

INSTRUCTION MANUAL FOR VERSION 2

Thank you for purchasing MULTIGOV from Aerospire LLC. MULTIGOV keeps your RC helicopter rotor speed nearly constant by monitoring the helicopter motor speed and automatically adjusting your model's throttle servo. MULTIGOV can be run in either full governor or overspeed limiter mode to match your flying style.



Please read all instructions carefully. Radio-controlled helicopters are not toys. Improper installation or misuse can result in serious injury, physical damage, and/or death. Since Aerospire LLC has no control over the installation or use of this product, no liability may be assumed, nor will liability be accepted for any damage resulting from the use of this product. Under no circumstances shall the buyer be entitled to consequential or incidental damages. By the act of installing this product, the user accepts all resulting liability.

FEATURES

- Maximizes your RC helicopter's power and response by providing a near constant rotor speed
- Switch between full governor or overspeed limiter flight modes on the fly
- Overspeed limiter goes beyond your throttle curve if needed -- flat 100% curve not required for maximum performance
- Three individual remotely selectable speed settings that cover a wide range of rotor speeds and gear ratios
- Adaptive algorithm provides excellent hovering and hardcore 3-D performance
- Detachable LCD configuration module makes setup fast and easy
- Only one LCD configuration module is needed for any number of MULTIGOV RC helicopter governors
- No optical tachometer/calculations needed for setup
- Advanced configuration options allow fine-tuning of performance
- Supports adjustable slow startup
- Works with Futaba, Spektrum, JR, and compatible receivers
- Software can be upgraded for future enhancements
- 100% digital control using powerful microcontroller
- Designed and developed in the USA

PACKAGE CONTENTS

- | | |
|---|--|
| 1 | MULTIGOV RC helicopter governor |
| 1 | Detachable LCD configuration module (if purchased) |
| 2 | Servo wire extensions |
| 3 | Sensor mounting brackets |
| 2 | Sensor Magnets |
| 1 | Adhesive heat shrink tubing |
| 1 | Cable tie |
| 1 | Jumper for disabling RPM Select function |

FULL GOVERNOR VERSUS OVERSPEED LIMITER MODE

MULTIGOV has the capability to run in either full governor mode or overspeed limiter mode. In full governor mode, MULTIGOV attempts to keep the target rotor speed nearly constant with minimal overshoot. It also uses your existing throttle curve to predict throttle adjustments before they are needed ("feedforward"). This mode provides a smooth and powerful flight performance.

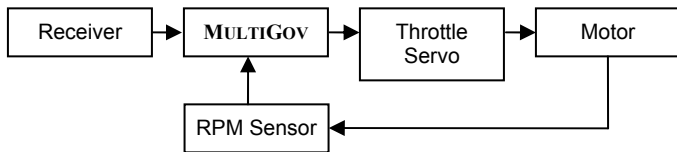
The overspeed limiter is an alternative for flyers. This mode operates differently depending on the rotor speed. If the rotor is overspeeding, MULTIGOV will act as a full governor to bring the speed down. If it is underspeeding, your radio's throttle curve will be quickly transmitted to the servo. If your throttle curve is set high enough to reach the target speed, there is minimal delay in reaching the target speed. If additional throttle is needed at any time, our limiter will add more to reach the target speed. Our limiter is more aggressive during an underspeed condition compared to the full governor mode. This gives increased 3D power but note that the rotor speed can overshoot more than the full governor. If you are a 3D flier, we recommend you use the overspeed limiter mode.

Depending on your flying style, level and setup, you may not notice any difference between the two modes. Some people like the full governor while others prefer overspeed limiting. We recommend you try both modes and decide for yourself which one you like better. You can easily compare the two modes in flight. Set up two speeds with the same value but one running in full governor and the other in overspeed limiter. Flip your radio's flight mode switch to toggle between the two while flying. Please be sure that your throttle curves are set correctly for each mode if you do this.

PRE-INSTALLATION REQUIREMENTS

- At the minimum, we recommend you use a throttle servo with at least a .21 sec/60 degrees speed. Digital servos in the .10 sec-.16 sec/60 degrees would be excellent choices. A faster servo will give you better performance.
- Any governor's performance will work only as well as your motor's response. It is highly recommended that you fly your model with the governor disabled and make motor needle adjustments for good flying response first.
- Digital servos and additional electronics increase the rate at which your receiver battery is drained. Use the highest capacity receiver battery that is reasonable for your model. **ALWAYS PERFORM A BATTERY CHECK BEFORE EACH FLIGHT.**
- If you decide to use PCM failsafe, we recommend that you set it to "idle".

