



Variometer/Flight Computer Guide

****A MSFS 2024 native hang gliding experience****

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\work

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The Hang Gliding Files

The hang gliding files is a project of the NextWave Mobile Apps company. We are building tools, aircraft, models, whatever is necessary to fly hang gliders in the MSFS 2024 flight simulator.

We want this to be as realistic as we possibly can.

But we also must leverage and bend to the environment that we are trying to do that in. This simulator gives us a great simulated Earth with complete geography, photogrammetry, weather and physics engine. It lets us explore this world as an Avatar. That Avatar happens to be an aircraft and all our interactions with this environment are as if we were this avatar. That makes it a flying simulator (as opposed to say a fishing simulator).

But a hang glider (flex wing types especially) does not fly or operate like any other aircraft other than they move the air and use aerodynamic physics to “fly”

MSFS 2024 Instrumentation guidelines

- **EFB Applications.** These are JavaScript/HTML based applications accessible via the EFB tablet. (*see EFB Application – The Widget for more information*).
- **C++ WASM gauges.** These are fast, efficient applications that run in the background while an aircraft is active. They can have UI interfaces as well. The Vario/Flight computer is one of these. It can perform many functions but must be included in each aircraft’s installation. Communications from a WASM application and the EFB and/or other 3rd party applications is usually done via setting and reading LOCAL VARIABLES. The EFB and WASM gauges can also interact with internet sources using HTTP protocols.
- **Cockpit Instruments.** Most aircraft have a “cockpit” and a “panel” where the flight instruments reside. Hang gliders have neither. However, the simulator assumes we (and all aircraft do). Because of this, it requires that the

pilot be in **INSTRUMENT MODE** (camera view) before allowing a pilot to interact with the instruments. When in standard cockpit mode, the instrument interactions (buttons, knobs, etc.) are inactive. We must follow this paradigm as well. Your variometer buttons are only active when you are in the instrument mode. (see HUD documentation that explains this in detail).

Hang Gliding Flight Variometer guidelines

A variometer—usually just called a *vario*—is the primary instrument used in hang gliding. Many pilots would argue it's the **only** instrument you truly need. Its job is simple but essential: it tells you whether you are rising or sinking, and how quickly.

Humans are surprisingly bad at sensing vertical motion in the air. Even experienced pilots can't reliably feel small changes in climb or sink rate, especially when the air is turbulent or the glider is accelerating. A variometer fills that gap, giving you the information you need to:

- Center thermals
- Avoid areas of strong sink
- Optimize glide performance
- Stay airborne longer and safer

To do this, a vario can calculate vertical movement in three different ways. Each method has its own purpose and level of sophistication.

- **Vertical Speed (basic vario)**. This is the simplest form of variometer measurement. It reports your **instantaneous vertical climb or sink rate**, usually in feet per minute or meters per second.
 - Measures altitude change directly
 - Responds quickly
 - Useful for basic soaring and general awareness
 - However, vertical speed alone doesn't tell the whole story. It includes the effects of **your own glider's motion**, not just the air mass you're flying through.
- **NETTO**. NETTO tries to answer a more interesting question:
 - “How fast is the air rising or sinking, independent of what the glider is doing?”
 - To do this, the instrument subtracts the glider's natural sink rate (*from its polar curve*) from the measured vertical speed. The result is a reading of the air mass itself.
 - Shows whether the **air** is going up or down
 - Helps you find the core of a thermal more accurately
 - Removes the effect of your glider's glide performance
 - If your NETTO shows +2 m/s, that means the air is rising at +2 m/s—even if your glider would normally sink at -1 m/s at that speed.
- **Total Energy**. Total Energy compensation is the most advanced method. It accounts for both:

- **Potential energy** (altitude)
- **Kinetic energy** (airspeed)
- Why does this matter? Because when you pull in and speed up, you momentarily lose altitude—but you’re not actually sinking; you’re converting altitude into speed. A basic vario would scream “SINK!” even though the air might be perfectly good.
- A TE vario compensates for this by adding back the energy gained from speed changes. The result is a much more stable and accurate reading of true climb/sink in turbulent or fast-changing conditions.
- Eliminates false sink when accelerating
- Eliminates false lift when slowing down
- Gives the cleanest, most reliable climb information
- This is the standard for high-performance soaring.

You’ll learn how to activate and use each variometer mode throughout this document. Along the way, the flight computer provides real-time information including:

- **Altitude** (both GPS and barometric)
- **Airspeed** and **groundspeed**
- **Wind direction** and **wind speed**

Hang Gliding Flight Computer guidelines

Modern hang-gliding flight computers combine several advanced soaring tools into one integrated system. These features help you navigate, optimize performance, understand the air around you, and record your flights for scoring or analysis. The following sections outline the major capabilities of the THGF flight computer.

