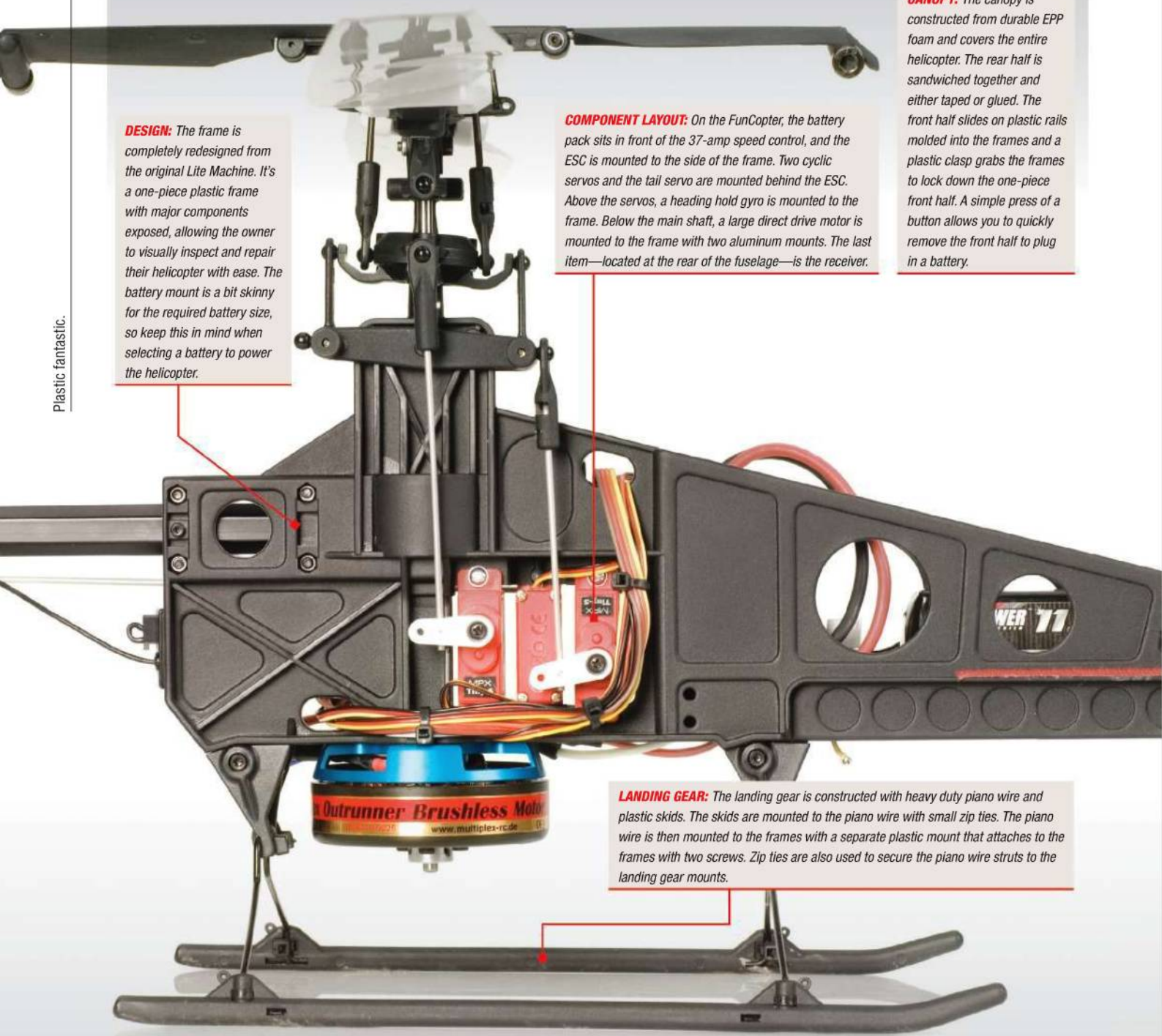
SIZE:	450
POWER:	Electric
TYPE:	Scale
BUILD TYPE:	ARF
TAIL DRIVE:	Torque Tube

FEATURES

The Multiplex FunCopter is based off a successful design by Lite Machines. The Lite Machines series of helicopters were known to be damage resistant and offered a stable platform for the beginner without spending a fortune in parts. The FunCopter sports a unique, all-foam fuselage using the same type of foam as their popular line of airplanes. The EPP (or Elapor) foam is a very tough material that has the ability to flex without breaking. In the case that the foam does break, normal CA can be used to glue the pieces back together. This type of glue is not only cheaper then foam-safe CA, it can also dry in seconds.

» MAIN **FRAME**

Plastic fantastic.



DESIGN: *The frame is completely redesigned from the original Lite Machine. It's a one-piece plastic frame with major components exposed, allowing the owner to visually inspect and repair their helicopter with ease. The battery mount is a bit skinny for the required battery size, so keep this in mind when selecting a battery to power the helicopter.*

COMPONENT LAYOUT: *On the FunCopter, the battery pack sits in front of the 37-amp speed control, and the ESC is mounted to the side of the frame. Two cyclic servos and the tail servo are mounted behind the ESC. Above the servos, a heading hold gyro is mounted to the frame. Below the main shaft, a large direct drive motor is mounted to the frame with two aluminum mounts. The last item—located at the rear of the fuselage—is the receiver.*

CANOPY: *The canopy is constructed from durable EPP foam and covers the entire helicopter. The rear half is sandwiched together and either taped or glued. The front half slides on plastic rails molded into the frames and a plastic clasp grabs the frames to lock down the one-piece front half. A simple press of a button allows you to quickly remove the front half to plug in a battery.*

LANDING GEAR: *The landing gear is constructed with heavy duty piano wire and plastic skids. The skids are mounted to the piano wire with small zip ties. The piano wire is then mounted to the frames with a separate plastic mount that attaches to the frames with two screws. Zip ties are also used to secure the piano wire struts to the landing gear mounts.*

» DRIVE TRAIN

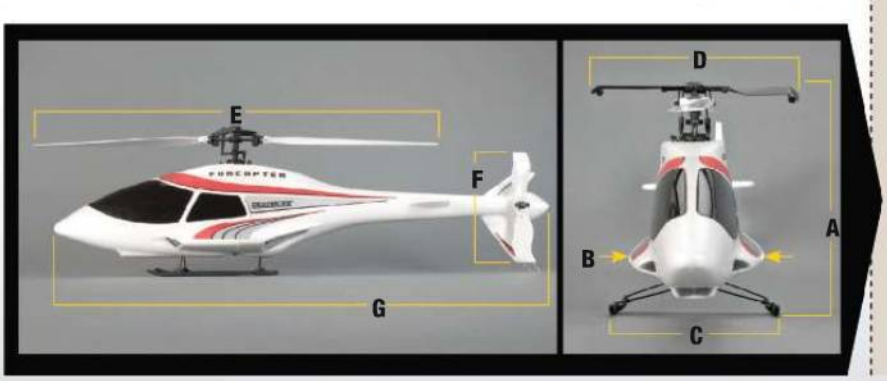
MOTOR MOUNT: The motor is mounted to the all-plastic frame using two aluminum stiffeners that fit into a recessed mold. Two stainless steel screws hold down the motor.

PINION: No pinion is necessary for this type of drive train. The motor is directly connected to the main shaft, giving the helicopter a 1:1 drive ratio.

MAIN GEAR: No main gear is needed for a direct drive motor.

TAIL DRIVE: A bevel gear is located in the middle of the main shaft and is secured with two setscrews. This bevel gear drives the torque tube.

"THE FUNCOPTER BRINGS A WHOLE NEW LOOK TO THE FORMERLY MOST DURABLE HELICOPTER ON THE MARKET."



Multiplex FUNCOPTER MODEL SPECIFICATIONS

CLASS:	450 sized electric
BUILD:	ARF
BLADE SIZE:	304mm
LEVEL:	Novice

FRAME

MATERIAL:	Plastic
TYPE:	One-piece
SERVO TO SWASH LINKAGE:	Direct
SERVO SIZE:	Micro

ROTOR HEAD

GRIPS:	Plastic
HEAD BLOCK:	Plastic
LINKS:	Ball and Z-bends
SWASH:	Plastic
CONTROL:	Fixed Pitch

TAIL

DRIVE SYSTEM:	Torque tube
AUTO DRIVEN:	N/A
TAIL PITCH SLIDER:	Dual
TAIL BLADE GRIPS:	Plastic
TAIL CASE:	Plastic
BOOM MATERIAL:	Foam

GEARING

MAIN ROTOR TO PINION RATIO:	1:1
MAIN ROTOR TO TAIL RATIO:	1: 1.8

WEIGHT

EMPTY:	1lbs, 7 oz. (665g)
WITHOUT BATTERY:	2lbs, 3 oz. (1,006g)
FULLY LOADED:	2lbs, 10 oz. (1,200g)

DIMENSIONS

HEIGHT (A):	10.5 in. (267mm)
CANOPY WIDTH (B):	6 in. (152mm)
LANDING GEAR (C):	6.75 in. (172mm)
PADDLE TO PADDLE DIA. (D):	9.5 in. (241mm)
MAIN ROTOR (E):	28 in. (711mm)
TAIL ROTOR (F):	7.25 in. (184mm)
LENGTH (G):	33 in. (838mm)

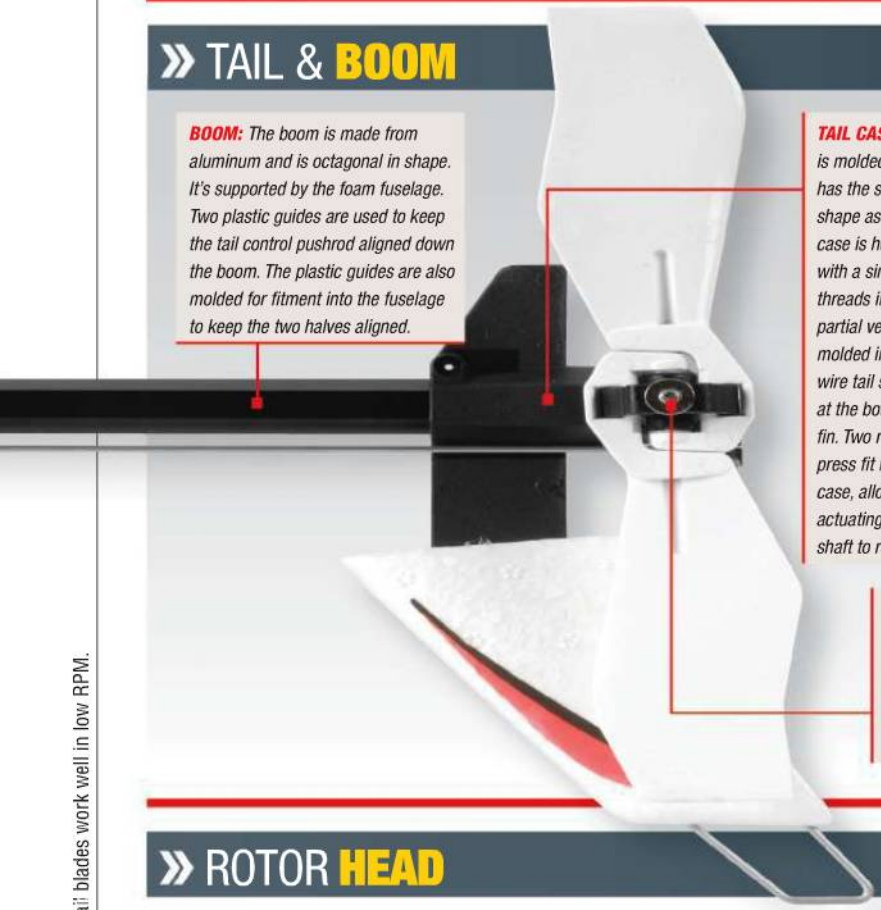
That is one huge motor.