INSTALLATION DIAGRAM



As shown the drawing above, **MULTIGOV** is installed between your receiver and the throttle servo. It monitors your motor's RPM and controls the throttle servo as needed.

BUILDING, TESTING, AND INSTALLING RPM SENSOR

The RPM sensor needs to be constructed so that it can accurately monitor motor speed. The sensor reads RPM through a magnet which is mounted on the motor fan.

- **Before you build the sensor, please study the picture of the completed sensor on the bracket.**
- **The bending direction of the sensor and its mounting on the sensor bracket may differ from our pictures depending on your situation.**
- **Only 1 magnet is needed for the sensor. If you decide to attach two magnets on the fan for optional balancing, make sure the second magnet is at 0 for the "Sensor" test.**
- **If you have a Trex 600 Nitro helicopter, please go to our web site for instructions to mount the RPM sensor at http://www.aerospire.com/trex600n_mount.html**

Building the RPM sensor

1. Select the appropriate carbon fiber bracket for your motor. When selecting the bracket, test fit it on your motor first. You can Dremel the carbon fiber for proper fit if necessary.
2. Cut approximately ½ inch of included adhesive heat shrink tubing and slide it over the RPM sensor chip onto the sensor wire. The heat shrink tubing will be used to secure the sensor to the carbon bracket.
3. The RPM sensor needs to be bent to face a magnet which is epoxied on the motor fan. Slide the top of the carbon fiber bracket inside the heat shrink tubing. With the text of the RPM sensor chip facing towards the motor fan, place the RPM sensor over the top of the bracket and carefully bend the sensor 90 degrees. **If you have an existing magnet on your motor fan, perform a sensor test using the LCD configuration to determine which way to bend the sensor.**
4. Using a heat gun, attach sensor to the bracket using included adhesive heat shrink tubing. Let the heat shrink adhesive dry for a few minutes.
5. Attach included cable tie over the heat shrink to ensure secure mounting.
6. Apply epoxy at the 90 degree joint to minimize vibration.



In preparation for bending sensor, place it on bracket and slide heat shrink over sensor. Do not heat until you have bent the sensor.

Figure 1. Heat shrink wrap on RPM sensor and bracket

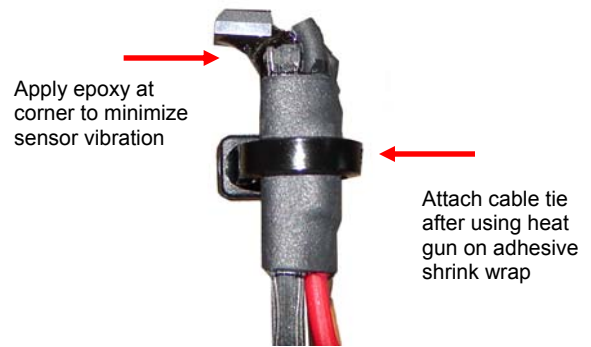


Figure 2. Completed RPM sensor mounted on bracket

Testing RPM sensor

1. Plug the RPM sensor connector onto the **MULTIGOV** connector labeled "Sensor" with the ORANGE wire toward the "HEART" light.
2. Connect the **MULTIGOV** LCD configuration module.
3. Using the included servo wire extension, connect receiver throttle channel to "RX Throttle". ORANGE wire goes toward the "HEART" light.
4. Turn on your receiver, enter the **MULTIGOV** configuration and go to the "Sensor" function.
5. As you move the magnet over the top of the RPM sensor approximately 1-2 mm away, the "Sensor" value should be close-to or at 100 if the magnet is oriented correctly. If this is not the case, flip the magnet over for opposite polarity and/or double check all your connections.