- **Moving Map.** A real-time, GPS-driven map showing your position, heading, track, and nearby terrain. The moving map also displays:
 - Waypoints and turnpoints
 - Airspace (if applicable)
 - Launch and landing zones
 - Thermal markers and track history
 - Task routes and cylinder boundaries
 - This is the primary navigation view during cross-country or task flying.
- **Thermal Mapping.** The flight computer continuously analyzes your climb performance and marks areas of rising air on the map. Thermal mapping helps you:
 - Visualize where lift was strongest
 - Re-center a thermal after drifting out of the core
 - Identify patterns in ridge lift or convergence

- Build a “heat map” of usable lift over time
- This is especially useful in MSFS where visual cues can be subtle.
- **Speed To Fly.** Speed-to-Fly guidance tells you about the optimal airspeed for the current conditions. It considers:
 - Your glider’s polar curve
 - Current lift or sink
 - Headwind or tailwind
 - Task requirements (if active)
 - The STF indicator helps you maximize glide efficiency and reach the next thermal or waypoint faster.
- **Tasks or Courses.** The flight computer supports structured tasks, including:
 - Race-to-goal
 - Elapsed-time tasks
 - Out-and-return
 - Triangle courses
 - Free-distance XC routes
 - It displays turnpoints, cylinder radii, distances, estimated arrival heights, and task progress.
- **IGC Flight Log.** Every flight can be recorded in standard **IGC format**, the international standard for soaring logs. The log includes:
 - GPS track
 - Altitude (GPS and barometric)
 - Vario data
 - Task declarations
 - Security signatures
 - These files can be uploaded to scoring servers or analyzed in XC tools.
- **Mission Scoring.** For MSFS missions or THGF-specific challenges, the flight computer provides:
 - Turnpoint validation
 - Timekeeping
 - Altitude checks
 - Penalty handling
 - Final score calculation
 - This allows multiplayer or solo missions to be scored consistently.
- **XCSoar task files.** The system can read and interpret **XCSoar .tsk** files, allowing you to:
 - Import predefined tasks
 - Fly community-created routes

- Sharing tasks between pilots
- Maintain compatibility with real-world soaring tools
- This makes the THGF ecosystem interoperable with established gliding software.
- **Glide performance metrics.** The flight computer continuously calculates performance indicators such as:
 - Glide ratio (instantaneous and average)
 - Required glide to next waypoint
 - Arrival altitude (predicted)
 - MacCready-adjusted performance
 - Wind-corrected glide estimates
 - These metrics help you make informed decisions during XC flying or competition tasks.

Glider Polar

The **glider polar** is the performance curve that describes how your hang glider sinks at different air speeds. Every calculation the flight computer performs—Speed-to-Fly, NETTO, arrival altitude, glide ratio, and even thermal efficiency—depends on this curve.

A polar typically provides:

- **Minimum sink speed**
- **Best glide speed**
- **Sink rate at all speeds across the usable range**
- **Stall and VNE boundaries**

The flight computer uses the polar to:

Predict Glide Performance

- Required glide ratio to reach the next waypoint
- Expected arrival altitude
- Wind-corrected glide estimates
- Safety margins for terrain and landing zones

Compute Speed-to-Fly

The STF algorithm references the polar to determine the optimal air speed for:

- Lift
- Sink

- Headwind
- Tailwind
- MacCready setting (if enabled)

Calculate NETTO and Total Energy

NETTO requires subtracting the glider's **natural sink rate** at the current speed. TE compensation uses the polar to determine how speed changes affect energy.

Improve Thermal Centering

By knowing the glider's inherent sink rate, the computer can isolate the *air mass* climb rate and help you find the strongest part of the thermal.

Support Task and XC Calculations

- Time-to-go
- Distance-to-go
- Final glide
- Turnpoint arrival estimates

A well-defined polar is the foundation of accurate soaring instrumentation.

