DLG6S for Ethos

Template for 6-servo DLG's

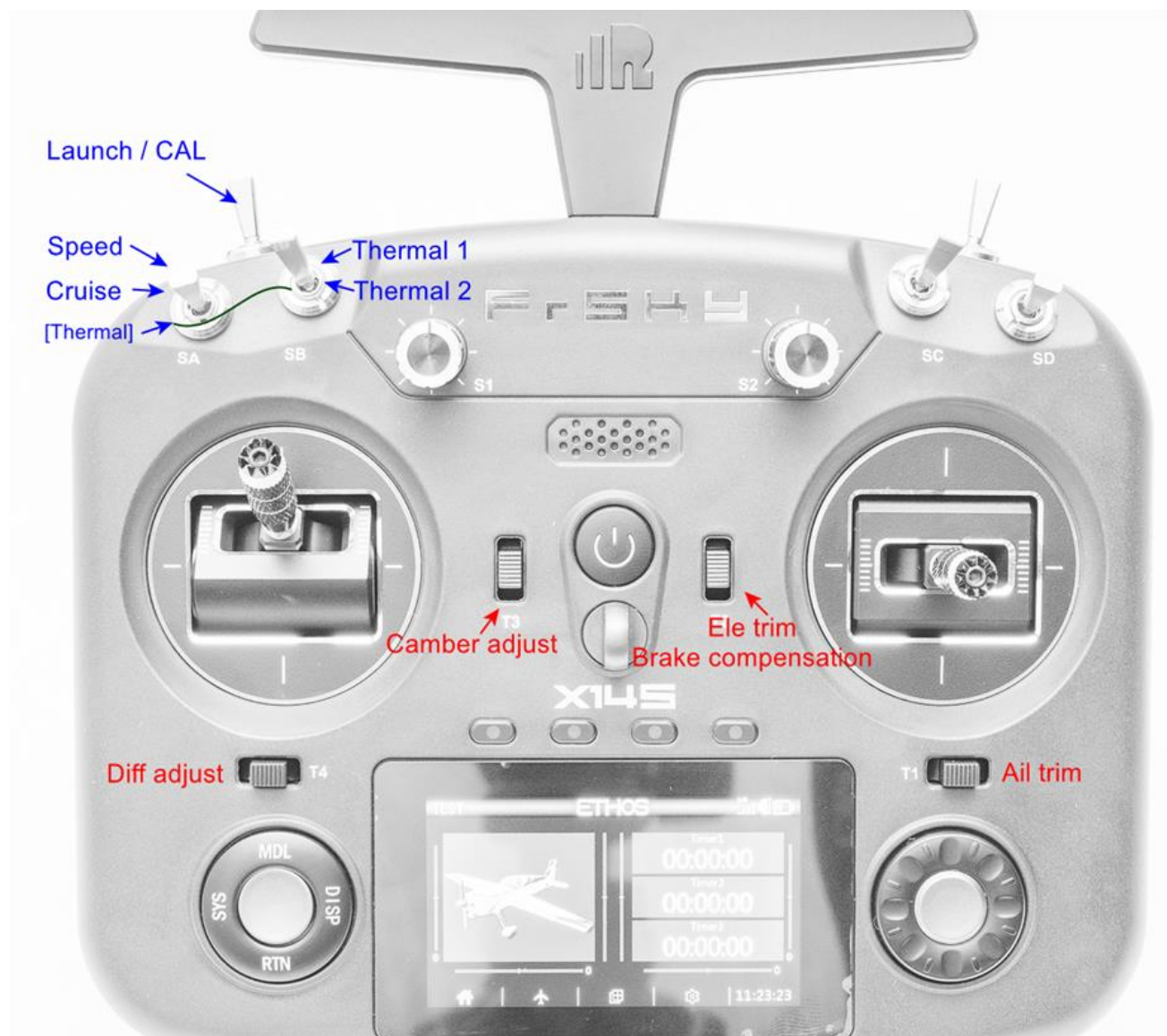## Version 2.0

for Ethos 1.5.19 and above

Setup Guide

Mike Shellim
30 August 2024

CONTENTS

1 INTRODUCTION

1.1 DESCRIPTION

DLG6S is a full feature template for DLGs with 6 servos.