Installing RPM sensor on motor

1. Mount bracket on motor using motor bolts. Do not tighten motor bolts yet.
2. Temporarily affix magnet on motor fan using tape. Position magnet or adjust bracket so that the magnet moves exactly over the sensor as you turn the fan.
3. Test to make sure the RPM sensor reads the magnet correctly (close-to or at 100) using the LCD configuration's "Sensor" function. The RPM sensor should be approximately 1-2 mm away from the magnet.
4. Once you have determined the correct location of the magnet, drill a hole for the magnet on the fan if necessary and secure with epoxy.
5. Bolt down RPM sensor to motor once magnet is secure and you have tested RPM sensor functionality. Don't forget to use blue Loctite on the motor bolts!
6. **When you mount the motor on the helicopter frame, make sure the helicopter frame/fan shroud does not touch the RPM sensor or bracket. Dremel/trim your frame to fix this if necessary.**



Figure 3. RPM sensor mounted on motor

CONNECTING MULTIGOV TO RECEIVER AND SENSOR

1. Connect the RPM sensor connector to the “Sensor” input. Make sure the orange wire is toward the “HEART” light.
2. Connect your throttle servo wire to the “Servo” input. Make sure the orange (JR)/white (Futaba) wire is toward the “HEART” light.
3. Using the included servo wire extension, connect your receiver’s throttle channel output to the “RX Throttle” input. Make sure the orange wire is toward the “HEART” light.
4. **If you want to use the RPM select function to have three different speeds, a free channel on your receiver is required.** Using the included servo wire extension, connect your receiver’s output to the “RPM Select” input. Make sure the orange wire is toward the “HEART” light.
5. **If you do not use the RPM select function, you must connect the included jumper on the “RPM Select” input. The jumper forces MULTIGOV to only use one speed setting. See picture below.**
6. Securely mount MULTIGOV on your model using the attached double sided foam tape or Velcro.

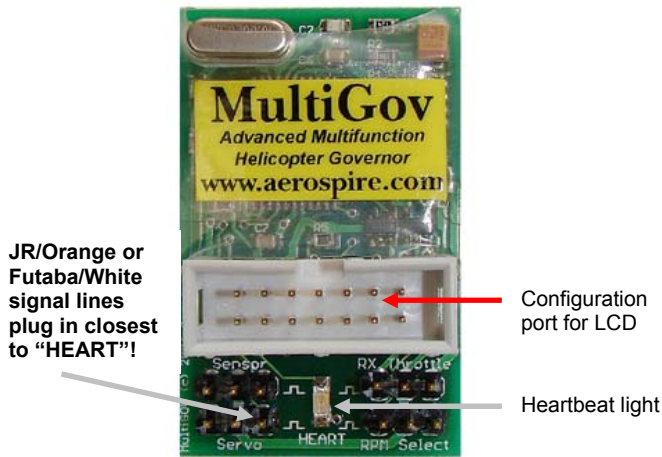


Figure 4. Connecting MULTIGOV

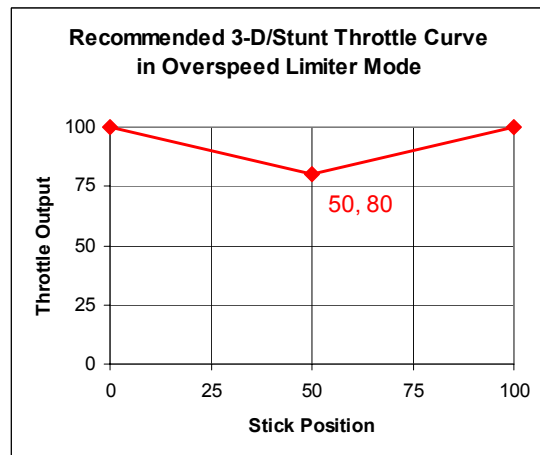
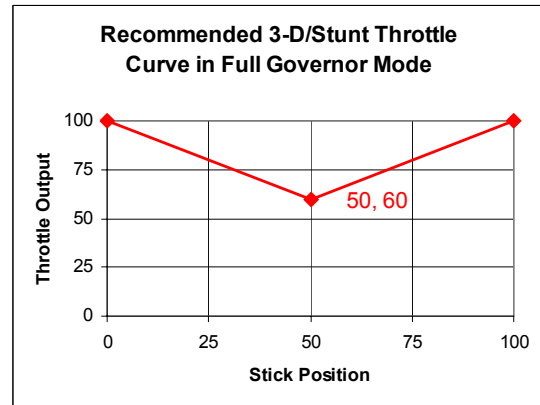
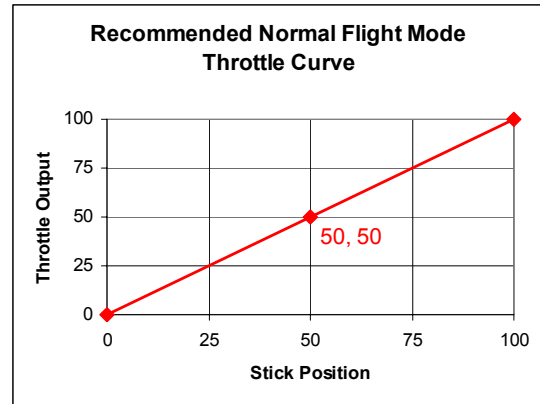


Figure 5. Connecting the jumper to the “RPM Select” input

RADIO CONFIGURATION

MULTIGOV activates governing when 1) the throttle channel input is 20% above the set idle point and 2) the rotor speed is over 70% of the target speed.

