CHAPTER 4
VORTEX ADVANCED TUNING

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Spartan

PREFACE

This chapter explains the operation of the numerous parameters that can be used to fine tune the flight characteristics of the Spartan Vortex flybarless system.

The tuning parameters have been split into to three groups, each identified in this user guide by an icon preceding the parameter name. In general parameters of the "Expert Users" group are more complex to comprehend and less likely that will need adjusting.

General Tuning Expert Users Experimental [FAQ148]

To access the full set of configuration parameters navigate to the "System Menu" and set the "Menu Type" option to "Full".

DATAPOD REMOTE ADJUST

A spare channel and dial of your radio system can be used to remotely control any bar or slider type menu. You can choose the channel that controls the remote adjust function in the System::DataPod Ctrl menu.

Open the parameter you wish to adjust and press both [+] and [-] buttons for two seconds. The DataPod will beep and the remote adjust indicator (1) will appear on the screen. The value is now adjusted using the dial of your radio. To exit remote adjust mode press either button.

WARNING!

Adjusting some configuration parameters too high or too low can make the helicopter unflyable. For example, setting the tail gain too high will result to rapid tail oscillations. Before taking off ensure that the remotely adjusted value is set to an acceptable safe level for flight. Always proceed in small steps and be prepared to reverse any changes made. If you wish to limit the remote adjustment range you can do so using the control channel endpoints in your radio.

ROTOR MENU

Cyclic Rate: Operates in a similar way as dual rates on the radio. By adjusting the rates on the Vortex we preserve the radio system resolution and make it possible to have different cyclic sensitivity for each of the four flight modes.

Cyclic Exponential: Operates in a similar way as exponential on the radio and allows using a different value for each flight mode. Negative values make the control slower and more precise near the stick centre.

Agility: This parameter controls the flip and roll speeds of the helicopter. Higher values will provide faster rotations. [FAQ143]

Style: When this value is set close to 0% the control is predominately based on flybar simulation. Higher values introduce more of the digital stabilisation algorithms. As a result the flight characteristics start to feel more locked in but also more artificial (also referred to as "robotic").

Gain: Controls the amount stabilisation that is applied to the main rotor. If you experience main rotor oscillations on hard stop manoeuvres (for example at the end of rainbows) or porpoising during fast forward flight reduce this value.

Elevator Debounce: This parameter makes it possible to eliminate vertical tail bounce on elevator stops. Typically a 450 size helis will be around 70-100%, 600 size around 100-130% and 700 size around 130-160%. Rigid and DFC heads will often require around 20-30% more. Increase this parameter in steps of 10% until the vertical tail bounce is eliminated.

Aileron Debounce: Similar to the Elevator Debounce above but operates on roll. As the helicopters angular momentum is much less on the roll axis we anticipate that this parameter will not often need adjusting. If you need to adjust it proceed in small increments of 2-5%.

Cyclic Acceleration: Controls how fast the helicopter responds to cyclic stick movement. Reducing this parameter makes the cyclic response more gradual as if the pilot is gently pushing the cyclic away from its centre. If this parameter is set too low the cyclic response will feel delayed. Helicopters with soft head dampeners may benefit from slightly reduced cyclic acceleration as higher values will often result to vertical tail bounce during elevator stops.

Cyclic Deceleration: Controls how fast the cyclic returns to neutral. Reducing this parameter makes the cyclic response more gradual as if the pilot is gently returning the cyclic to its centre Helicopters with soft head dampeners may benefit from slightly reduced cyclic acceleration as higher values will often result to vertical tail bounce during elevator stops.

Control System: The "Vigorous" control system offers a more pure and fluent flight feel. The cyclic response can also be substantially faster by increasing the Cyclic Acceleration & Deceleration values. However, some fine tuning will be required particularly to the "Elevator Debounce" parameter. The "Adaptive" control system provides better out of the box results and as such we encourage all pilots to start with this one first. Advanced 3D and F3C pilots may then explore the "Vigorous" option at a later time once they are more familiar with fine tuning options that the Vortex provides. [FAQ170]

Collective Boost: Increasing this value makes the collective feel crisper in manoeuvres like tic-tocs and rainbows.

Paddle Response: Doubling this value has the same effect as halving the weight of the flybar paddles thus making the helicopter more agile. At the same time the helicopter becomes less stable. [FAQ143]

Pitch Up Compensation: Increase this value if the helicopter is pitching up in fast forward flight. Larger values may result to the helicopter feeling more "robotic"; it is thus preferable to use the lowest value that solves the pitching up tendency.