Variometer Page Overview



Variometer/flight computer on Basetube

The variometer is the pilot's primary flight instrument and the central interface to the entire Hang Gliding Files ecosystem. It combines real-time flight data, navigation, task management, and post-flight analysis into a single, compact LCD display controlled entirely through a fixed set of twelve physical buttons. These buttons are the pilot's only means of interacting with the instrument, and the design philosophy is simple: **every function must be accessible, predictable, and operable with one hand in turbulent air.**

NOTE: This is done using either the mouse (on a PC) or using the game controller when in FREELook mode (see HUD documentation) to look at a button and activate that button

Although each page may assign different actions to the buttons, several controls remain consistent across the entire system:

Power (On/Off)	Located on the side of the vario
Vario ↔ Map Toggle	The OK button in the center. Will return you to the main page from anywhere, any time.
Next Page	The F1 button will move to the next screen from any page.
Sub-Page Toggle	On pages that have a subpage available (has a LOGO icon), the F2 button will toggle subpages.

These universal interactions ensure that even as the pilot moves between complex pages—task management, map overlays, scoring, or post-flight analysis—the core navigation remains intuitive, and muscle-memory driven.

The variometer organizes its functionality into a set of **Main Pages**, each dedicated to a specific phase of flight or type of information. Some pages include **sub-pages**, and some are only available in certain flight states (for example, after landing). The following sections introduce each page at a high level; the detailed behavior, data fields, and button mappings for each will be covered in their own chapters.

Variometer Pages

Unlike a panel of gauges and instruments, you get 1 instrument that has 1 screen. On that screen you need to get the right information you need at any time. We do this by using pages.

VARIO PAGE

The primary in-flight display. This page presents the essential soaring information a pilot needs immediately:

- Compass and heading
- Variometer scales (instantaneous and averaged climb/sink)
- Airspeed and ground speed
- User-defined data fields
- Current waypoint information (when a task or Goto is active)

The Vario Page is designed to be readable in bright sunlight, responsive in turbulence, and uncluttered during critical phases of flight.

MOVING MAP

A dynamic, zoomable map display showing the pilot’s position relative to terrain, thermals, tasks, and waypoints. Depending on context, the map may include:

- Thermal history overlays
- Task course lines
- Waypoint markers
- Airspace or site-specific features

- Minimal but essential data fields (speed, altitude, glide, etc.)

This page is the pilot's situational awareness hub during cross-country flight.

XC TASK

A task-management interface showing all XCSoar task files that have been loaded into the variometer. From here, the pilot can:

- Browse available tasks
- Activate a task
- Review task metadata

Sub-Page: Declare a Goal Allows the pilot to define a simple out-and-return or distance goal directly from the cockpit, without a pre-loaded task file.

WAYPOINTS

Displays detailed information about the active task:

- List of Waypoints
- Current waypoint
- Points achieved
- Distances and bearings
- Timing and scoring information

This page is essential for pilots flying competition tasks or structured XC routes.

ABOUT

A system information page showing:

- Glider type and category
- Site information
- Launch location
- Local weather
- Firmware and instrument details

Sub-Page: Glider Polar Displays the performance polar for the current glider, including sink rate, best glide, and speed-to-fly characteristics.

SETTINGS MENU

A simple menu that leads to three configuration sub-pages:

- Unit Settings

- Vario Tone Control
- Speed to Fly Settings

These allow the pilot to tailor the instrument's behavior to their preferences and glider.

Post-Landing Pages

These pages appear only after the pilot has landed and the instrument detects a stationary state.

FLIGHT DATA

A summary of the completed flight:

- Total time
- Distance flown
- Task score (if applicable)
- Launch and landing details

Sub-Pages:

- Mission Score
- IGC Graph & Export

These tools allow the pilot to review performance, analyze climb rates, and export the flight log.

DAMAGE PAGE

If the landing resulted in a crash or hard impact, this page displays:

- Damage assessment
- Impact on glider forces
- Relevant telemetry

Sub-Page: Velocity Vector Shows the vector analysis that contributed to the damage event.

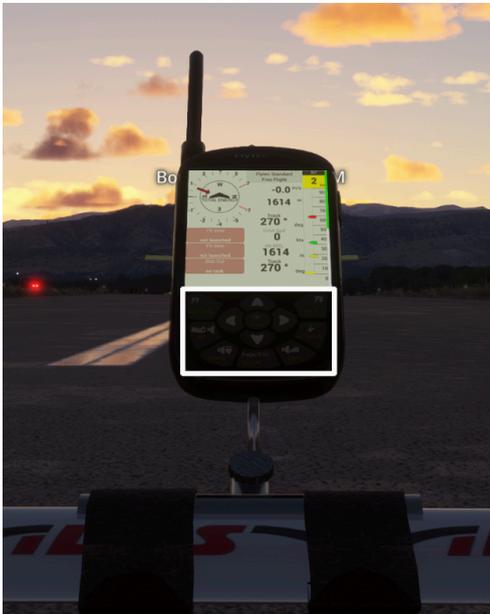
Summary

The variometer's page system is designed to support the entire lifecycle of a soaring flight:

- **Before launch:** task selection, waypoint review, glider setup
- **In flight:** navigation, climb optimization, task execution
- **After landing:** scoring, analysis, and safety reporting

Each page is purpose-built, but all share the same consistent button logic, ensuring the pilot can operate the instrument confidently without taking eyes off the sky.