The following are the recommended throttle curves that you should set on your helicopter radio. Make sure your throttle servo travel endpoints are as close to 100% as possible.



Configuring the RPM select channel

There are three independent speeds that are available when using the RPM select feature. The speed that is currently activated is determined by the receiver output going to the “RPM Select” input.

Speeds 1, 2, and 3 correspond to low stick, half stick, and full stick respectively. This may be opposite depending on your JR/Futaba radio type and the servo reversing function. Please program your flight mode switch to output these three positions on the RPM select channel. This way, you can automatically have three different speeds depending on your flight mode. Visit the “Support” page on our website for instructions on how to do this with the most common radios.

To test the RPM select functionality, go to the “Speed” configuration function. As you flip your flight mode switch, you should see the speed setting change. Also verify that no other switch or stick movement changes the speed.

ACCESSING THE CONFIGURATION OPTIONS

After you have installed MULTI-Gov, you must configure it before flying. Enter the basic configuration options and set/verify each function as shown in the basic configuration chart.

Entering basic configuration

1. Turn off your model.
2. Plug the LCD configuration cable into MULTI-Gov.
3. Turn on your model.
4. Press "NEXT-MENU" for **3 seconds** to enter configuration.

"NEXT-MENU" or "PREV-MENU" Enter basic config.
 "NEXT-MENU" and "PREV-MENU" Enter advanced config.
 "NEXT-MENU" and "-VALUE" Reset to factory defaults

"or" = press either button for 3 seconds

"and" = press both buttons at the same time for 3 seconds



Figure 6. Configuration module

BASIC CONFIGURATION OPTIONS

Throttle servo is disabled during configuration except when "**Test Idle, High**" is used. Please set the options highlighted in **bold**. As a safety measure, the throttle servo will not operate until you have done the "**Set Idle, Set High**" procedure.

OPTION	FUNCTION	RANGE	DEFAULT	NOTES
Speed1, Speed2, Speed3	Sets the target rotor speed and governor mode for the three available settings. Governor can be disabled if you set the speed to "OFF" by going below 500 RPM.	<ul style="list-style-type: none"> • OFF is below 500 RPM • Top rotor speed is 25,000 motor RPM gear ratio 	1800-FULL, 1900-FULL, 1900-OVSP	"FULL" = Full Governor "OVSP" = Overspeed limiter To toggle between full and overspeed modes, press "+VALUE" and "-VALUE" at the same time.
Gear Ratio	Sets the main gear ratio of the model: $\text{Gear Ratio} = \frac{\text{\#main gear teeth}}{\text{\#motor pinion gear teeth}}$	1-30 in 0.001 increments	8.500	This number needs to be set exactly for proper operation.
Sensor	Tests whether the sensor is working and is close enough to the magnet.	0 to 100	--	Reading must be close-to or at 100 when magnet is over the sensor. Must be 0 when not over sensor.
Set Idle, Set High	Sets the motor idle and high points of the throttle servo. When setting, be sure your throttle curve goes from 0 to 100 and that you are not in stunt/3-D flight mode!	The number represents the throttle channel's pulse width. Should move as you move the throttle stick. The number may decrease or increase depending on your radio settings; either is ok as long as it is consistent.	--	Press "+VALUE" to set each point. Press the button only momentarily to set each point; holding the button down too long will cause a "Bad Endpoints" error. If you change your throttle linkage or radio's endpoints, you must set this function again!
Test Idle, Test High	Moves the throttle servo to the points that you have set.	--	--	Servo will move to each point as you cycle with +/- VALUE. When "Test Idle" is displayed, your throttle servo should be at idle. When "Test High" is displayed, your throttle servo should be at full throttle.
Gov. Test	Bench-test the throttle stick where the governor would be enabled in flight. Move throttle stick through its range.	<ul style="list-style-type: none"> • OFF where governor would be disabled • ON where governor would be enabled 	--	If you are using multiple speeds tied to your flight mode switch, verify correct operation by doing this test with each flight mode.
LowThrotPcent	Sets the lowest governed throttle point. A lower value controls overspeeding better but motor sound/exhaust smoke may not seem constant as throttle approaches the motor idle point. With too high a value, you may be higher than the target rotor speed.	5-90 percent	30	This is % above the idle point. Percentage is based on the idle to high throttle range.