APPLICATION
- For DLG gliders with separate ailerons and flaps
- Any stick mode
- Freely assignable switches

LAUNCH HEIGHT CALLOUT
- Optional launch height callout (using ALT telemetry)

7 FLIGHT MODES
- Launch followed by Zoom
- Cruise, Thermal1, Thernal2, Speed
- Landing (auto activated)

LANDING BRAKES
- brake-aware adaptive trim
- brakes are inhibited while exiting Zoom mode
- roll rate enhancement mix

IN-FLIGHT ADJUSTERS
- Adjuster for aileron diff (per flight mode)
- Adjuster for camber (per flight mode)

SNAPFLAP
- Individually configurable up/down travel, per FM
- Adjustable deadband

CONTROL SURFACE CALIBRATION
- Special 'CAL' mode for quick calibration
- 5-point balancing curve for flaps

MISC
- Flight timer
- Aileron to rudder mix
- Channels 7,8,9 free for other functions

You're in the right place to achieve a great DLG setup, but please observe these golden rules for success:

> *- READ THROUGH THESE INSTRUCTIONS ONCE BEFORE STARTING!*
> *- FOLLOW THE INSTRUCTIONS IN SEQUENCE!*
> *- VISIT THE SUPPORT PAGE FOR LATEST ALERTS*

1.2 PACKAGE CONTENTS

What's included in the ZIP file:

Filename	Description
dlg6s20*x.bin	Model file
d6s***.wav	Audio files
dlg6s_ethos_20_SetupGuide.pdf	Setup guide (this document)
dlg6s_ethos_20*_SettingsRef.xlsx	Settings reference

1.3 MININUM REQUIREMENTS

- FrSky transmitter
- Ethos 1.5.19 or above
- Momentary switch for launching
- 3-position switch for flight modes
- Additional 2- or 3-position switch for thermal 1 / 2 selection

Note: the template name and version number are stored as the channel name of CH32, which can be viewed in the Outputs menu.

2 OVERVIEW

2.1 STICK MODE AND ASSIGNMENTS

Any stick mode may be used (SYSTEM→STICKS menu)

Stick/trim functions are as follows:

Control	Function
Throttle stick	Brakes
Throttle trim	Camber
Rudder trim	Aileron differential

2.2 SWITCH ASSIGNMENTS

New in 2.0: Switches are assigned by the user – see section 3.2

Switch name	Function	Assign in
SW_Launch	Launch switch (momentary)	
SW_Flightmodes	Thermal/Cruise/Speed switch	See section 3.2
SW_Thermal1-2	Thermal1/Thermal2 switch	

2.3 FLIGHT MODES

There are 7 flight modes: Launch, Zoom, Cruise, Thermal1, Thermal2, Speed, and Landing.
Launch and Zoom have highest priority. Landing has priority over Thermal, Cruise and Speed.

Flight Mode	ID	Activation method	Priority
Launch	FM2	**SW_Launch**	High
Zoom	FM3	Follows Launch mode. Up/down elevator to exit	High
Landing	FM4	Throttle stick ↓ (activates brakes)	Mid
Cruise	FM0	**SW_Flightmodes** —	Low
Speed	FM5	**SW_Flightmodes** ↑	Low
Thermal 1	FM6	**SW_Flightmodes** ↓ and **SW_Thermal1-2** ↑	Low
Thermal 2	FM7	**SW_Flightmodes** ↓ and **SW_Thermal1-2** ↓	Low

2.4 SERVO ASSIGNMENTS

Channel	Function
1	Rudder
2	Elevator
3	Left aileron
4	Right aileron

Channel	Function
5	Left flap
6	Right flap

The left and right channels are not interchangeable – *please ensure the servos are connected correctly!*
Left and right are from the point of view of an observer looking forwards from the tail.

2.5 MIXER TABLE

The table below shows the mixers in each flight mode. Mix adjusters are in brackets.

Flight mode	Diff	Ail=> Rud	Brakes	Brake Comp	Rudder offset	Camber/ Reflex	Snapflap
Launch	✓ (Rud trim)	✓			✓	✓ (Throttle trim)	✓
Zoom	✓ (Rud trim)	✓				✓ (Throttle trim)	✓
Landing	✓ (Rud trim)	✓	✓	✓ (Ele trim)		✓ (Throttle trim)	✓
Thermal1/2	✓ (Rud trim)	✓				✓ (Throttle trim)	✓
Speed	✓ (Rud trim)	✓				✓ (Throttle trim)	✓
Cruise	✓ (Rud trim)	✓				✓ (Throttle trim)	✓

2.6   BASIC OPERATION

Trims
- Aileron trim is global
- Elevator trim is independent per flight mode
- Rudder trim is repurposed to adjust differential, per flight mode
- Throttle trim is repurposed to adjust camber/reflex, per flight mode

Rudder offset
- A rudder launch offset may be preset

Aileron differential
- Aileron diff is adjustable using the rudder trim, per flight mode

Camber presets
- Camber/reflex is adjusted via the throttle trim, per flight mode

Brake compensation (brake=>elevator mix)
- Brake compensation is adjusted using the elevator trim ("brake-aware adaptive trim")

Aileron=>rudder mix
- Aileron=>rudder mix is preset, per flight mode.