FEATURES CONTINUED

» TAIL & BOOM

BOOM: *The boom is made from aluminum and is octagonal in shape. It's supported by the foam fuselage. Two plastic guides are used to keep the tail control pushrod aligned down the boom. The plastic guides are also molded for fitment into the fuselage to keep the two halves aligned.*

TAIL CASE: *The tail case is molded in one piece and has the same octagonal shape as the boom. The case is held to the boom with a single screw that threads into the boom. The partial vertical fin is also molded into the case and a wire tail skid is held in place at the bottom of the vertical fin. Two radial bearings are press fit into the plastic case, allowing the tail pitch actuating system and tail shaft to rotate smoothly.*



TAIL ROTOR SYSTEM: *The tail can be described as anything but standard. It's controlled using a wire that is fed through the tail shaft. A plastic hub is inserted between large tail blades which are molded much like the E-flite Blade helicopter's main rotor blades. The hub is held to the tail shaft with two setscrews that feed through the tail blades. The wire is then attached to a plastic pitchfork that pins to the tail blades.*

Wide tail blades work well in low RPM.

» ROTOR HEAD

HEADBLOCK: *The plastic headblock is molded with all the required mounting points for the Hiller arm, pitch plate, and flybar. The headblock is secured to the main shaft by a single clamping screw that partially engages the small diameter main shaft.*

ROTOR BLADES: *The unique rotor blades are mounted to a pitch plate that does not have any damping support. The blades connect to pivoting blade holders that allow the blades to move freelyand center themselves. The blades are designed with the ability to move up and out of the way in the event of a crash.*

CONTROL: *The rotor head is controlled by a Bell/Hiller mixing system. A few output options are available to increase the Hiller authority. A plastic Hiller arm is directly mounted to the headblock using a pin. A small and wide flybar that is short in length with wide paddles are constructed completely from plastic. Two large screws at the end of the flybar are used for weights to provide stable flight characteristics.*

» INSTRUCTIONS & BUILDING TIPS

WHEN YOU OPEN THE BOX

Upon opening the box, you'll find that the helicopter is securely packed and almost ready to fly. The kit included some tools and a bundle of manuals in a plastic bag alongside the helicopter.

MANUAL AND BUILD

The FunCopter comes with a barrage of manuals. The main manual is printed in several languages and has detailed drawings of each component. The manual even walks you through the entire build process in case you ever have to rebuild the helicopter. Finishing off the model was simple and fast—a piece of Velcro stuck to the receiver, plugged in wires, and the build was pretty much finished. You do have to glue or tape the rear half of the fuselage, so I opted to tape it up in case we needed to take it apart. Programming was just like setting up a plane; make sure that the swash is tilting in the right direction, reverse servos if needed, then add some expo and lower the travel using the dual rates.

Multiplex FUNCOPTER
RTF & TEST GEAR

» SUPPLIED GEAR

- **SERVOS:** Multiplex, Tiny S, M65121, .60 oz. (17g)

- **GYRO:** Multiplex, Multi gyro 300DP, 75503, .35 oz. (10g)

- **MOTOR:** Himax, C 6310-0225, 333070, 8.23 oz. (235g)

- **SPEED CONTROL:** Multiplex, BL-37/II, 7 2276, 1.0 oz. (30g)

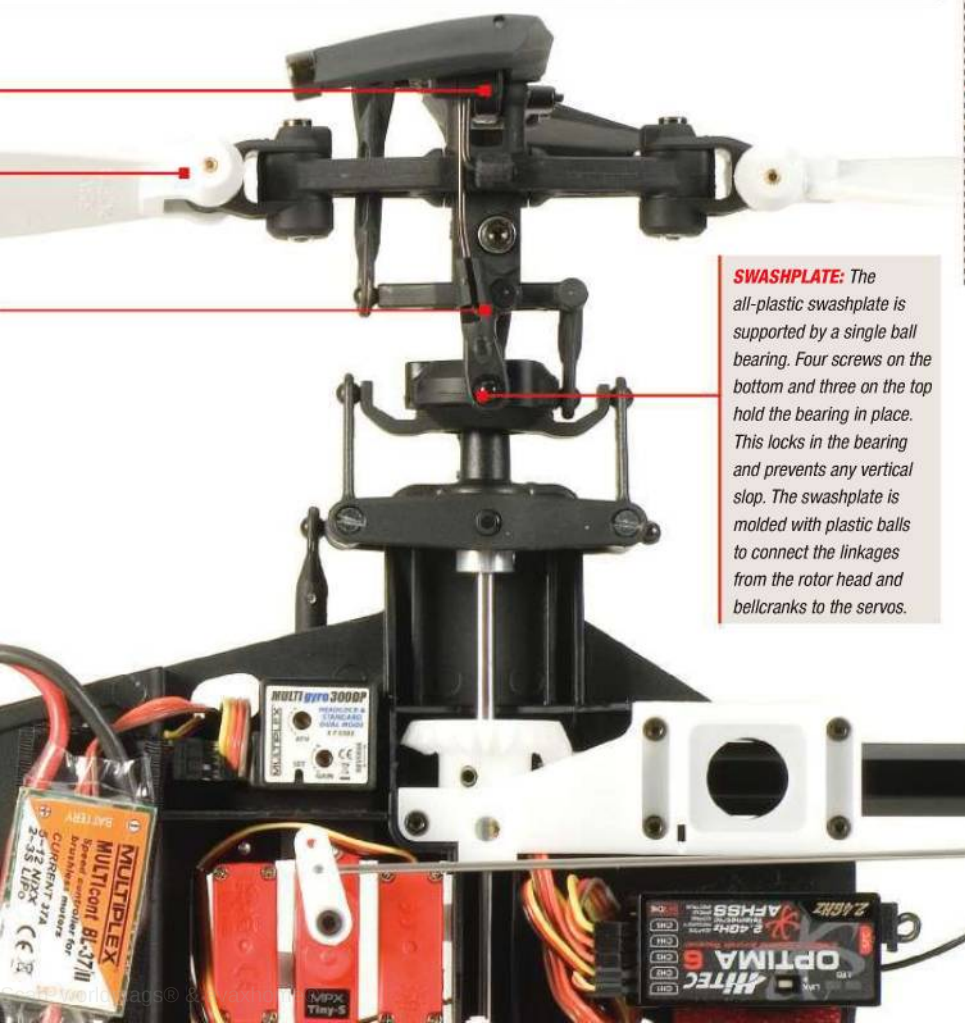
» TEST GEAR

- **RADIO:** Hitec, Optic 6 Sport, HRC159241, $150

- **RECEIVER:** Hitec, Optima 6, HRC28410, .54 oz. (15.3g), $50 (included with radio)

- **BATTERY:** SMC, 11.1v 2200mah 25C, SUM2200LE, 6.84 oz. (194g), $79

- **CHARGER:** iCharger, 206B, 206B, $140



SWASHPLATE: *The all-plastic swashplate is supported by a single ball bearing. Four screws on the bottom and three on the top hold the bearing in place. This locks in the bearing and prevents any vertical slop. The swashplate is molded with plastic balls to connect the linkages from the rotor head and bellcranks to the servos.*

Or is it foam fantastic.

TESTING

Flying the FunCopter takes me back to the old days flying a Lite Machines helicopter. The FunCopter brings a whole new look to the formerly most durable helicopter on the market. We opted to use a basic 6-channel radio to operate the FunCopter. The radio programming was a breeze, as the helicopter is set up using an airplane profile. The FunCopter makes it possible for any regular airplane flyer to begin flying without having any knowledge of helicopter programming.

HOVERING • On calm days the FunCopter can hover like a dream. Minimal inputs are required to keep the helicopter stationary. With the addition of expo and D/R settings applied to the cyclic, the helicopter is very manageable for the first time helicopter pilot. The tail wanted to drift around a bit, but a few clicks of trim took care of any unwanted motion. On windy days the FunCopter was a bit more to handle. The wind really affected the stability, but after a few hours of flying the helicopter in calm conditions should be enough to prep any beginner pilot to conquer the wind.
Rating: 4

FORWARD FLIGHT • Flying the FunCopter in forward flight is a bit tricky due to the head design and the additional weight of the fuselage. You have to stay ahead of the helicopter and give early inputs for turns. The FunCopter is extremely quiet and really looks cool in forward flight. Watch out for high speed flight, as you will notice a large amount of pitch correction will be needed.
Rating: 3

CYCLIC PITCH RESPONSE • The cyclic can be surprisingly responsive if you are not using expo and dual rates. Setting up the helicopter with expo really gives the cyclic a smooth feel. In forward flight the cyclic seems to become less responsive, so keep your inputs in front of the helicopter's actions and you should be fine. Overall, the cyclic felt like it had plenty of authority in windy conditions and a stationary hover.
Rating: 3.5

TAIL ROTOR RESPONSE • With the aid of the Multiplex heading lock gyro, the tail did a decent job staying in control. I had to set the gain all the way up in the radio to keep the tail from feeling a little loose, but overall the tail did a good job even when applying full throttle climbouts. Some trim is necessary to keep the tail from drifting, but this task only has to be done at the beginning of each flight.
Rating: 4

POST FLIGHT INSPECTION • I let a number of beginner pilots fly the FunCopter. It took some abuse and held up well. I ended up losing one of the Bell/Hiller links with a Z-bend, but a quick fix was made easily with a piano wire that I had laying around the shop. The foam held up quite well and only received minor damage from the blade striking the boom. I noticed that the tail hub had come loose. Make sure you go through the helicopter and lock down the setscrews with a drop of blue threadlock.
Rating: 4.5

CONCLUSION

The FunCopter is a great beginner helicopter that can help you make the transition from planes. The construction and design was definitely geared towards the beginner pilot looking for a helicopter that would be easy to work on, program, fly, and repair. The FunCopter might not perform as well in forward flight as other helicopters in its class, but it sure can take more of a beating. RCH

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INNOV8TIVE DESIGNS

TESTING SPECS

Multiplex **FUNCOPTER**

Part #: M263001
Distributor: Hitec
Web: www.multiplexusa.com

Street Price: $235
Price as Tested: $464
Build/Setup Time: 1 hours

PERFORMANCE

RPM IN A HOVER:	Variable
MOTOR TEMP (after flight):	105° F
BATTERY TEMP (after flight):	110° F
FLIGHT TIME:	8 minutes
CRASH COST:	$0 under most circumstances

TEST CONDITIONS

WEATHER:	Sunny
TEMP / HUMIDITY:	103° F/ 22%
BAROMETRIC PRESSURE:	29.88 in.
WIND SPEED:	12 mph
VISIBILITY:	10 miles
ALTITUDE:	725 feet

REQUIRED TO FLY

Radio, receiver, 11.1v 2200-3200mah battery pack, charger

WHO'S IT FOR?

This helicopter is a great choice for any airplane pilot looking to transition to a helicopter without having any knowledge of helicopter flight. The low cost and durable construction gives the new pilot a little extra comfort while training.

SCORECARD

SCALE RATING: 1=POOR 5=EXCELLENT

4	Instructions
3.5	Parts Quality/Fit
4.5	Durability
3.5	Tunability
3	Overall Performance
4	Value

THE GOOD

- Open construction
- Durable
- Quiet

THE BAD

- Older head design
- Battery tray is a bit thin

Get ready for some FunCopter.