Elevator Pre-compensation: Mixes a small amount of collective pitch to elevator. Some helicopters benefit from this adjustment in full collective fast-forward flight. However, if this parameters is set too high it is likely to affect the behaviour of the helicopter during pitch-pumping.

Cyclic Deadband: This adjustment creates a small range around the stick neutral where the helicopter is not affected by rudder stick movement. The default value is negligible and primarily acts as a filter for minute variations when re-centring the rudder stick.

(Piro) Cyclic Decay: Gradually reduces the cyclic sensitivity as the pirouetting speed increases. As a result the helicopter feels more controllable in fast pirouetting manoeuvres.

Cyclic Symmetry: Use this parameter to equalise the flip and roll speeds if they feel different. Use a positive value if the rolls feel faster than flips. Use a negative value if the flips feel faster than rolls.

Rotor Phase: Used to set the correct phase in some scale multi-bladed rotor heads. It is not needed for the popular 3D helis and should remain at 0 degrees.

TAIL MENU

Rudder Sensitivity: Sets the maximum pirouetting speed in °/s when the rudder stick is at full deflection.

Rudder Exponential: Operates in a similar way as exponential on the radio and allows using a different value for each flight mode. Negative values make the control slower and more precise near the stick centre.

Gyro Type: Select the desired tail gyro mode. The options are *Rate* and *AVCS* (Heading Hold).

Gyro Gain: Sets the gain for that tail gyro. The optimal gain value is the highest value you can reach that does not cause tail wag at any time during flight. [FAQ3]

Acceleration: Sets the acceleration rate of the tail thus reducing strain on the drive gears when the rudder stick is operated sharply.

Deceleration: Sets the deceleration rate of the tail thus reducing strain on the tail drive gears. Also, by matching the deceleration rate of the gyro with the mechanical capabilities of the heli fast stops will become crisper and reduce bounce back.

CW/CCW Stop Gain: The stop gain parameters allow a different amount of gain to be used for stops and can be separately adjusted for clockwise and counter-clockwise rotations. If your helicopter does not wag in flight but is showing wag at the stops lower the stop gain of the corresponding direction that causes the wag. Similarly if the stop appears too soft increase the stop gain of that direction. Increasing the stop gain

will make the stops more aggressive which can help in eliminating stop bounce.

Stick Deadband: This adjustment creates a small range around the rudder stick neutral where the gyro is not affected by rudder stick movement. Some pilots prefer a moderate amount of deadband as this allows fast collective pitch changes without accidentally affecting the rudder. The default value is negligible and primarily acts as a filter for minute variations when re-centring the rudder stick.

Cyclic to Tail: This parameter mixes a percentage of the cyclic pitch to tail rotor pitch, thus pre-compensating for any additional torque as a result of rapid cyclic inputs.

Collective to Tail: This parameter mixes a percentage of the collective pitch to tail rotor pitch, thus pre-compensating for any additional torque as a result of rapid collective inputs.

AVCS Gain: The benefits of adjusting this parameter are currently reviewed by our test pilots. Please keep this parameter at the default value.

AVCS Gain Piro: The benefits of adjusting this parameter are currently reviewed by our test pilots. Please keep this parameter at the default value.

GOVERNOR MENU

Governor: Selects if the governor is operational or not for each of the flight modes.

Rotor RPM: Selects the desired RPM for the main rotor. The selected value is used by the governor, rotor phase optimiser and vibration filtering algorithms. Set this parameter even if you are not using the built in governor. In this case the RPM value does not need to be precise and a best guess within ±100RPM would be acceptable.

Governor Gain: If the engine is hunting (rapidly revving up and down) reduce the gain until the hunting stops. Similarly, if the engine to responds too slowly to rapid changes of the collective pitch the governor gain will need to be increased.

Engage Ramp: The governor engages when the actual rotor RPM is over 75% if the programmed RPM. For example, when this parameter is set to 3.5s and the head speed is set to 2000RPM the governor will engage at 1500RPM and will ramp up to 2000RPM over the next 3.5sec. This parameter also affects the transition time between different RPM selections.

Autorotation Abort (Time): When aborting an autorotation there is often a sudden jump of throttle as the flight mode is changed from Hold to Idle-Up. This can cause the blades to fold. The autorotation abort function provides a gradual increase of throttle over a set time. It is activated when the throttle is less than 15% and suddenly jumps to over 30%.

(**Autorotation) Abort Exponential:** When set to 0% the throttle ramps linearly from Hold to Idle-Up. Higher values cause the ramp to start slowly and progressively speed up. Since a faster spinning rotor can tolerate more rapid throttle changes the use of an exponential ramp will maintain a soft start but help shorten the overall autorotation abort time.