Snapflap
- Snapflap (elevator=> ail/flap) may be preset, per flight mode.

2.7   FLIGHT TIMER

Timer1 is the flight timer.
- *To reset and start*: release Launch switch
- *To stop*: press and hold Launch switch

2.8   THE FLIGHT SEQUENCE

Nothing special here, the flight sequence is standard for DLGs:

1. Rotate the model whilst activating the launch switch. Model is in Launch mode.
2. As the model leaves the hand, release the launch switch. Model enters Zoom mode.
3. Near the top of the climb, **move the elevator stick**. Model exits Zoom mode.
4. Once out of Zoom mode, the flight mode is determined by flight mode switch and throttle stick.

2.9   ZOOM SAFE EXIT

Zoom Safe Exit prevents the brakes from deploying suddenly.

When exiting Zoom mode, if the brake stick is not in the 'off' position a warning sounds, the brakes remain retracted and the next lower priority flight mode is activated (Cruise, Thermal1, Thermal2, or Speed).

To re-enable brakes, move the brake stick to the off position.

3 PREPARING THE TRANSMITTER

3.1 TRANSFER FILES
Start by transferring the model and sound files to your transmitter:

Establish a USB connection
1. Enter Bootloader mode.
2. Connect to PC via USB. The tx's SD card and/or internal memory should appear as a new drive.

Copy files
Note: '*' refers to the template's minor version number
1. Unzip file *dlg6s-ethos-20*.zip* into a directory on your local drive
2. Select and copy all the.wav (sound) files to the folder designated for **voice1**. To determine the voice1 folder, open the **SYSTEM>GENERAL** menu on your transmitter, and scroll to the 'Audio' section.
   Example: if voice1='gb', copy .wav files to folder \audio\en**gb**. *Do **not** copy to the 'system' sub-folder!*
3. Copy the file *dlg6s20*x.bin* to the \models folder.
4. Terminate the USB connection and restart the transmitter.
5. Open the **MODEL>SELECT** menu and activate model 'DLG v20*X'. If the model is not visible, check that the Ethos version satisfies the minimum requirements for this template.

3.2 ASSIGN FLIGHT MODE SWITCHES (NEW IN V2.0)
In this step, you'll choose the switches for selecting the flight modes. Your choice will depend on the switches available on your transmitter used as well as your personal preferences.

The physical switches are defined in the *Values* field of the following three VARs:

VAR menu	Flight mode	Switch type
SW_Launch	Launch mode	Momentary switch
SW_Flightmodes	Cruise/Thermal/Speed mode	3-pos switch
SW_Thermal1-2	Thermal1/Thermal2 mode	2-pos (preferred) or 3-pos switch

To check and alter an assignment:
1. Go to the **VARS** menu and open the corresponding VAR (see table above)
2. The *Values* field will show the current assignment (or '---' if not no switch is defined).
3. To change the switch, click in the *Values* field and move the switch - the entry will update automatically.
4. To reverse a switch, click on the adjacent hamburger icon, choose Options, and select Negative.

The example below shows Launch switch (**SW_Launch**) assigned to physical switch SH.
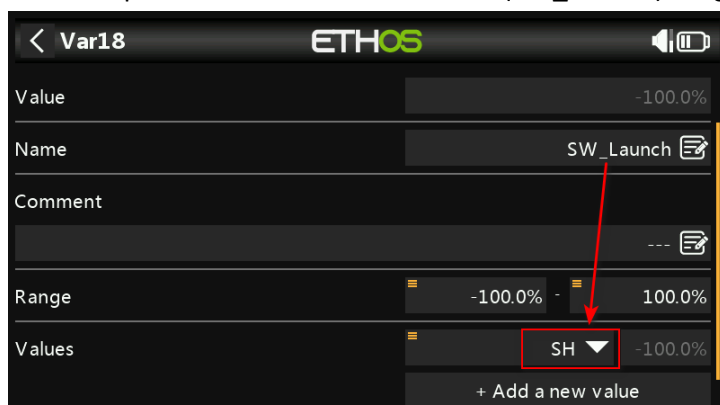
3.3 FAMILIARISATION