FACTORY TEAM PILOTS

BERT KAMMERER
Tequesta, Florida

KYLE STACY
Sodus, New York

DARRELL BELL
Detroit, Michigan

MITCH MAROZAS
Chicago, Illinois

BEN STORICK
Las Vegas, Nevada

MICHAEL WILSON
Scarborough, Ontario

CRAIG OKU
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Port Jefferson Station, New York

ART HUGHES
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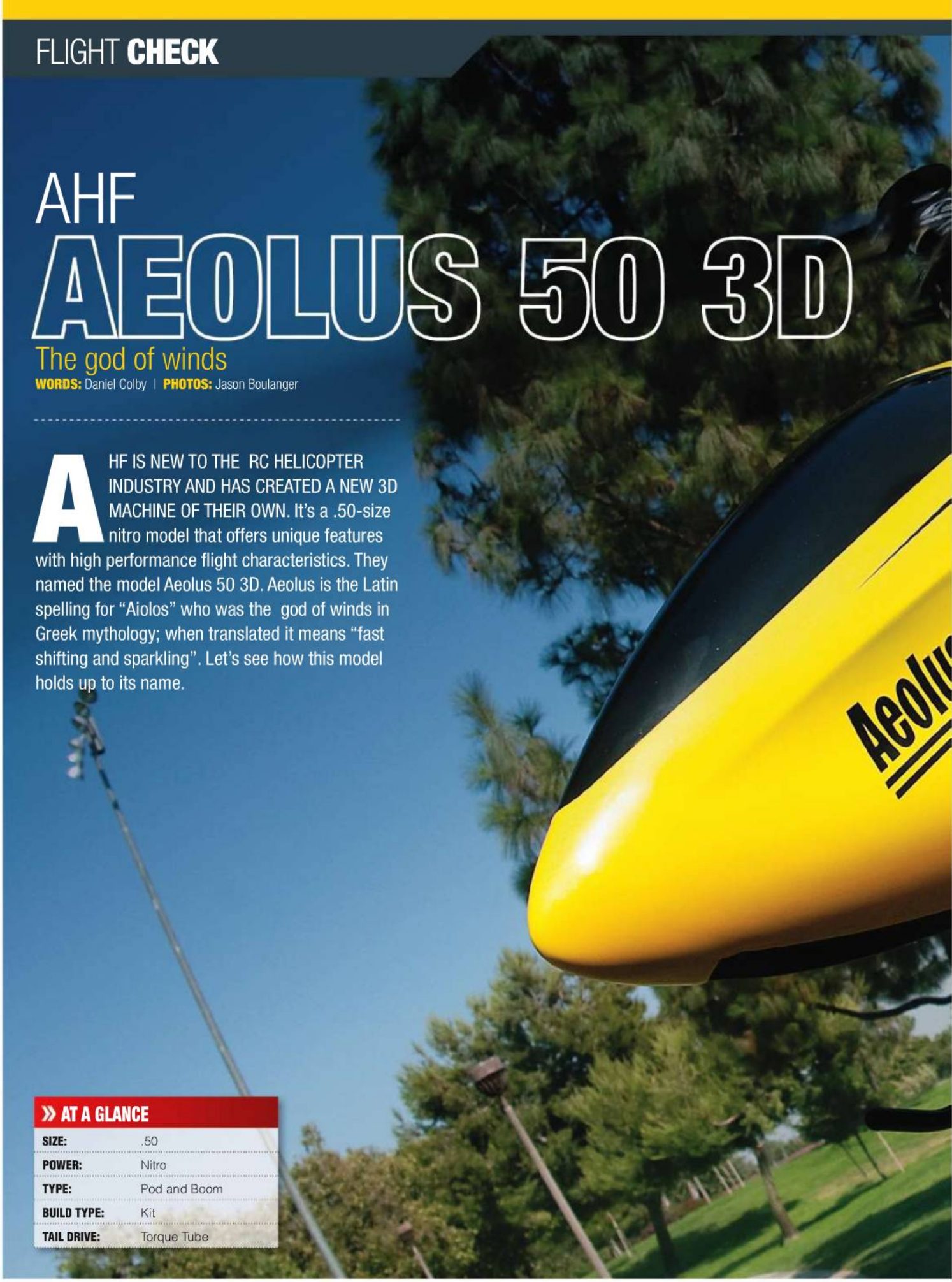
AHF AEOLUS 50 3D

The god of winds

WORDS: Daniel Colby | **PHOTOS:** Jason Boulanger

AHF IS NEW TO THE RC HELICOPTER INDUSTRY AND HAS CREATED A NEW 3D MACHINE OF THEIR OWN. It's a .50-size nitro model that offers unique features with high performance flight characteristics. They named the model Aeolus 50 3D. Aeolus is the Latin spelling for "Aiolos" who was the god of winds in Greek mythology; when translated it means "fast shifting and sparkling". Let's see how this model holds up to its name.

It sparkles like the wind?



» AT A GLANCE

SIZE:	.50
POWER:	Nitro
TYPE:	Pod and Boom
BUILD TYPE:	Kit
TAIL DRIVE:	Torque Tube

The canopy has a small crack, can you see it?

FEATURES

The Aeolus kit includes a lot of upgrades that even the bigger name companies don't include in their kits, such as ball link sizing tools, rubber skid stops, and a boom support brace. The Aeolus also incorporates a single-axle CCPM control system.

» MAIN **FRAME**

SWASH CONTROL: *The swash control is accomplished using bellcranks that connect to the servos using a push-pull linkage system. The bellcranks are dual ball bearing supported and offer smooth transitions from the servos to the swashplate.*

DESIGN: *The main frame is composed of two carbon fiber side plates spaced 1-1/8" apart using spacers and bearing blocks. There is a plastic tray up front that holds all of the electronics and doubles as a frame spacer. The engine mount is a unique design intended for fast and easy maintenance. The landing gear has slots that the frame slides into, doubling them as a frame spacer/stiffener.*

COMPONENT LAYOUT: *All of the electronics mount up front on their own tray, which can be removed easily for maintenance. The cyclic servos mount to the top of the tray in a vertical fashion, in front of that is a base for the gyro.*

CANOPY: *The canopy on the Aeolus is made of Kevlar and is pre-painted from factory. The canopy mounts by utilizing the post and grommet method and a clip on the bottom that secures to the landing gear.*

LANDING GEAR: *The four-piece landing gear mounts the frame using molded tabs that slide between the frames and are secured by two bolts per strut. The skids attach to the struts with four setscrews. AHF also includes rubber skid stops to protect the struts from wearing through.*

Wiring on a helicopter is always a challenge.

» DRIVE TRAIN

ENGINE: The engine mount is a unique, modular design that makes for speedy installation and maintenance. With the pop of the throttle linkage, fuel line, and 12 screws, the clutch assembly and engine separates from the frames.

CLUTCH: The clutch, clutch bell, and pinion are located above the engine and cooling fan. The clutch bell has large cutouts to provide cooling and lightening It also has one pre-drilled hole for a governor magnet. The clutch has a one-way bearing pressed in to allow the starter shaft to spin freely after the engine has been started.

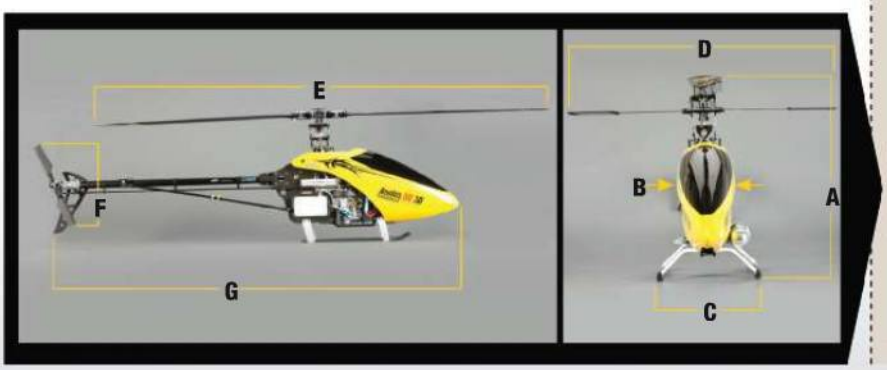
COOLING FAN & SHROUD: The cooling fan is molded from plastic and has angled fins to provide plenty of airflow. The fan shroud assembly is fitted to the engine prior to installation and attaches to the frames using four machine screws that thread in to aluminum spacers mounted in the fan shroud.

MAIN GEAR: The main gear is machined from durable Delrin. Lightening holes are big, but plenty of material is left to provide a rigid gear for performance and durability.

AUTOROTATION DRIVE: The main gear has an aluminum hub that is bolted down using four machine screws and houses the one-way bearing for autorotations.

TAILDRIVE: The tail drive gear is located below the main gear and is secured directly to the main shaft. The tail gear drives a secondary gear that uses a set of beveled gears to drive the aluminum torque tube. All the gears are made of Delrin for durability and performance.

"The parts cost and quality - combined with its performance - are going to be a hard one to beat."



AHF AEOLUS 50 SD MODEL SPECIFICATIONS

CLASS:	.50 size nitro
BUILD:	Kit
BLADE SIZE:	600mm
LEVEL:	Intermediate to advanced

FRAME

MATERIAL:	Carbon fiber
TYPE:	Stacked
SERVO TO SWASH LINKAGE:	Bellcrank with push-pull rods
SERVO SIZE:	Standard

ROTOR HEAD

GRIPS:	Metal
HEAD BLOCK:	Metal
LINKS:	Ball
SWASH:	Metal
CONTROL:	CCPM 120°

TAIL

DRIVE SYSTEM:	Torque tube
AUTO DRIVEN:	Yes
TAIL PITCH SLIDER:	Single-point
TAIL BLADE GRIPS:	Plastic
TAIL CASE:	Metal
BOOM STRUT :	Carbon

GEARING

MAIN ROTOR TO PINION RATIO:	8.5:1
MAIN ROTOR TO TAIL RATIO:	5:4

WEIGHT

EMPTY:	5 lbs, 15oz.(2693g)
WITHOUT FUEL:	7 lbs, 10oz.(3492g)
FULLY LOADED:	8lbs. (3628g)

DIMENSIONS

HEIGHT (A):	16in (408mm)
CANOPY WIDTH (B):	3.25 in. (82mm)
LANDING GEAR (C):	8 in, (203mm)
PADDLE TO PADDLE DIA. (D):	23.25 in (590mm)
MAIN ROTOR (E):	53 in. (1346mm)
TAIL ROTOR (F):	10.4 in. (263mm)
LENGTH (G):	52.5 in. (1335mm)

You can't go wrong with carbon fiber and aluminum.

FEATURES CONTINUED

» TAIL & BOOM

TAIL CASE: *The tail case is a two-plate design. The plates are made of aluminum and bolt to the aluminum transmission case on the boom. The tail rotor output shaft is 5mm in diameter, resulting in a very robust construction.*

BOOM: *The aluminum tail boom is 22mm in diameter and 736mm long. Two carbon fiber rods support the boom.*

TAIL BLADE GRIPS: *The plastic tail grips have radial and trust bearings in each grip. They are mounted to the tail hub assembly using a machine screw. The hub mounts to the tail shaft using a single setscrew.*

PITCH ACTUATOR SYSTEM: *The tail rotor bellcrank mounts to an aluminum bracket on the side of the tail case. It's connected to a ball on the pitch slider, which moves smoothly on the tail output shaft. The control arms connect to the slider using machine screws.*

» ROTOR HEAD

HEADBLOCK: *The aluminum head block is a one-piece design and comes with a head button. The kit offers three different durometer dampers. The head block attaches to the main shaft using a single Jesus bolt and nut.*

BELL/HILLER MIXER: *The plastic Bell/Hiller arms are supported with dual bearings. They mount to the flybar carrier by two self-tapping screws. They do offer two input options, which are located on the flybar seesaw.*

PHASING: *Phasing is accomplished by two pins that are pressed into the head block and feed straight into the washout assembly. There is no play in this setup.*

WASHOUT ARMS: *The plastic washout arms are dual bearing supported. They connect to the washout base with a machine screw. They do not offer option inputs. The washout links connect to the washout arms using a machine screw that supported by a brass sleeve.*

Some Align parts can be used as a subsitute if needed.