Minimum Throttle: The governor throttle range is limited by this parameter. The governor will never drive the throttle below this point.

Stick On/Off: The governor is armed when the throttle stick is higher than this value. It disarms at 5% less. For example if this adjustment is 20% the governor will arm when the throttle stick is over 20% and will disarm when the throttle stick comes down to below 15%.

Cyclic to Throttle: Mixes cyclic to throttle thus enabling the engine to provide the additional power needed for large cyclic movements. This process eases the workload of the governor and helps maintain more consistent RPM. Large .120 size nitro engines may slightly overspeed during rolls with the default value which will need to be reduced.

Collective to Throttle: Mixes collective pitch to throttle thus enabling the engine to provide the additional power needed for large collective movements. This process eases the workload of the governor and helps maintain more consistent RPM.

Collective to Throttle Boost: The boost process monitors the manner in which the collective stick is operated to predict if more throttle will be needed in the near future. This process allows the engine to pre-compensate with additional power before it is bogged down by the increase in collective pitch.

SYSTEM MENU

Flight Log: This sub-menu provides access to noteworthy information for your last flight. For example you can view how many times the Vortex switched between satellite receivers or the minimum voltage encountered in flight when the battery/BEC was under the load. These data are cleared when the Vortex is powered off; as such, they must be reviewed at the end of the flight.

Trim (flight): The trim flight can greatly improve various aspects of flight including piro compensation and yaw tail stops. Whilst the result of the trim flight will take effect instantly, it is best to use the trim flight as guidance on how to improve the helicopters mechanical setup. Swash angles over 0.5° are typical when the airframe is misbalanced or the swashplate is not accurately level. The letters F, B, R, L indicate the direction in which the Vortex needs to move the swash in order to maintain drift free hover (front, back, right and left respectively). Wind gust will affect the accuracy of the trim flight so avoid performing it in windy conditions.
Activate the trim flight and put the helicopter is a stationary hover. Once stable, try not to touch the cyclic stick for 5 seconds. Completion of the trim flight is indicated by the Vortex gently stepping up the collective thus causing the helicopter to slightly rise. During the trim flight the helicopter does not need to remain perfectly stationary however do not allow it to move at a rapid pace. When the "Hover Now" screen closes the new trim values have been saved. A bad trim flight can have negative effect to the flight performance of the Vortex thus pay particular attention that it is performed correctly and repeat if any doubts exist. If weather conditions prevent you from performing a successful trim flight it is best to set the trims to zero. To do this, start a new trim flight and then press [S] to cancel it.

Vibration Analysis: This screen provides a frequency vs magnitude plot of the vibrations present on the helicopter. Use the [+] and [-] buttons to position the cursor. The plot freezes whilst the cursor is active thus allowing to examine any areas of interest. At the bottom of the screen the frequency that corresponds to the cursor position is displayed in RPM and Hz. The corresponding vibration magnitude is shown at the bottom right corner.

Vibration Hold: If *Never* is selected the vibration plot always runs live. When a time interval is selected the plot will freeze after the specified time has lapsed. This delay makes it possible to capture vibration data whilst the helicopter is in flight.

Throttle Failsafe: Throttle failsafe takes effect when the Vortex stops receiving updates of the throttle stick position. When using Spektrum satellites or receivers without a built-in failsafe feature this becomes the primary failsafe. If your receiver offers a built-in failsafe it should be programmed in addition to this parameter. Move the throttle stick to the desired failsafe position and confirm that you wish to update the failsafe position. [FAQ150]

Aux Outputs: When the AUX/3 port is not used for receiver signal inputs it can drive accessories like retract, night lights or glow igniters. This menu option selects which transmitter channels are routed to the spare pins of the AUX/3 port. [FAQ140]

DataPod Ctrl: This parameter selects a spare channel of your radio system to be used for the DataPod Remote Control function.

Battery Alarm: When the receiver battery voltage is below the alarm voltage the Vortex will not confirm that it has completed initialisation by zipping the swashplate up and down. The pilot should treat this as an indication that it is not safe to fly. However, the Vortex remains operational and is able to fly.

Menu Type: By default some of the parameters in Rotor, Tail and Gov menus are hidden to avoid unnecessary complexity and clutter. Expert users can enable these additional parameters by setting the menu type to "Full".

System Info: Displays the Vortex serial number and other production data.

Factory Reset: You will be promoted to confirm your selection. Once "Yes" is selected the factory default values are loaded to all configuration parameters.