Using the transmitter on its own, practise the following:

- Activate Launch, Zoom, Thermal1, Thermal2, Cruise, Speed and Landing modes (see Section 2.2).
  Tip: start with the throttle stick pushed fully forward.
- Check the flight mode callouts are working. If not, check that the sound files are in the correct location.
- Start/stop/reset the flight timer (see Section 2.7)

4 CALIBRATING THE OUTPUTS

In this section you will set the operating range of the servos, using a special CAL mode.

4.1 CAL MODE

CAL is a special flight mode which you'll use in this section. When CAL mode is selected, mixers and trims are disabled, and stick values are passed directly to the servo channels.

To activate CAL mode:

1. Apply full left aileron and full up elevator, and hold.
2. Pull and release momentary switch **SW_Launch**
3. Release the sticks

Using the flight mode switch, you can choose between two submodes:

Sub mode	Switch	Description
'Calibrate flap neutral'	**SW_Flightmodes** ↓↑	For calibrating the flap neutral offset
'Calibration'	**SW_Flightmodes** —	For calibrating servo end points, and equalising flaps. *Note:* the flaps move in 25% steps.

To exit CAL mode:

- Pull **SW_Launch** switch.

4.2 SET SERVO ROTATION

First, check and if necessary change the servo direction. *This must be done in CAL mode!*

1. Switch on the transmitter (do not power up the receiver yet).
2. Set **throttle stick** to centre, move switch **SW_FlightModes** to middle position.
3. Enter CAL mode.
4. Switch on the receiver.
5. Go to the **OUTPUTS** menu.
6. While still in CAL mode, check the servo directions as per the table below. ***Pay attention to the notes regarding aileron and elevator!***

Stick command	Control surface	Notes
Aileron stick right →	RtAil goes up ↑ LtAil goes up↑	***In CAL mode, the ailerons must move up together.*** This aids visual calibration later.
Thr stick forward ↑	RtFlap goes up↑ LtFlap goes up↑	
Ele stick forward ↑	Ele goes up ↑	***In CAL mode, the elevator moves in reverse direction to normal.***
Rud stick right →	Rud goes right →	

To reverse a servo:

1. Open the **MODELS→OUTPUTS** menu
2. Click on the relevant channel and open the edit menu
3. Change the Invert option from 'Normal' to 'Reverse'.

Once all the servos have been checked:

1. Exit CAL mode and enter Cruise mode.
2. Move the aileron, elevator and rudder sticks, and check for correct direction.
   Note: **the brakes will not function yet!!**

4.3 ADJUST SERVO END POINTS AND CENTRES

The next task is to set travel limits, and to equalise the ailerons and flaps.

Note:

- All adjustments are made in CAL mode.
- The travel limits should be set the maximum possible, limited only by the linkages.
- Adjustments are made using curves. Leave *Min*, *Max* and *Subtrim* at their default values.
- With Ethos (unlike the OpenTX version), you will need to experiment to see which of two curve points to adjust, as explained in the table below.

Target	Calibration procedure

Left flap	Start with the left flap.
	1. Move switch **SW_FlightModes** to middle
	2. Enter CAL mode
	3. In the **CURVES** menu, open **CAL_LeftFlap**
	4. Adjust points:
	   ☐ Throttle stick fully back (↓),adjust the lower travel limit with curve point 1 or 2 (whichever works).
	   ☐ Throttle stick forward (↑), adjust upper travel limit with point 2 (or 1).
	Note: do not worry about the flap neutral position, it will be set later via a mix.

Right flap	Next, calibrate the right flap. A 5-point curve is used, using the left flap as a reference.
	1. Enter CAL mode
	2. Move switch **SW_FlightModes** to the middle position
	3. In the **CURVES** menu, open **CAL_RightFlap**
	4. Adjust the points to exactly match the left flap. Note: *the order of the curve points may be reversed — if the first point doesn't work, try the alternative (in brackets).*
	   ☐ stick fully back, adjust point 1 (or 5) for the lower limit of travel.
	   ☐ stick 50% back, adjust point 2 (or 4)
	   ☐ stick at centre, adjust point 3.
	   ☐ stick 50% forward, adjust point 4 (or 2)
	   ☐ stick fully forward, adjust point 5 (or 1) for the upper limit of travel
	To match the end points on left and right sides, it may be necessary to alter the end points for the left flap (see previous step).
	Do a final check. Pay particular attention the points adjacent to flap neutral.