ADVANCED CONFIGURATION OPTIONS

Press NEXT-MENU and PREV-MENU on LCD at the same time to enter advanced configuration options. Throttle servo is disabled during configuration. Advanced configuration options are provided for experienced users and troubleshooting only. **Do not change these settings unless you fully understand what each function does!**

OPTION	FUNCTION	RANGE	DEFAULT	NOTES
AdaptiveMode	Enables/disables adaptive control algorithm. Do not turn off unless you are troubleshooting.	OFF / ON	ON	
Base Gain	Sets the minimal gain.	10-1000	65	Lowest gain that is used. A higher value may provide better performance. Too high a value can cause motor "hunting".
GainAgres	Sets the gain aggressiveness.	1-10	5	The higher the value, the governor becomes more aggressive. If you experience any motor "hunting", try lowering this value by 1 and retry.
AdaptAgres	Sets the aggressiveness of the adaptive mode.	1-500	10	A lower value may improve performance but too much may cause "hunting".
OvSpdTcrvLmt	Used in limiter mode only. Limits the throttle servo to your radio's throttle curve at all points in time.	OFF / ON	OFF	If needed, the limiter will add more throttle beyond your radio's throttle curve when OFF.
OvSpdAgres	Used in limiter mode only. Speed at which the throttle servo is moves during an underspeed condition.	1-100	30	A higher value can improve performance but too high may cause overspeeding.
HovRthresh	Sets the hovering rotor speed threshold.	1-100	30	A lower value improves hovering RPM smoothness but may decrease 3-D performance. A higher value may improve 3-D performance at the possible cost of lower hovering smoothness.
Startup Speed	Sets the rotor startup speed when transitioning from governor being disabled to active.	1-50	10	Lower values will increase the startup time (a slower startup). Higher values will make the governor try to reach the target speed faster when it becomes active (faster startup). Startup period expires approximately 5 seconds after being active.
Feedforward	Sets the amount of throttle channel feedforward. Feedforward puts in some of your throttle curve changes directly to the servo to predict speed adjustments before they are needed.	0-200 percent	20	Too much feedforward can cause motor to overshoot.

HEARTBEAT STATUS LIGHT

The "HEART" light indicates MULTI-GOV's operational status.

With motor OFF

No blinking	Error; check the battery and connections. DO NOT start motor.
Slow blinking (2 sec. apart)	Status OK.
Fast blinking	Configuration needed (throttle servo is disabled) or low voltage detected. DO NOT start motor.

With motor ON

No blinking	Error; check the battery and connections. SHUT OFF MOTOR IMMEDIATELY.
Slow blinking (2 sec. apart)	RPM sensor is not reading magnet correctly. Shut off motor and check.
Fast blinking	Status OK. RPM samples being captured.

PRE-FLIGHT CHECKS

Before you attempt to fly your model, please perform the following checks in addition to your normal procedure:

1. Verify your receiver battery is sufficiently charged.
2. Make sure the LCD configuration is not connected.

3. **After turning on your model, verify the throttle servo moves correctly as the radio's throttle stick is moved. If it doesn't, turn your model off and then back on.**
4. *Make sure throttle stick is on idle before starting the motor!*
5. Verify the heartbeat light is slowly blinking before you start the motor and quickly blinking after you start the motor.

OPTIONAL: TWEAKING OVERSPEED LIMITER FOR HARDCORE 3-D

If you are an advanced 3-D flier who wants to fine-tune MULTI-GOV's overspeed limiter for more power, you can experiment with the "OvSpdAgres" setting in the Advanced Configuration options. "OvSpdAgres" sets how fast the throttle servo is moved during an underspeed condition. The faster the movement, the underspeed condition should be corrected quicker. On the flip side, setting this too fast may cause more noticeable/longer overspeeding.