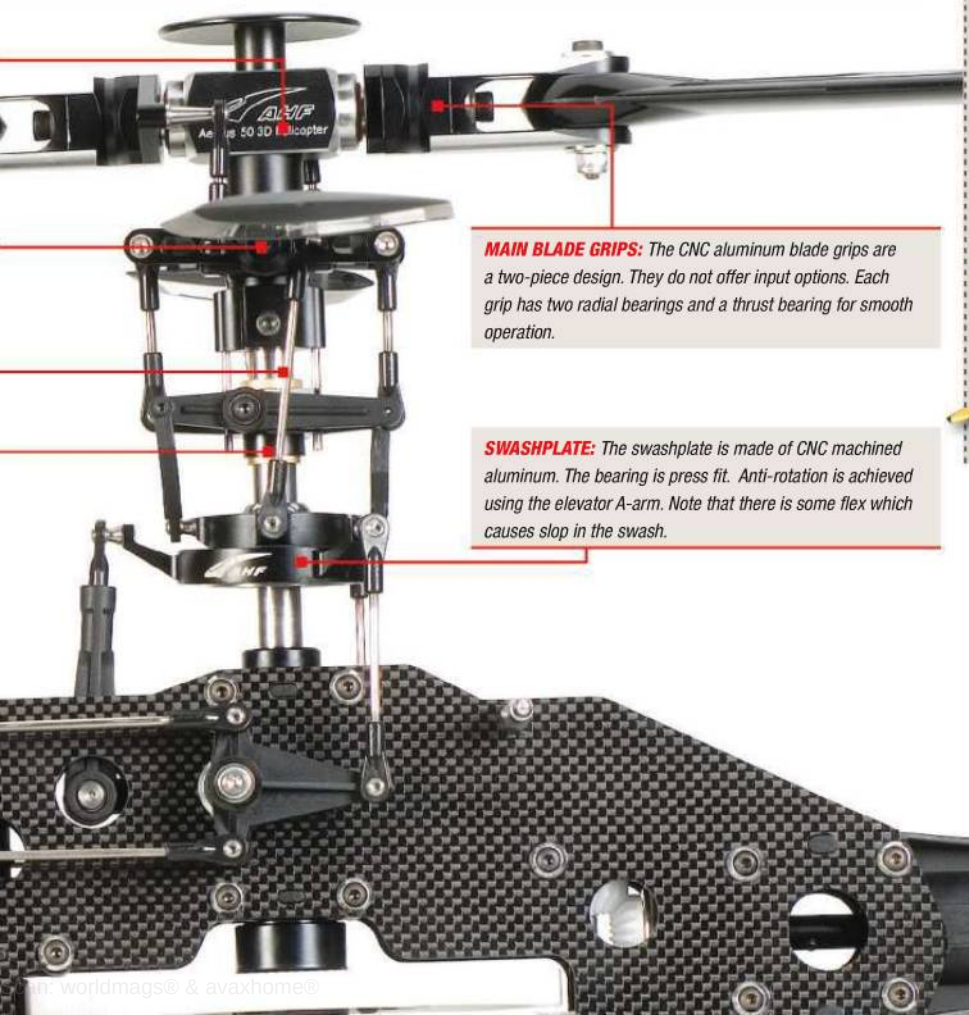
» INSTRUCTIONS & BUILDING TIPS

WHEN YOU OPEN THE BOX

Everything is very nicely packed and organized in bags lettered to the corresponding step in the manual. The canopy is nicely painted and has a very sleek look to it. A glance into each bags shows that the kit was well organized and of high quality. If you follow each step and only open the bag that matches the step in the manual, you won't have extra parts laying out and everything will make sense.

MANUAL AND BUILD

The manual for the Aeolus is somewhat vague for the beginner. It didn't have a lot of text describing fine detail. I would have liked to see more assembly detail and basic radio set up. Other than that, the nice things are that each step has a corresponding letter that matches a bag of parts, which makes the build clean and easy.



MAIN BLADE GRIPS: *The CNC aluminum blade grips are a two-piece design. They do not offer input options. Each grip has two radial bearings and a thrust bearing for smooth operation.*

SWASHPLATE: *The swashplate is made of CNC machined aluminum. The bearing is press fit. Anti-rotation is achieved using the elevator A-arm. Note that there is some flex which causes slop in the swash.*

AHF
AEOLUS 50 SD
RTF & TEST GEAR

» TEST GEAR

- **RADIO:** JR, X9503 2.4, JRP2930, $550

- **RECEIVER:** Spektrum, AR7000SPM6070, .5oz. (14g), $99

- **CYCLIC SERVOS (3):** Spektrum, H6040, SPMSH6040, 1.8oz. (52g), $80 ea.

- **THROTTLE SERVO:** ACE RC, DS 1015, ace8127, 2.328oz. (66g), $99

- **TAIL SERVO:** Futaba, S9256, FUTM0226, 2oz. (57g), $120

- **ENGINE:** O.S., .50sx-h, OSM15550, 14.3oz. (406g), $199

- **FUEL:** Byron Fuels Rotor Rage 30%

- **GYRO:** Futaba, GY611, FUTM0825, 2.25oz. (64g), $379

- **RECEIVER BATTERY:** LIFE Source, LIFE 6.6v 2100mAH, HCAM6435, 5oz. (143g), $34

- **BLADES:** RotorTech, 610mm, CN266166C, $99

Un-regulated, just like the "How To".

TESTING

We tested the Aeolus with some of the latest gear to get a true feeling for how well this helicopter would perform. We configured the Aeolus using Spektrum's new heli servos along with the new JR x9503. For power we used Thunder Tigers new Redline 53.The tail is controlled by Futaba's GY611 combo with the S9256.

HOVERING • The Aeolus had a very connected feel during hovering, making it easy to manage and not overly sensitive. I followed the measurements in the manual and they were pretty close to perfect. I only needed to add a small amount of trim to keep it centered. Even with wind present it was locked in; I didn't feel as if I had to chase it around.
Rating: 4.5

FORWARD FLIGHT • I was very happy to see that the connected feeling carried over from hovering to forward flight. It was solid and tracked very straight with no pitchiness or ballooning. The nose stayed down and the heli carried itself nicely through turns without any odd tendencies.
Rating: 4

CYCLIC PITCH RESPONSE • Whe The Aeolus is a strong performer when paired with the new Spektrum heli servos. The cyclic pitch response was another aspect of the helicopter that didn't disappoint. It rolls and flips quickly, whether in place or at top speed.
Rating: 4

COLLECTIVE PITCH RESPONSE • With the pitch range set to +/- 12 degrees and combined with the new Redline 53, the model was really spirited and had a lot of pop. Full throttle climbouts are a bit sluggish and bogged the motor slightly, so collective management was needed. Regardless, the heli had a smooth collective response.
Rating: 4

TAIL ROTOR RESPONSE • Any tail paired with the 611 performs very well. With the torque tube design I didn't have to worry about a belt slipping. During testing I couldn't get the tail to lose its lock, no matter what I did. It can fly fast both backwards as forwards without a problem.
Rating: 4.5

AUTOROTATION CAPABILITIES • The Aeolus performed autos very well; it held its head speed well and had good tail control. I did many high altitude autorotations, and all of them were performed without a hitch. There was plenty of head speed built up to flare the helicopter for long periods of time and perform soft landings.
Rating: 4

POST FLIGHT INSPECTION • After a few days of testing and performing several hard flights, the Aeolus stayed intact. The only problem I had is that the vertical tail fin is a little short, allowing the tail to dig into the grass during an auto, which resulted in stripped secondary gears. When we got it back to the shop I replaced the gears and thoroughly inspected it. There was no sign of any wear or screws backing out, and all of the mechanics remained intact and slop free.
Rating: 4.5

CONCLUSION

AHF really entered the helicopter scene in a strong position with this kit. The parts cost and quality - combined with its performance - are going to be a hard one to beat. If you're looking to get into .50 size nitro this is the route that I would take. AHF may not be a big brand name, but that is just for now. Sources say they have a new version already in the works along with an electric version.RCH

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The Leader in Spread Spectrum Technology

TESTING SPECS

AHF AEOLUS 50 3D

Part #: Aeolus503D
Distributor: AHF
Web: www.ahf-usa.com

Street Price: $389
Price as Tested: $2208
Build/Setup Time: 15 hours

PERFORMANCE

MODE FLOWN:	Normal, idle up 1, idle up 2
RPM OF EACH MODE:	Normal: 1700 Idle 1: 1950 Idle 2: 2070
ENGINE TEMP (after flight):	180º F
FLIGHT TIME:	6 minutes
CRASH COST*:	$60

TEST CONDITIONS

WEATHER:	Sunny
TEMP / HUMIDITY:	75° F/41%
BAROMETRIC PRESSURE:	30.04 in.
WIND SPEED:	5 mph
VISIBILITY:	10 miles
ALTITUDE:	675 feet

PITCH CURVES

NORMAL:	-12, 0, 12
IDLE-UP 1:	-12, 0, 12
IDLE-UP 2:	-12, 0, 12

** includes main shaft, tail boom, spindle, landing gear, flybar, torque tube*

REQUIRED TO FLY

Radio, receiver, all required servos, gyro, engine, muffler, battery, battery charger, and blades.

WHO'S IT FOR?

Anyone looking for a quality good flying .50-size helicopter

» SCORECARD

SCALE RATING: 1=POOR 5=EXCELLENT

4	Instructions
4.5	Parts Quality/Fit
4.5	Durability
5	Tunability
4	Overall Performance
4	Value

THE GOOD

- Easy maintenance
- Good performance
- Excellent quality

THE BAD

- Muffler size restriction
- Manual is vague

Hey that heli has a tattoo.

Walkera LAMA3

A 450 sized coaxial helicopter

WORDS: Ryan Kephart | **PHOTOS:** Jason Boulanger

WALKERA HAS MADE SEVERAL SMALL COAXIAL HELICOPTERS OVER THE YEARS. Coaxial helicopters are known to be stable, predictable, and easy to fly. One problem coaxial helicopter face is the ability to fly outdoors (or more precisely, in windy conditions). The combination of the size and stability make this class of helicopter a poor choice for outdoor flight until now. Walkera's answer to outdoor coaxial fun is the Lama 3.

It looks like it has a tail rotor!