Target	Calibration procedure
Flap neutral	Next, set flap neutral by adjusting an offset mix. 1. Enter CAL mode 2. Open the **VARS** menu 3. Scroll to V_FlapNeutral 4. Move switch **SW_FlightModes** ↓ and listen for 'calibrate flap neutral'. 5. Adjust the number in the *Values* field for correct neutral. If the flaps are not perfectly in line with each other, then repeat the calibration for the **right flap**, paying particular attention to the two points adjacent to the neutral position.

Rudder	1. Enter CAL mode (position of the flight mode switch is not critical.)
	2. In the **CURVES** menu, open **CAL_Rudder**
	  ☐ Rudder stick to centre, adjust point 2 for neutral
	  ☐ Rudder right (→), adjust end point 1 (or 3) for right limit
	  ☐ Rudder left (←), adjust end point 3 (or 1) for left limit
	3. Check equal travel left/right

Elevator	*Note:* **In CAL mode the elevator moves in the opposite way to normal.**
	1. Enter CAL mode. (Position of flight mode switch is not critical.)
	2. In the **CURVES** menu, open **CAL_Elevator**
	  ☐ Ele stick to centre, adjust point 2 for correct neutral
	  ☐ Ele stick forward (↑), adjust point 1 (or 3) point for **upper** (↑) limit
	  ☐ Ele stick back (↓), adjust point 3 (or 1) for **lower** (↓) limit
	3. Check travel is equal up & down

Left aileron
Right aileron
	Finally, calibrate ailerons.
	Note: **In CAL mode, the ailerons move together. This is to aid visual alignment.**
	1. Enter CAL mode
	2. Move switch **SW_FlightModes** ↓. Flaps go to their calibrated neutrals.
	3. In the **CURVES** menu, go to **CAL_LeftAil** and open the curve editor
	  ☐ Aileron stick to centre. Set Point 2 for correct centre
	  ☐ Move aileron stick right (→). Set point 3 (or 1) for desired upper limit.
	  ☐ Move aileron stick left (←). Set point 1 (or 3) so that down-travel=up-travel. If down-travel is limited and you cannot complete this step, then move flight mode switch ↑ – this reduces aileron movement by 50% during calibration only; retry the calibration remembering that you will get double the movement when you exit CAL mode.
	  Don't worry if down-travel is excessive when you exit CAL – later adjustments to aileron rate and diff will reduce it.
	4. Repeat for curve **CAL_RightAil**
	5. Check for equal travel up/down, and check left and right ailerons match. Readjust if necessary.

Check operation:
1. Exit CAL mode
2. Check that aileron, elevator and rudder control surfaces move in the correct sense. Don't worry if there's too much movement– it'll be reduced in the next section.

Note: after exiting from CAL mode, **the throttle stick will not work** until configured in the next section.

5 CONFIGURING TRAVEL AND MIXERS

In the final section, you'll set the control rates and mixers. All adjustments are made in the VARs menu. Settings are stored in the *Values* fields of each VAR. The first value is the default.

5.1 RATES (TRAVEL)

Control travel is set in the following VARs:

- **V_AilRates** – for aileron rate. Upward travel only (to alter downward travel, see section 5.3).
- **V_EleRates** – for elevator rate.
- **V_RudRates** - for rudder rate.

The first value is the default rate. Extra lines may be added to override the default, for particular flight modes. To add a line, click on the 'add' icon, and choose category 'Flight modes'. Then select the flight mode.