The default "OvSpdAgres" value should give you excellent performance. Perform the following only if you want to do some tweaking while running in overspeed limiter mode:

1. Hover your model in 3-D flight mode.
2. Quickly pump the pitch up about 10 feet and come to an instant stop to unload the rotor.
3. If the rotor does not noticeably overspeed, you can increase the "OvSpdAgres" setting by about 5 or so.
4. If you hear the rotor overspeed more than you like, decrease the "OvSpdAgres" setting.

5. Repeat steps 1-4 until the rotor does not overspeed too much when being unloaded. A good setting is a little below your acceptable overspeed point.
6. Fly your model through other 3-D maneuvers and adjust down if you notice too much overspeeding.

SPECIFICATIONS

Battery input voltage:	4.2 – 11 volts DC
Radio receiver compatibility:	Futaba, Spektrum, JR, and compatible
Receiver input pulse width:	0.8 ms to 2.2 ms
Current consumption:	Approximately 26 mA
RPM sensor range:	500 – 25,000 motor RPM
Dimensions	1.75 by 1.125 inches
Weight	0.30 oz

FAQs AND TROUBLESHOOTING

What is the maximum voltage I can run MultiGov at?

As long as you have the "RPM Select" input connected to your receiver, you can run MultiGov up to 11 volts. If you are using only one speed and have the jumper installed, you can go up to 7 volts.

Note that you still need to make sure that your throttle servo can handle higher voltages. Depending on your servo, you may need to regulate/drop-down the power going to the servo.

I want to reduce the amount of overspeeding during unloading of the rotor. What can I try?

You can decrease the "LowThrotPcnt" basic configuration option so that the lowest throttle position MultiGov will go is lower. The default setting is 30% above idle. You can try to lower it to the 20-25% range. The downside to having this setting too low is that you may not have consistent smoke/motor noise. Depending on your helicopter, you may also run the risk of disengaging the clutch during flight if set too low which is not good.

Another option is to increase the "BaseGain" value to see if that helps. Try increasing "BaseGain" by 10-15 point increments.

I am experiencing some periodic motor surging/oscillations in hover. Alternatively, the motor does not seem to run smoothly during hard flight. What should I do?

This could possibly happen if your motor needles are too rich. Try leaning out the needle settings. If that doesn't help, go the Advanced Configuration menu and try decreasing the "GainAgres" value by 1.

I want to try and get more recovery power for fast pitch pumping 3D maneuvers. What can I do?

You can increase the "LowThrotPcnt" basic configuration option so that the lowest throttle position MultiGov will go when controlling overspeeding is higher. This can improve RPM recovery for fast pitch changes. Adjust to your liking. A good value might be in the 35-45% range. You may experience more overspeeding the higher you make this value.

From our testing and feedback, this is more beneficial for .91 sized motors. If you are running a OS .50 Hyper motor, going beyond the default setting is not usually needed since the OS .50 Hyper typically runs a high RPM at low throttle.

I hear a motor "hiccup" after I unload the rotor. What should I do?

Try and lean out the low/mid throttle needles to see if it gets rid of the problem.

Optionally, your motor may have a rough spot around the low throttle range which causes the hiccup. You can avoid the rough spot by increasing "LowThrotPcnt".

When I do a throttle hold and then abort the throttle hold, the rotor speed spools back up too slowly. What can I do?

When you do a throttle hold and the rotor speed drops very low, the slow startup is re-engaged when you abort the throttle hold. For a faster rotor speed startup, set the "Startup Speed" value higher in the "Advanced Configuration" options. Increase to your liking.

Please visit our website at www.aerospire.com for the latest frequently asked questions and troubleshooting issues.

90-DAY LIMITED WARRANTY

Aerospire offers a 90-day limited warranty from the date of purchase against defects in materials and workmanship. During the warranty period, Aerospire will repair or replace the defective unit. This warranty does not cover damages due to improper installation, misuse, modification, crashes, or negligence.

When returning a MULTIgov unit for warranty repair or replacement, please include the following information:

1. Your name, address, phone number, and email address.
2. A detailed description of the problem, including your RC helicopter model, radio control system, receiver, and throttle servo if applicable.
3. A copy of your dated sales receipt (if not purchased direct from Aerospire).

Send your MULTIgov unit to:

**Aerospire LLC
Attn: Warranty Service
PO Box 25925
Honolulu, HI 96825 USA**

Note: Aerospire is not liable for lost or damaged shipments.

Web: www.aerospire.com
Email: support@aerospire.com

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