» AT A GLANCE

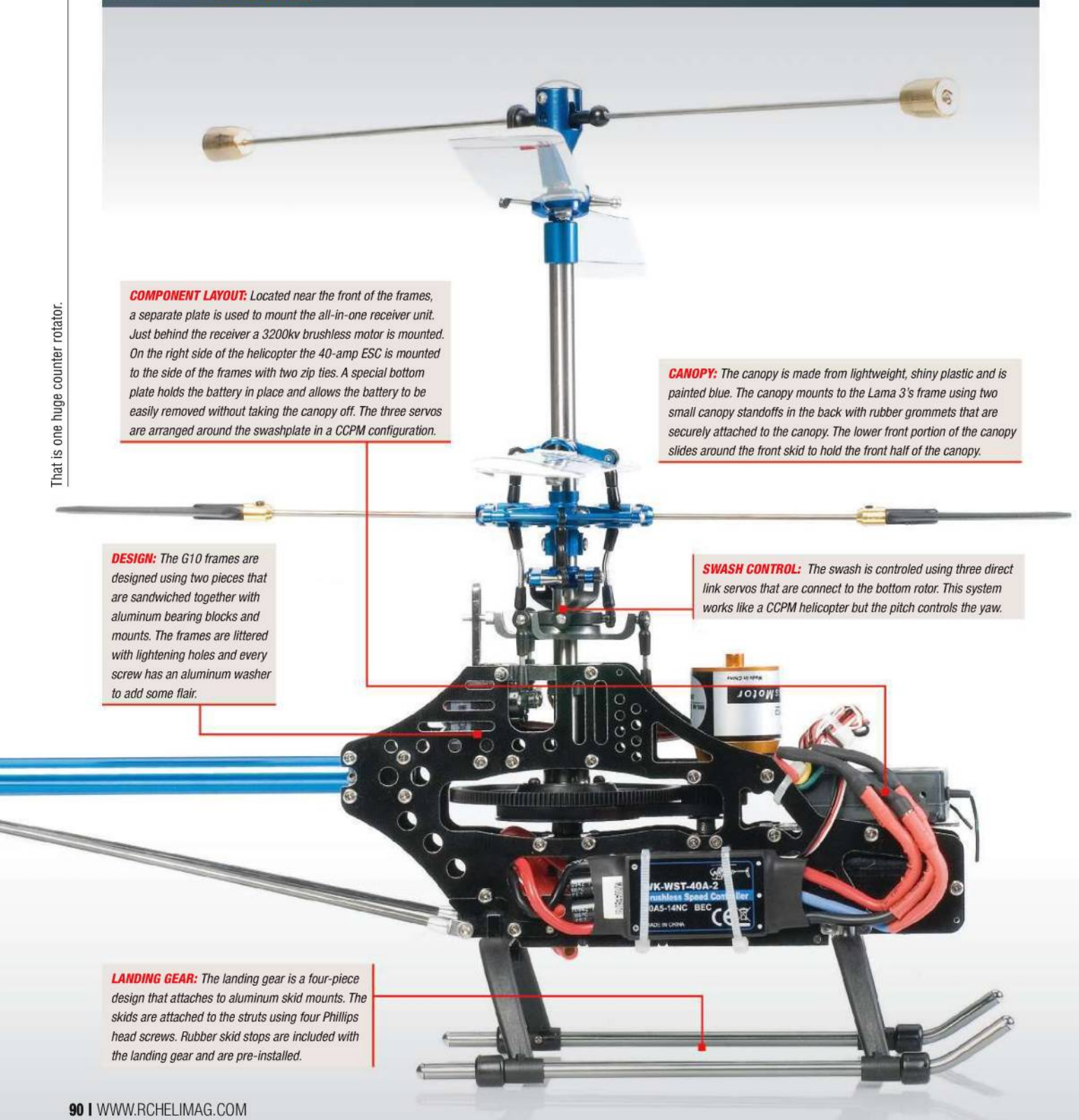
SIZE:	450
POWER:	Electric
TYPE:	Pod & Boom Coaxial
BUILD TYPE:	RTF
TAIL DRIVE:	N/A

Don't checkerboard patterns mean that it's fast?

FEATURES

The Lama 3 features a G10 composite frame and all aluminum rotor heads. A single brushless motor drives both rotors using a unique design not commonly seen in coaxial helicopters. The Lama 3 is controlled using Walkera's RX2429 combination receiver, mixer, and gyro unit. The helicopter is powered by a 3-cell, 2100mah battery and everything is ready for a charge and go flight.

» MAIN **FRAME**



COMPONENT LAYOUT: *Located near the front of the frames, a separate plate is used to mount the all-in-one receiver unit. Just behind the receiver a 3200kv brushless motor is mounted. On the right side of the helicopter the 40-amp ESC is mounted to the side of the frames with two zip ties. A special bottom plate holds the battery in place and allows the battery to be easily removed without taking the canopy off. The three servos are arranged around the swashplate in a CCPM configuration.*

CANOPY: *The canopy is made from lightweight, shiny plastic and is painted blue. The canopy mounts to the Lama 3's frame using two small canopy standoffs in the back with rubber grommets that are securely attached to the canopy. The lower front portion of the canopy slides around the front skid to hold the front half of the canopy.*

DESIGN: *The G10 frames are designed using two pieces that are sandwiched together with aluminum bearing blocks and mounts. The frames are littered with lightening holes and every screw has an aluminum washer to add some flair.*

SWASH CONTROL: *The swash is controled using three direct link servos that are connect to the bottom rotor. This system works like a CCPM helicopter but the pitch controls the yaw.*

LANDING GEAR: *The landing gear is a four-piece design that attaches to aluminum skid mounts. The skids are attached to the struts using four Phillips head screws. Rubber skid stops are included with the landing gear and are pre-installed.*

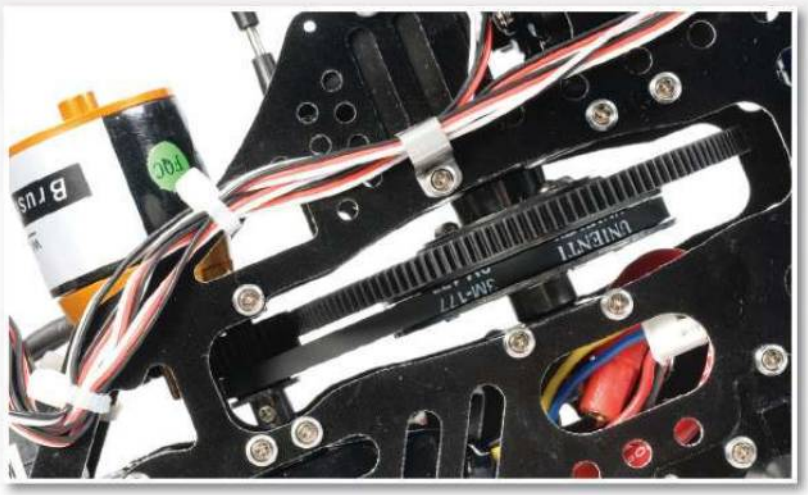
That is one huge counter rotator.

» DRIVE TRAIN

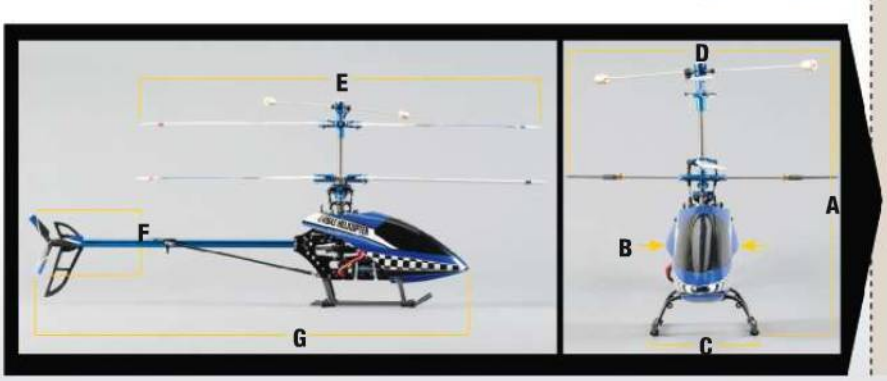
MOTOR MOUNT: An aluminum motor mount is secured to the frames using four machine screws The motor mount also incorporates a bearing block for the secondary drive gear. The mount has slotted rails to provide an adjustable gear mesh.

PINION: A small brass pinion is press fit to the shaft of the brushless outrunner motor. The pinion meshes with a secondary gear that drives both the main gear and a pulley. The pulley drives a rubber belt that is attached to the upper rotor. This style of drive gear allows the counterrotating motion needed for a coaxial helicopter.

MAIN GEARS: The lower main gear has an aluminum hub and directly meshes with the counter gear. Below the main gear is the upper rotor head pulley, which is made of aluminum.



> The increased size gives you a better sense of control and a larger surface to look at during flight.



Walkera LAMA3 MODEL SPECIFICATIONS

CLASS:	450 Electric
BUILD:	RTF
BLADE SIZE:	325 mm
LEVEL:	Beginner

FRAME

MATERIAL:	G10
TYPE:	Two-piece
SERVO TO SWASH LINKAGE:	Direct
SERVO SIZE:	Micro

ROTOR HEAD

GRIPS:	Metal
HEAD BLOCK:	Metal
LINKS:	Ball
SWASH:	Metal
CONTROL:	Fixed Pitch

TAIL

DRIVE SYSTEM:	Coaxial
AUTO DRIVEN:	None
TAIL PITCH SLIDER:	None
TAIL BLADE GRIPS:	None
TAIL CASE:	Aluminum
BOOM STRUT MATERIAL:	Carbon

GEARING

MAIN ROTOR TO PINION RATIO:	N/A
MAIN ROTOR TO TAIL RATIO:	N/A

WEIGHT

EMPTY:	1lbs., 6oz. (633g)
FULLY LOADED:	1lbs., 13oz. (816g)

DIMENSIONS

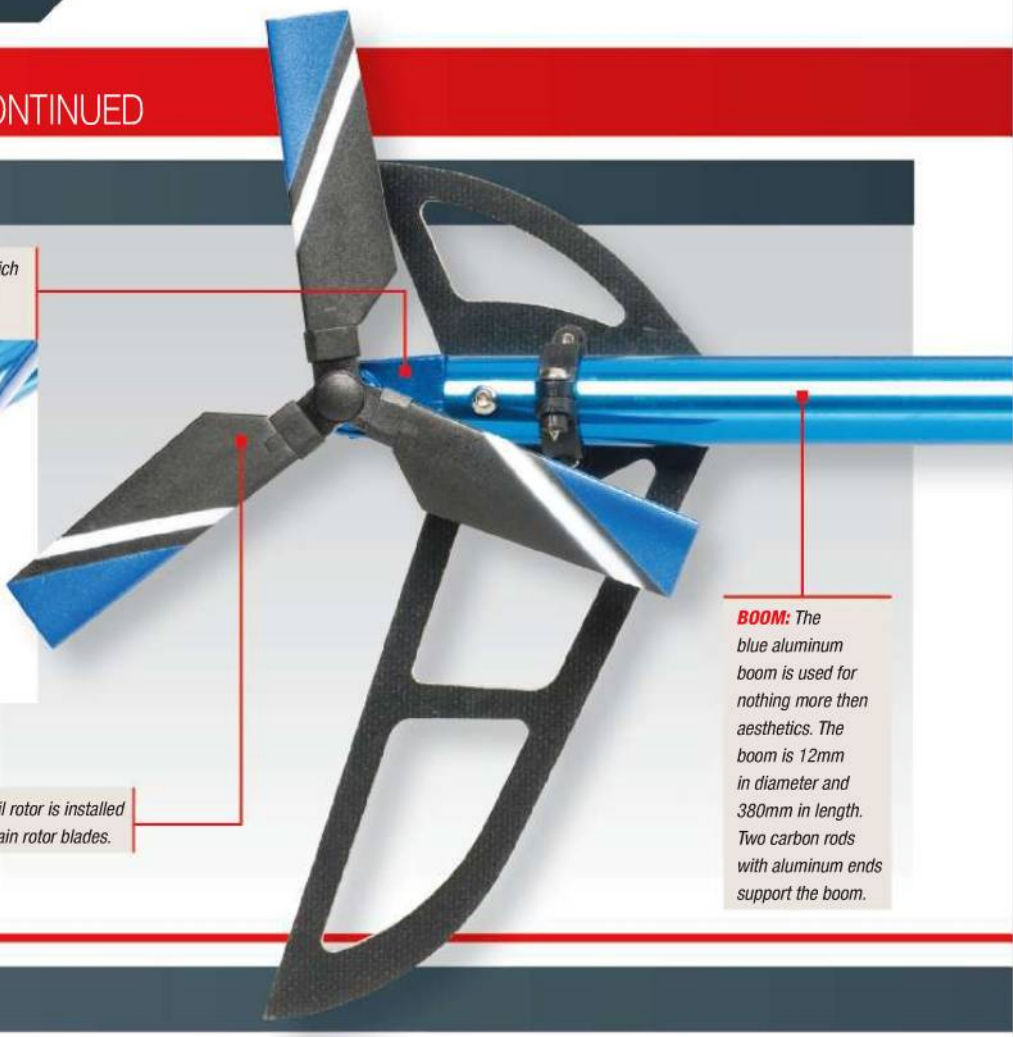
HEIGHT (A):	12.31 in (313mm)
CANOPY WIDTH (B):	3.5 in (89mm)
LANDING GEAR (C):	4.75 in (120mm)
PADDLE TO PADDLE DIA. (D):	12.75 in (324mm)
MAIN ROTOR (E):	24.5 in. (620mm)
TAIL ROTOR (F):	3.75 in (95mm)
LENGTH (G):	26 in. (666mm)

Pitch controls the yaw? Ok now I am confused.