SAFETY: always ensure that the default rate provides sufficient control. Never set it to zero!
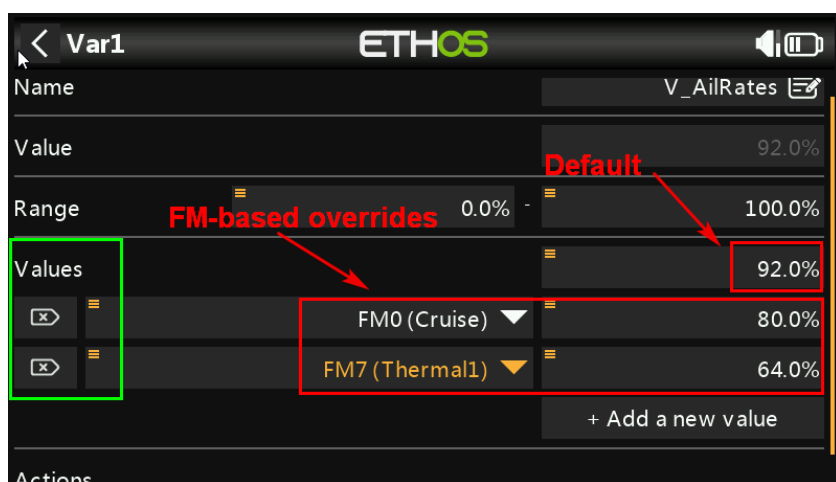
5.2 EXPO

Expo is adjusted in the following VARs:

- **V_AilExpo** – for aileron expo
- **V_EleExpo** – for elevator expo
- **V_RudExpo** – for rudder expo

The first value is the default. Additional fm-specific values may be specified as for Rates above.

5.3 AILERON DIFF

Aileron differential ('diff') determines the travel of the downgoing aileron. The more diff, the less downward travel. Diff is adjustable in flight using the rudder trim.

- Trim fully left: down-travel = 30%
- Trim centre: down-travel = 80%
- Trim full right: down travel = 130% (more down than up)

IMPORTANT: The adjustment is flight mode dependent - *remember to set diff individually for each flight mode*!

5.4 AILERON TO FLAP

The aileron-to-flap mix enables the flaps to assist with roll inputs. Adjust in **V_AilToFlap**. The first line is the default and will normally be zero. Override as required for specific flight modes.

5.5 RUDDER LAUNCH OFFSET

Counteracts rotation of the model following launch. Adjust in **V_RudOffset**

5.6 ELEVATOR LAUNCH OFFSET

There's no special setting – just activate Launch mode and adjust the elevator trim.

5.7 BRAKE TRAVEL

Aileron offset due to brakes is set in **V_BrakeToAil**. Offset may be upwards (+ve) or downwards (-ve).
The flap travel due to brakes is set in **V_BrakeToFlap.** Movement is downwards only.

Automatic roll rate enhancement
To maintain good roll response under braking, the aileron offset is reduced as aileron is applied. To visualise this, apply full brakes, then slowly move aileron stick from centre to one end point.

5.8 BRAKE STICK DEADBAND

The stick position where the brakes start may be adjusted in **V_BrakeDeadband**. Allowable range is 50% to 95%. The default value is 85% and should not need altering.

5.9 BRAKE-AWARE ADAPTIVE TRIM

When deploying brakes, amount of pitch trim is determined by a brake-to-elevator mix and 5-point 'compensation' curve. When you adjust the elevator trim, the system automatically bends the curve, choosing the correct points to adjust. This makes it easy to achieve perfect pitch trim across the full range of brakes.

The procedure is transparent, it's not necessary (or recommended) to look at the screen.

To familiarise with the system, open the **CURVES** menu and highlight CV:'BrakeComp'. Apply say 50% brake. Then move the elevator trim and observe how the curve changes. Note that the last point on the curve (immediately after transitioning into Landing mode) is fixed and does not respond to the trim - this is by design.

Use the trim to configure the initial curve according to your DLG instructions. Start with a linear response, then refine during test flights (see section 6.1).

> *Technical note:* at transition into Landing mode, the elevator trim value is inherited from Cruise mode. This constitutes the 'base' trim. As more brake is applied, the (variable) compensation is added to the base trim to give the final elevator offset.

5.10 CAMBER

Camber (+ve or -ve) is adjustable in Cruise, Thermal1/2, Speed, Landing modes. To adjust, use the throttle trim:

- o Trim centre=>zero camber
- o Trim back => +ve camber
- o Trim forward => —ve camber ('reflex')

To set the relative camber of flaps and ailerons, adjust **V_AilFlapBalance**. The range of adjustment is -100% (flaps only) to +100% (ailerons only). *The ratio is applied to both camber and snapflap adjustments!*

5.11 SNAPFLAP (ELEVATOR TO FLAP MIXING)

Snapflap may be configured for flight modes Cruise, Speed, Thermal1 and Thermal2. Configuration is via the **VARS** menu.

- **V_SnapDown** sets downward travel from pulling up-elevator
- **V_SnapUp** sets upward travel from pushing down-elevator.