FEATURES CONTINUED

» TAIL & BOOM

TAIL CASE: *The Lama 3 also has a simulated tail, which includes an aluminum tail case that is attached to the boom with two machine screws.*



TAIL ROTOR SYSTEM: *A freewheeling three-blade tail rotor is installed and spins in light winds or by the downwash of the main rotor blades.*

BOOM: *The blue aluminum boom is used for nothing more then aesthetics. The boom is 12mm in diameter and 380mm in length. Two carbon rods with aluminum ends support the boom.*

» ROTOR HEAD

HEADBLOCKS: *Both top and bottom headblocks are made from solid aluminum and CNC machined with a smooth finish. Both blocks are rigidly mounted to the main shafts. The upper block is mounted by means of a Jesus bolt and locknut, while the lower headblock is secured using two screws that only thread into the outer portion of the main shaft.*

ROTOR BLADES AND GRIPS: *The included rotor blades are made from fiberglass and are painted white. Stickers are applied to the blades to give them some aesthetics, and tracking tape is also applied so you can identify an out-of-track situation. The grips are made from blue anodized aluminum and are rigidly mounted to the headblocks. The lower rotor head blade grips are dual ball bearing supported and attach to the hub with two machined screws.*

CONTROL: *The lower rotor head provides all of the control for the Lama 3. A flybar provides lower rotor head stability while a Bell/Hiller configuration gives the helicopter the ability to handle slight wind with some authority. The upper rotor head only provides stability and additional thrust. Two brass weights are used on the upper rotor head's flybar.*

Your my boy BLUE.

» INSTRUCTIONS & BUILDING TIPS

WHEN YOU OPEN THE BOX

Upon opening the colorful box of the Walkera Lama 3, you will find that the helicopter is secured by a plastic shell that covers both sides of the helicopter. The top half of the shell is clear and easily pops off the white bottom half. This case can be used for transportating of the Lama 3. Beneath the helicopter, a section is molded for the included digital radio. On the sides of the plastic insert a spot is molded for the battery, charger, and wall adapter.

MANUAL AND BUILD

The Lama 3 includes two different manuals, one for the helicopter and one for the 2.4GHz digital radio. Both manuals come in multiple languages. The manual shows basic setup for the radio and gear, but does document parts in great depth. Basic maintenance and blade tracking information is in the manual, including linkage lengths. No building was required on the Lama 3, but I did notice the main blades were a bit loose.

Walkera LAMA3

RTF & TEST GEAR

» SUPPLIED GEAR

- **RADIO:** Walkera, WK-2603, WK2603

- **RECEIVER:** Walkera, RX-2429, RX2429, 1.28 oz (32g)

- **SERVOS:** Walkera, WK-7.6-6, WK-7.6-6, 0.29oz (8.4g)

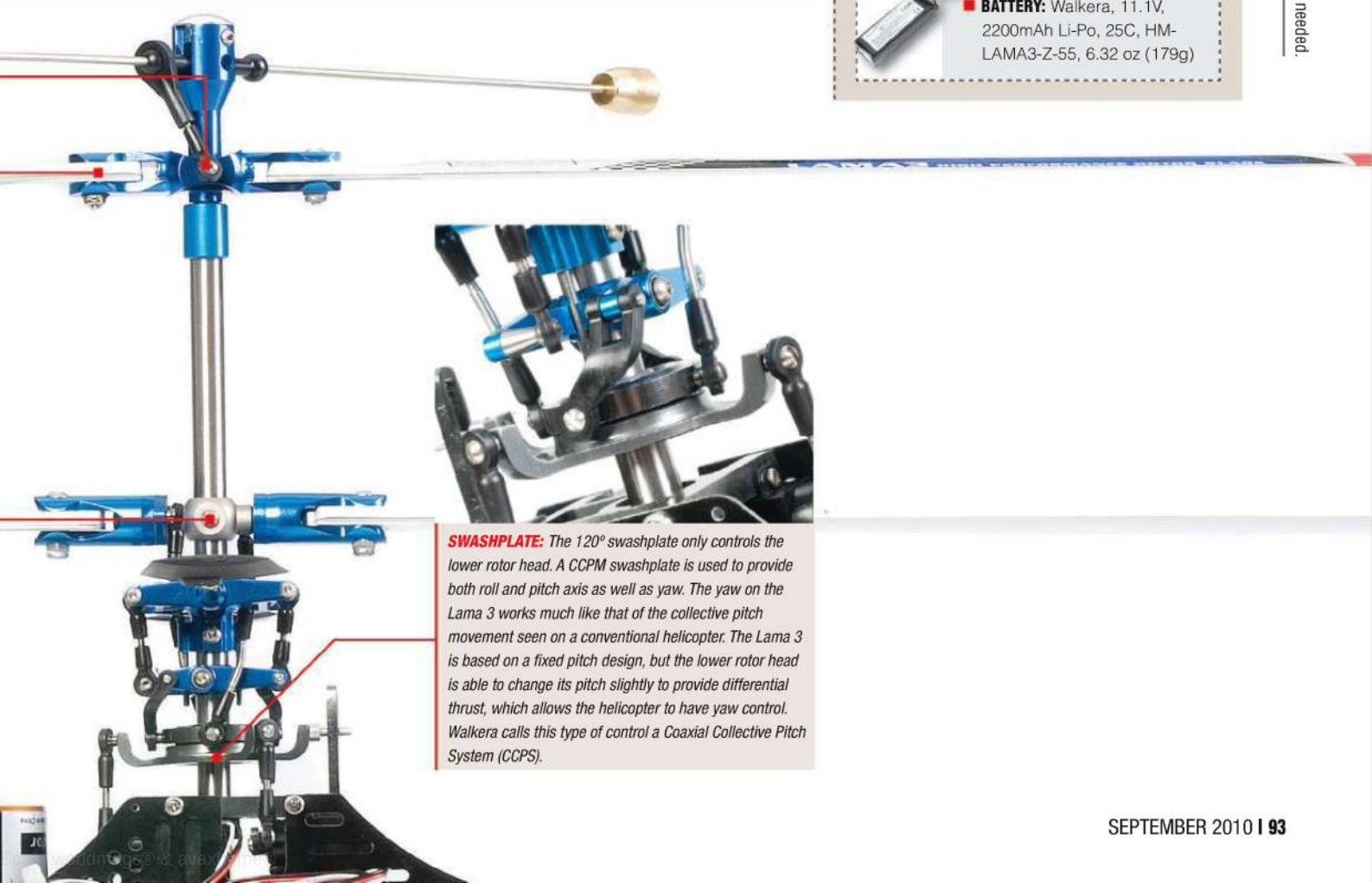
- **GYRO:** Built- in 3D Gyro

- **MOTOR:** Walkera, WK-WS-28-007W, WK-WS-28-007W, 1.48 oz. (42g)

- **SPEED CONTROL:** Walkera, 40-amp ESC,WK-WTS-40A-1, 1.48 oz (42g)

- **BATTERY:** Walkera, 11.1V, 2200mAh Li-Po, 25C, HM-LAMA3-Z-55, 6.32 oz (179g)

No extra components needed.



SWASHPLATE: *The 120° swashplate only controls the lower rotor head. A CCPM swashplate is used to provide both roll and pitch axis as well as yaw. The yaw on the Lama 3 works much like that of the collective pitch movement seen on a conventional helicopter. The Lama 3 is based on a fixed pitch design, but the lower rotor head is able to change its pitch slightly to provide differential thrust, which allows the helicopter to have yaw control. Walkera calls this type of control a Coaxial Collective Pitch System (CCPS).*

TESTING

We tested the Lama 3 with the included radio gear and battery. The only items needed to get this giant coaxial helicopter in the air were eight AA batteries for the transmitter. I went over the helicopter to make sure that everything was tight and had thread locking compound, and I was pleased to find that every screw was securely attached.

HOVERING • The giant size of this coaxial helicopter seems a bit unorthodox at first, considering that most coaxial helicopters can't swing this size of blade. Watching the rotors spin up, I was pleased to see the Lama 3 gently lift off the ground and remain stationary in a hover without much control at all. Just like its smaller brothers, the Lama 3 is rock steady in a hover. Slight controls were needed on a breezy day, but overall the Lama 3 can hover better outdoors than a smaller coaxial helicopter.
Rating: 5

FORWARD FLIGHT • Transitioning into forward flight, you will notice that it takes the Lama 3 a little time to build up some speed. The helicopter does get going pretty well, but does not track as well as a conventional helicopter. Overall, the forward flight seems good, but some cyclic roll needs to be applied to keep the helicopter flying in a straight line. Moving from forward flight into a turn requires careful planning, as the helicopter tends to balloon up quite a bit if you are not ready for it.
Rating: 3

CYCLIC PITCH RESPONSE • The cyclic pitch response is like that of any coaxial helicopter. The response starts slowly but gradually picks up. It's possible to over control the Lama 3, so don't just jab in full cyclic and hold it there. Quick direction changes are not something the Lama 3 can perform; this helicopter was designed with the beginner in mind.
Rating: 4

TAIL ROTOR RESPONSE • The yaw control on this helicopter uses a collective pitch differential on the lower main rotor blades. This gives the helicopter consistent pirouette speed, but the response seems to lag a bit. When applying rudder inputs, the helicopter will start to spin and you will hear the motor lag or accelerate a little behind your inputs. Be prepared when pirouetting, as you will need to add more or less throttle when initially entering a pirouette.
Rating: 3

OUTDOOR CAPABILITES • With its larger size and heavier weight, the Lama 3 performs very well outside. In a light breeze it doesn't feel affected at all. The only time I started to notice that correction was needed was on days were the wind exceeded 7 mph. Although the Lama 3 can handle winds stronger then 7 mph, I would not suggest flying it until you have mastered this helicopter in calm wind conditions.
Rating: 4.5

POST FLIGHT INSPECTION • I did not notice any abnormal wear and tear. The landing gear was sturdy enough to handle rough landings, and even the blades were pretty tough. When testing in heavy wind, I got a chance to scrape the blades up a little and the Lama 3 withstood the challenge. The only thing that needed replacement was the lower fiberglass blades.
Rating: 4.5

CONCLUSION

If you're looking for a good beginner helicopter or a larger coaxial helicopter that you can take outside, the Lama 3 is the perfect choice. The increased size gives you a better sense of control and a larger surface to look at during flight.

It is a crazy sight to see!

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TESTING SPECS

Walkera **LAMA3**

Part #: HM LAMA3
Distributor: Walkera
Web: www.walkera.com

Street Price: $299
Price as Tested: $308
Build/Setup Time: 1 hour

PERFORMANCE

MODE FLOWN:	Not Applicable
RPM OF EACH MODE:	Variable
MOTOR TEMP (after flight):	180° F
BATTERY TEMP (after flight):	120° F
FLIGHT TIME:	10 minutes
CRASH COST*:	$24.00

TEST CONDITIONS

WEATHER:	Sunny
TEMP / HUMIDITY:	88° F/ 54%
BAROMETRIC PRESSURE:	29.99 in.
WIND SPEED:	9 mph
VISIBILITY:	9 miles
ALTITUDE:	725 feet

** includes main shaft, tail boom, spindle, landing gear, flybar, torque tube*

REQUIRED TO FLY

8 AA batteries

WHO'S IT FOR?

The Lama3 from Walkera is a great beginner helicopter for the pilot looking for increased visibility and a helicopter that can fly outside.

SCORECARD

SCALE RATING: 1=POOR 5=EXCELLENT

2	Instructions
4	Parts Quality/Fit
4	Durability
3	Tunability
3.5	Overall Performance
4.5	Value

THE GOOD

- Brushless motor
- Super stable design
- Easy battery installation and removal

THE BAD

- You probably only would want to fly this helicopter outside.

Look at that concentration, or is it amusement?

Main Blade Fiberglass&CF

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SPECIFICATION:

MEMS Gyro Sensors in three axes
Digital signal processor
Operating voltage: 4-10 Volts, current < 80mA
Temperature range: -10°C to +50°C
Servo compatibility: 1520uS/333Hz, 1520uS/250Hz, 1520uS/167Hz and 760uS/333Hz digital servos, 1520uS/71Hz Analog servo
Size: 33x34x18mm
Weight: 15g

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HK500GMT 3D ELECTRIC HELICOPTER KIT

(INCL. CF BLADES AND C.F. FRAME PLUS ALL ALLOY)

- Length: 840mm
- Height: 310mm
- Tail drive gear: 31T
- Tail rotor diameter: 200mm
- Motor pinion gear: 13T
- Main drive gear: 162T
- Main rotor diameter: 970mm
- Drive gear ratio: 1:12.46:4.68
- Flying weight: Approx 1700g
- Weight(without power system): 1370g

$99.99

HOBBYKING

401B AVCS

DIGITAL HEAD LOCK GYRO

- Compatible with both Digital and Analog systems.
- Minimizes rudder trim changes caused by wind, other meteorological changes, and varieties of helicopter attitude changes are automatically cancelled.
- Sensor vibration proofing.
- Simple sensitivity adjustment.

$13.99

HK 600 GT

$129.99

- Length: 1200mm(47.25 in)
- Height: 388/405mm(15.25 in/16 in)
- Main Blade Length: 600mm
- Weight(w/o main blade): 1340g
- Tail Rotor: 240mm(9.45 in)
- Motor Drive Gear: 10T(11T optional)
- Main Drive Gear: 170T
- Autorotation Tail Drive Gear: 160T
- Tail Drive Gear: 40T
- Drive Gear Ratio: 1:17.0:4.5/1:15.45:4.5
- Main Rotor Diameter: 1350mm(53.15 in)
- Flying Weight: Approx 3000g(6.6 lbs).

HobbyKing.com

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Butch Wellmaker's SIKORSKY S-76

WORDS and PHOTOS: Chuck Bassani

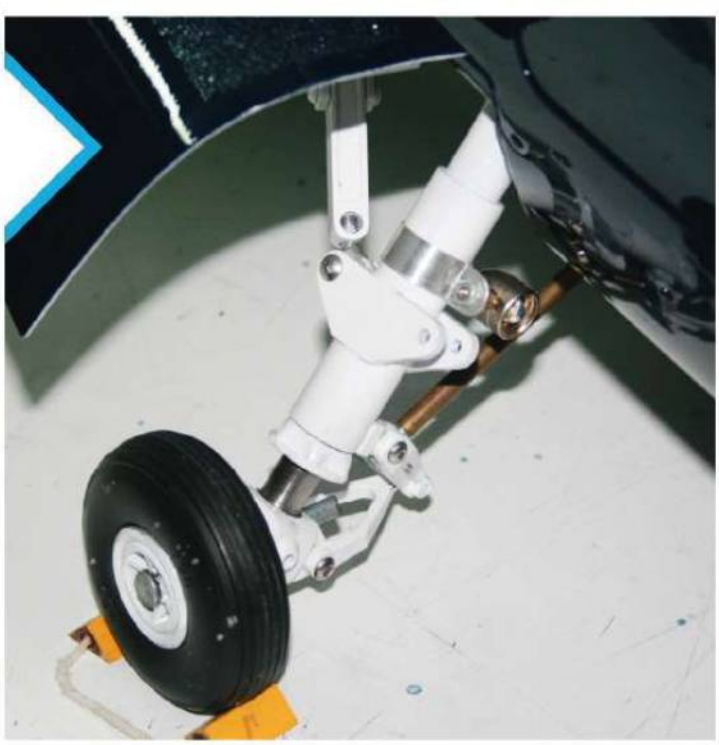
Who knew Chhuck was a scale guru.

I'VE RECENTLY HAD THE PLEASURE OF VISITING WITH BUTCH WELLMAKER. THOSE OF YOU WHO ARE INTO SCALE R/C HELIS WILL SURELY RECOGNIZE HIS NAME. His latest masterpiece is a "super scale" Sikorsky S-76. Butch decided his subject for this project would be the very aircraft he works on as a certified A&P. Looking at the finished model, I think everyone will agree that the results are nothing less than outstanding. Believe me, the photos don't do it justice. You really need to see this model with your own eyes. It's easy—just make it a point to attend this year's AMA Scale Nationals Competition and/or IRCHA.

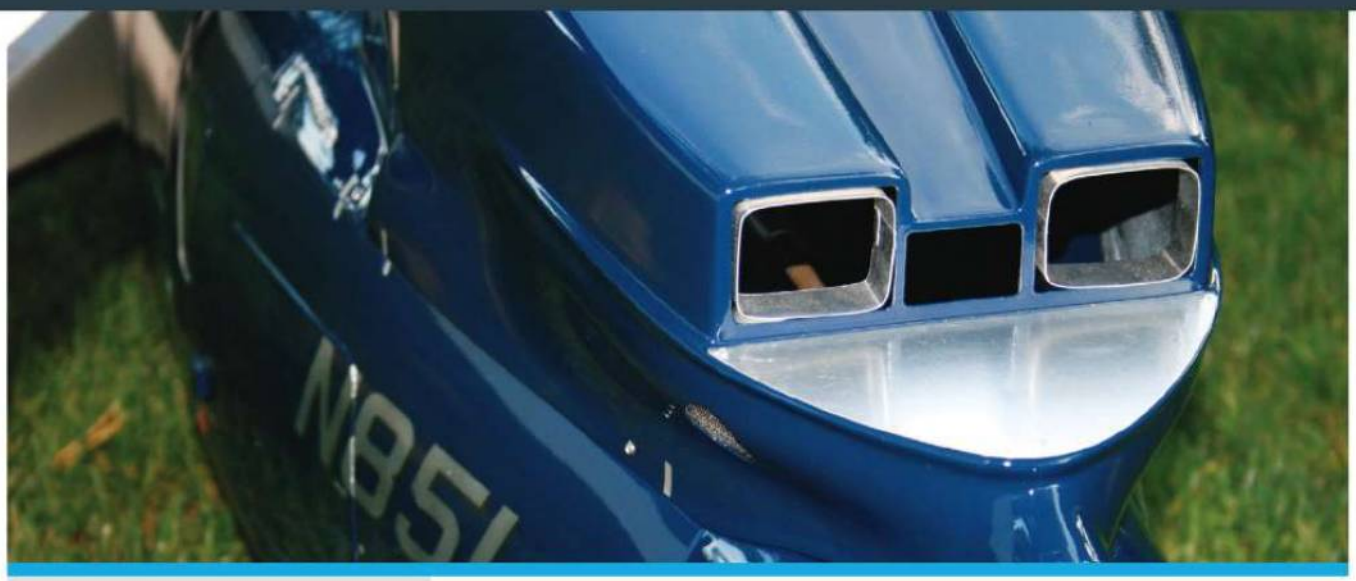
FUSELAGE

The project started out as a stock ScaleJet International S-76 fuselage kit, which includes a fairly accurate scale retractable landing gear set. From there, Butch set off to do some amazing customization in order to bring the body and legs of this beast to the point where it was an exact replica of the scale subject. This was a major undertaking that included:

- Filling in many of the pre-molded panel lines that were not in the correct locations. The re-located lines as well as the necessary additional panel lines were scored into the glass.
- The cockpit door windows needed to be extended down about a half inch in order to duplicate the windows of the full-scale subject.
- All NACA scoops, antennas (with the exception of the ELT), and door handles were hand-crafted.
- Every rivet, screw, and body strap was painstakingly reproduced to match the full-scale subject.
- ElectroDynamics was employed to produce accurate scale aircraft lighting. All the lights are in their scale location and their associated sequencing mimics the full-scale subject.
- The fuse was painted with PPG Industries Admiral Blue color followed by PPG Industries clear coats.



Note—There are no instructions are provided. It is therefore obvious that this kit is marketed towards expert builders. Butch would like to mention, however, that ScaleJet International had been 100% supportive during the build.



MECHANICS

Originally, Butch envisioned this as a turbine powered model. He even went so far as to purchase the turbine. However, as construction progressed it became clear that flying a turbine on Long Island presented some issues; specifically, there are a very limited number of fields that permit their use. So the decision was made to switch over to electric power.

The Peka-Luftechnik mechanics include a 4-blade main rotor, 8 HP brushless out-runner motor, and flex-drive tail rotor system. It runs oh-so-smoothly thanks largely to a 2-stage belt reduction system.

TO COMPLETE THE DRIVE SYSTEM, BUTCH USED:

- A Castle Creations ICE 160 ESC
- Dual New York Amp Dude 6S / 10,000 mAh / 22C LiPo battery packs (12S system)
- M-Blades 950mm (metal) main rotor blades

THE BACK END OF THE MACHINE CONSISTS OF:

- Huner Technik 4-blade tail rotor system, modified by Butch to conceal completely inside the fuselage tail section
- M-Blades 145mm (metal) tail rotor blades

The Huner-Technik tail rotor gearbox is completely concealed.

BUTCH'S TIPS FOR WANNABE SCALE MODELERS

- Patience
- Use the wealth of information and expert help that can be found on many of the online forums. There isn't a scale modeler out there who isn't willing to help.

SCALE RC HELIS – www.scalerchelis.com
AIRLINERS.NET – www.airliners.net
RUNRYDER – www.runryder.com

- Take advantage of "networking" for help and parts
- Documentation and lots of photos.
- Access to the full-scale subject is a big plus.
- Lots and lots of beer

Getting ready for another flight.

The full scale subject.

Attention to detail.

INTERIOR

The painstaking work didn't end on the outside. One look inside the cockpit and Butch's skills as a master craftsman will become even more evident. This has to be one of the most beautifully detailed instrument panel and consoles that I've ever seen.

Seen here is the instrument panel produced by the rapid prototype system and the silicon mold that was made from it.

Constructing the cockpit detail began with scanning the original Sikorsky instrument panel and console blueprints. Using CAD software, relief was added to the 2D scans in order to produce 3D computer models of the parts. The resulting 3D models were then sent out to a high-end rapid prototype shop. What Butch received back was extremely accurate to scale cockpit parts.

These parts were then used as positives (plugs) for making silicon molds. From these molds, duplicate parts could be re-produced using casting resin. Some framework and a fiberglass hood topped off this work. And if that wasn't enough, photographs were taken of actual screen images for all of the glass displays. The photographs were then laser printed on Mylar and positioned behind open display holes in the instrument panel. The entire panel was then backlit with an array of eighteen LEDs. Finally, all of the details were hand-painted. The result is spectacular.

The finished instrument panel and center console.

State of the art glass cockpit!

CONTROL

Control of this masterpiece would only be trusted to the best. Butch uses a JR 12X 2.4 GHz transmitter and a JR R1222 PowerSafe receiver. To power the on-board systems, two JR VR6010 10-amp voltage regulators and two New York Amp Dude 2S2P / 4200 mAh LiPo battery packs are used. These serve as redundant power sources for the R1222 PowerSafe receiver.

SOME PARTING STATS

FINAL FLIGHT READY GROSS WEIGHT: 41 pounds.
LABOR HOURS: HAAAA!!! (Although a rough estimate is about 2-4 hours a day, every day, for two years).
COST: Parts add up to about 15 large! (That's $15,000 for the non-Sopranos watching folks). This includes three sets of motor power and electronics power batteries. RCH

TWELVE SERVOS ARE NEEDED FOR CONTROL:

- Four JR DS8717 servos on swash (configured as 4-servo eCCPM)
- One JR DS8717 servo on rudder
- Each main gear uses one Futaba S5301 servo for retraction and one HiTec HS-325HB servo for the gear door operation
- Nose gear uses one HiTec HS-635HB servo for retraction and two HiTec HS-55 servos for the gear doors
- A Skookum Robotics SK-360 Digital Flybar tames the beast.