To set the relative movement of flaps and ailerons, see section 5.10 above.
The deadband around elevator centre may be adjusted in **V_SnapDeadband**.

5.12 AILERON=>RUDDER

This mix can help with entry into turns, and is especially useful with brakes deployed. Adjust in **V_AilToRud**.

6 FIELD/FLYING TIPS

6.1 ADJUSTING PITCH TRIM WITH BRAKES

The 'brake-aware' trim system makes it easy to adjust the pitch trim when brakes are deployed. Here's the recommended procedure:

1. Adjust the trim in Cruise mode.
2. Next, apply varying amounts of brake, and adjust the elevator trim as necessary. Make sure to cover the full range. (Behind the scenes, the elevator trim is adjusting the brake compensation curve - see section 5.9.)

6.2 CHECK CALIBRATION

It's a good idea to activate CAL mode at the start of each session. If you see that a control surface is not centring correctly in CAL mode, it's a sign that a servo has drifted or a linkage has been knocked. If the discrepancy is small, it's not necessary to do a full re-CAL. Instead, open the output (in the **OUTPUTS** menu) and adjust *PWM centre* - this is equivalent to rotating the servo arm on its spline.

On exit from CAL mode, all your trim settings will be restored.

7 CUSTOMISING YOUR SETUP

This section describes some simple customisations. You can apply these at any time.

7.1 CONFIGURING THE LOW BATTERY ALARM

The template can sound a "receiver battery low" alert every 7 seconds, while the voltage is below a threshold. To configure and activate the low battery alarm:

1. Go to the **LOGICAL SWITCHES** menu, open LSW29:RXBAT_LOW.
2. Set the source to Category>Telemetry>'RxBatt' (you may need to discover sensors first)
3. Set *Value(X)* to the threshold pack voltage.
4. Go to the **SPECIAL FUNCTIONS**: Play audio:'d6srxbatlow'.
5. Set *State* to 'Enable' and set the repeat interval (default 7 seconds).

7.2 SETTING DIFF ADJUSTMENT RANGE

The default range of diff adjustment is −30% to +70%. The limits may be altered by editing the curve 'DiffRange'.

7.3 DISABLING THERMAL 2

If you prefer, you can disable thermal_2. In that case, only thermal_1 is available.

Function	Menu point	Value	Default
Thermal 2 enable	**VARS**→V_Therm2Enable→*values*	0 = disabled 1 = enabled	Enabled

If Thermal_2 mode is disabled then,
- the Thermal1/Thermal2 mode switch is no longer used and can be reassigned for other purposes.
- you may wish to change the sound file for Thermal_1 to say just 'thermal' or 'slow' - alternative WAV files are provided in the package. Go to **SPECIAL FUNCTIONS**:Play Audio: d6sthermal1, and replace with your choice.

7.4 LAUNCH HEIGHT ANNOUNCEMENT

If you have a receiver with altitude telemetry, or a separate altitude sensor, the system can call the maximum height achieved until 3 seconds after exiting Zoom mode. Some mods will be need to special functions SF11 and SF12. The mods must be made while telemetry is active.

Function	Menu point	Note
Enable launch height callout	**SF11**→ Altitude Max	To activate, set *sequence* to Play Value Telemetry→Altitude, long press to select 'MAX' option. Set *State* to 'enable'
Reset ALT at launch	**SF12** → Reset Altitude	Set *reset* to Telemetry→Altitude.
Callout delay	**LOGICAL SWITCHES**→EXIT_ZOOM_DELAY→*During*	Delay after exiting Zoom, default=3secs

7.5 MAKING YOUR OWN MODIFICATIONS

Before making your own mods, please study the Excel documentation and make sure you understand the impact of any changes. Recommended workflow as follows:

- Set up your model as described in this guide.
- Backup your setup (make a clone)
- Apply your modifications incrementally, testing and backing up as you go along.

8 DISCLAIMER

Although this setup is well tested, it's up to the pilot to make sure that the controls respond correctly under all conditions. The author will not be responsible for the consequences of any bugs in the setup or documentation or as the result of changes in Ethos.

Test your setup thoroughly before the
first flight and after any modifications!

If in doubt, don't fly!!

If you have any queries, you can contact me via http://rc-soar.com/email.htm. For technical queries, please provide the following information: transmitter type, Ethos version and template version.

Safe flying!

- Mike Shellim