CONTACTS

- **FUSE:** www.scalejet.com
- **MECHANICS:** www.scalejet.com www.huner-technik.ch www.eastcoastvario.com
- **BLADES:** www.m-blades.com
- **LIGHTING:** www.electrodynam.com
- **CONTROL:** www.jrradios.com www.futaba-rc.com www.hitecrcd.com www.skookumrobotics.com
- **ELECTRONIC SPEED CONTROL:** www.castlecreations.com
- **BATTERIES:** www.nyampdude.com
- **PAINT:** www.ppg.com

Wow that looks cool.

A good foundation will last a lifetime.

BASICS OF HELI AEROBATICS

Four Ways to Fly

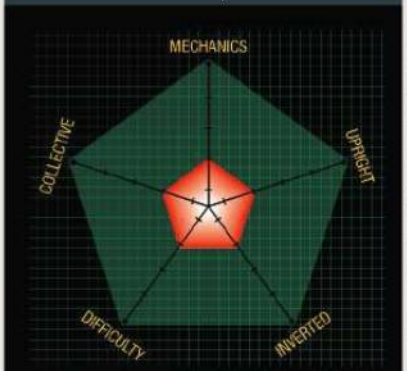
WORDS: Aaron Shell

MOST AEROBATIC HELICOPTER FLIGHT INCLUDES WHAT I CALL THE "FOUR BASIC MODES OF RC HELICOPTER AEROBATICS". Learning how to master each of these flight conditions is critical before a pilot is ready to move into 3D flight; this is the foundation you need to make 3D possible. In some ways this is an exercise in orientation, in others it's a lesson in the symmetry which is unique to RC helicopters. Unlike any other aircraft, including 3D RC airplanes or full-scale helicopters, RC helis can fly equally well in any of these four basic aerobatic flight modes; forward and backward upright, and forward and backward inverted.

Flight School Training

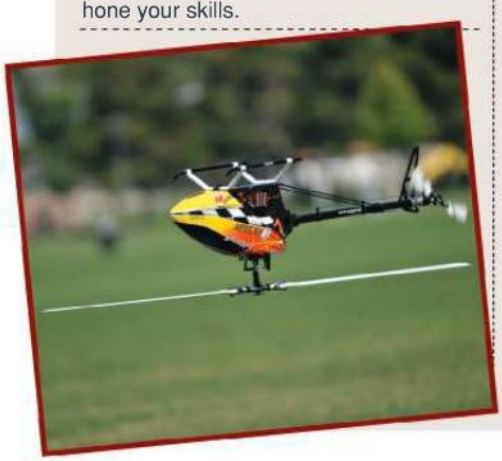
» SKILLS NEEDED

SCALE RATING: GREEN = Easy / RED = Advanced



WARNING: Only perform these maneuvers under safe conditions and in a large open area or designated flying field away from power lines, building, traffic and populated areas. Make sure you are familiar with your helicopters controls and can perform basic flight maneuvers.

Getting Started: Before you tackle this lesson you need to be relatively comfortable with your helicopter. You should have the model set up for aerobatic flight with Idle-up modes to allow for inverted flight, and you should be flying some basic aerobatics like loops and rolls and inverted hovering. Your helicopter needs to have a well tuned setup with the same amount of positive and negative collective pitch for your Idle-up modes, and enough power and headspeed to be able to flip and roll without bogging the model excessively. If you aren't ready for this yet, a simulator can still be very helpful. If you can get it down on the sim and are confident in your model's setup, you should be ready to give it a try! Even if you are a seasoned pro, it can be very helpful to try different practice routines to help hone your skills.



LEARNING THE WAY

One of the groundbreaking lessons you must wrap your head around for 3D flight is learning how the helicopter flies equally well forward or backward, upside down or upright. The helicopter will respond equally to the controls regardless of which direction it is flying; you just have to give the correct commands and the helicopter will follow through. Before you can attempt new flight modes for the first time, you should try to conceptualize what you are doing instead of just exploring the controls. It may be helpful to hold your model and try to work through each mode of flight.

Even Ryan had a hard time thinking about how the controls actually worked.

Breaking It Down

Once I began conceptualizing what control inputs would be needed to achieve the four modes of flight, I went back to re-examine my forward flight skills. I attempted to fly some basic upright forward patterns while focusing and thinking about what individual controls I was actually giving to achieve smooth forward flight and coordinated turns. If you can break down how much of each control you are using to make the helicopter fly, you can master the inputs needed to make the helicopter fly equally well in any of the other flight modes. If you want to fly the same turn in all four flight modes it will require different inputs, but the amount of each input and when you use it should be about the same.

1. FORWARD UPRIGHT

In normal upright forward flight, a helicopter flies somewhat like an airplane. You use coordinated inputs of roll and yaw and pull back on the cyclic stick to pull the nose toward the rotor blades and move the helicopter through the turn. If the helicopter is flying away from you, a right roll stick input, a right yaw input, and pulling back on the stick would command the heli to make a turn to the right. To bail out, you would level the disk with roll first, then level the nose with cyclic and give positive collective.

2. BACKWARD UPRIGHT

If you begin in an upright, nose-in hover, drop your tail and begin flying away backward; the commands to make the right hand turn will be right yaw, left roll and pushing forward on the cyclic. Be extra cautious when first learning this flight mode, people have a tendency to try to bail out by pulling back on the cyclic, which buries the tail in the ground. The safe move to bail out is to level the disk with roll first, and then add forward cyclic and positive pitch.

3. FORWARD INVERTED

Forward inverted flight with a helicopter is similar to flying an airplane inverted. If you flip the heli over into a tail-in inverted hover and begin to fly away from yourself, it will take opposite inputs of roll and yaw to make a coordinated turn. Your roll inputs would be in the desired direction, and the yaw input goes the opposite way. For a right hand turn flying away from yourself, you would use a right roll input, a left yaw input, and you would push forward on your cyclic stick to push the canopy away from the blade disk and fly through the turn. Bailing out would use the appropriate roll input to level the disk first, and then forward cyclic and negative pitch to climb and fly out.

Make sure to practice these moves high.

4. BACKWARD INVERTED

If you flip the heli over into a nose-in inverted hover and begin flying away from yourself backwards, the helicopter will need yaw and roll inputs to the left to fly the same right hand turn. You would pull back on the cyclic to pull the canopy towards the blade disk in an inverted backward turn. To bail, level the disk with roll first, and then pull back on the cyclic and add negative pitch.

MIND TRICKS, HELPFUL TIPS

After reading the different inputs required to make the same right hand turn you might be thinking "This guy is nuts! How in the world would I remember in an instant which way to go? I'd probably just bury it!" Don't worry! It doesn't take a genius to master all four flight modes, it just takes good basic skills and practice!

To master the basic skills required, it helps to remember this; Forward upright and backward inverted are nearly the same inputs, but the direction of the roll and yaw are opposite for backward inverted. Forward inverted and backward upright are nearly the same, but the yaw and roll commands are opposite as well. If you can sit down and work through the same turn in your head all four ways time and time again, it begins to come together. Combine this lesson with a good foundation in flight orientation, and you should be able to get it!

Keep in mind not to apply excessive inputs; begin with low rates for this exercise and watch what the disk is doing. Give inputs accordingly, don't just stab the sticks to the corners. Once you master turning in one direction, try flying a Figure 8 in all four flight modes.. Once you've got that down you should be able to fly in any of the four basic flight modes equally well.

PRACTICE THE BASICS

The key to mastering the four basic modes of aerobatic helicopter flight is building on a solid skill set. Having all of your basic orientation skills mastered is mandatory. If you struggle with this exercise, practice upright and inverted hovering in all orientations. Before you attempt the turn in all four modes of flight, work on a well controlled, straight line flight path in each different mode. Your helicopter will fly equally well and require the same amount and same timing of inputs to achieve controlled flight in any direction you command. RCH

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MOLLER SKYCAR

Roads? Where we're going we don't need roads

WORDS: Ryan Kephart

Star Trek is just around the corner.

WHEN YOU IMAGINE THE FUTURE, WHAT IS ONE OF THE FIRST THINGS THAT YOU THINK ABOUT? Chances are that your vision of the future includes flying cars. Several aircraft manufacturers have looked into this future and tried to design a vehicle which can not only be easy to fly, but take off from the length of your driveway. One of the more distinctive designs is the Moller Skycar. This unique and sporty looking aircraft may just be the future of civilian transportation.

DESIGN

The Moller Skycar is considered a "vo-lan'ter, or vertical takeoff and landing aircraft that's capable of flying in a quick, nimble, and agile manner." The Skycar is developed by Moller International by owner and inventor Paul Moller. The dream of future flight has motivated Moller for over forty years.

The Skycar's design is much like that of a model "ducted fan" engine, in which the four main fan units are encased in a duct. This design allows for better performance and bystander protection. The Skycar was equipped with an onboard computer that controls a large portion of the flying. It still needs the pilot to operate the controls and tell the car where to fly. Although the Skycar is very simple to fly, the operator still needs to carry a private pilots license. Eight Rotapower engines directly drive propulsion fans encased in a Kevlar lining with intake screens. A Rotapower engine is essentially a Wankle-style engine that operates with much less moving parts then a conventional reciprocating engine. The engines are all controlled by a computer and run independently. This design also will allow the Skycar to land safely in the event of a single engine failure.

FLIGHT

The first flight of the Moller Skycar took place in 2003 while attached to a tether. The Skycar took to the skies in the hovering mode. Tethered flight tests were to be performed on this prototype in 2006 but were canceled. Moller decided to upgrade the engines in 2007 and made an entirely new prototype labeled the "M400X". Not much has been said about this new prototype, but we hope to see some testing in the near future. RCH

SPECS

CAPACITY: Four passengers
LENGTH: 19.5 ft. (5.9m)
WINGSPAN: 8.5 ft. (2.6m)
HEIGHT: 7.5 ft. (2.3m)
EMPTY WEIGHT: 2,400 lbs. (1088kg)
USEFUL LOAD: 750 lbs. (340kg)
POWERPLANT: 4 'Rotapower' Wankel engines w/ducted fans, 180 hp (134 kW) each

PERFORMANCE

MAXIMUM SPEED: 330 mph (531 km/h) at 25,000 ft. (7620m)
CRUISE SPEED: 305 mph (491 km/h) at 25,000 ft. (7620m)
SERVICE CEILING: 36,000 ft. (10973m)
RATE OF CLIMB: 4,800 ft./min. (1463m/min.)

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120 SR

While the new 120 SR is certainly small enough to fly inside, Blade has optimized its power, size and control authority so that it feels like a bigger heli when you fly it outside, even if there's a little wind. At the heart of this impressive performance is a Bell-Hiller head design that gives the 120 SR the kind of speed and agility you would expect from a single-rotor heli plus some of the "hands off" stability of a coaxial heli. It also features adjustable swash sensitivity that lets you tweak it for more aggressive control response when you're ready.

Check out the Blade 120 SR at your favorite Blade retailer or get details, video and more at bladehelis.com.

AVAILABLE IN:	RTF BLH3100 / BNF BLH3180
LENGTH:	12.5 in (318mm)
HEIGHT:	5.0 in (130mm)
FLYING WEIGHT:	3.75 oz (106 g)
ROTOR DIAMETER:	12.5 in (318mm)
MAIN MOTOR:	Brushed (installed)
TAIL MOTOR:	Coreless (installed)
ON-BOARD ELECTRONICS:	5-in-1 receiver/servos/mixer/ESC/gyro (installed)
BATTERY:	1S 3.7V 500mAh Li-Po (1 included)
CHARGER:	Celectra™ DC Variable Rate Li-Po with AC adapter (included)
TRANSMITTER:	MLP4DSM 2.4GHz DSM2™ 4-channel (included with RTF only)

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