Button Interface Overview



The variometer is operated entirely through a fixed set of twelve physical buttons located directly beneath the LCD display. These buttons form the complete interaction model for the instrument—every page change, every configuration adjustment, every task declaration, and every post-flight review is performed through these keys. The design philosophy is simple: the pilot must be able to operate the instrument confidently, with one hand, in turbulence, without ever taking their eyes off the sky.

Although the buttons are physically fixed, their functions are dynamic. Each page defines its own button actions, and some pages override or repurpose buttons to support specialized workflows. Despite this flexibility, the system maintains a consistent interaction logic that keeps the instrument predictable and intuitive.

How the Buttons Work

L: VAR-Driven Input System

The variometer reads button presses through a set of L: VAR simulator variables. Each button corresponds to a specific L: VAR, and the instrument reacts whenever that variable is triggered.

This design has two major advantages:

Hardware-agnostic control: Any controller, joystick, keyboard, or custom hardware can be mapped to these L: VARs. If your device can set the variable, the variometer treats it exactly like a physical button press.

Perfect integration with MSFS 2024: The instrument behaves identically whether the pilot presses the physical button, a mapped controller button, or a scripted input.

This makes the variometer both flexible and futureproof.

Button Behavior Rules

- Not all buttons are active on every page
- Some pages use only a subset of the twelve buttons. Inactive buttons simply do nothing on that page.
 - Some buttons work everywhere
 - Some pages override buttons for page-specific actions

For example:

- On the XC Task page, a button may load or activate a task.
- On the Flight Data page, a button may export an IGC file.
- On the Settings pages, buttons may adjust values or confirm changes.
- This is intentional. The variometer adapts its controls to the task at hand.
- Same button, different page = different action

This is by design and mirrors real-world flight instruments. The pilot learns the *pattern* of interaction, not the specific mapping of each button.

Master Layout — Where the Buttons Are

The twelve buttons are arranged in a fixed, ergonomic layout directly beneath the LCD screen. While the exact labeling may vary depending on the glider category or firmware version, the physical positions never change.

This arrangement supports:

- Thumb-driven navigation
- Quick access to directional controls
- Dedicated confirm/cancel actions
- Fast page switching
- Reliable muscle memory in turbulence

Each button's meaning is defined by the active page, but the physical layout remains constant, allowing the pilot to operate the instrument without looking down.

Summary

The variometer's button interface is intentionally simple in hardware but powerful in software. By combining:

- a fixed physical layout
- L: VAR-driven input
- page-specific button actions
- consistent global controls

...the instrument achieves a balance of flexibility and predictability that supports every phase of flight—from launch, to thermalling, to cross-country navigation, to post-flight scoring.

Pilot Status Indicators



Every page on the variometer—without exception—includes a pair of **vertical status bars** located on the far right edge of the LCD. These indicators provide immediate, always-visible feedback about the pilot's physical configuration in flight. They are intentionally simple, color-coded, and readable briefly, even in turbulence.

These indicators are not tied to any specific page; they are part of the global UI and remain visible regardless of what the pilot is viewing.

Pilot Pose Indicator (Top Bar)

This bar reflects the pilot's **body position** and is directly linked to the **spoiler state**:

- **GREEN** — Spoilers closed
 - Pilot is in **prone** flying position
 - Normal aerodynamic configuration
- **RED** — Spoilers open
 - Pilot is in **upright** position
 - Typically used for approach, landing, or speed control

Visibility Notes

- When on the ground, the camera view may not show the spoiler animation, so this indicator becomes the only reliable cue.
- In the air, the pilot cannot visually confirm spoiler position via camera changes, making this indicator essential for situational awareness.

Gear / Harness Indicator (Bottom Bar)

This bar shows whether the pilot's **legs are inside the harness** or **extended for landing**:

- **GREY** — Feet enclosed in harness
 - Normal flight configuration
 - Minimal drag
- **BLACK** — Feet extended
 - Landing or takeoff posture
 - Increased drag and altered handling

Visibility Notes

- On the ground, camera changes may show the pilot's legs, but this is not reliable in flight.
- This indicator ensures the pilot always knows their gear state, even when external visuals are unavailable.

Purpose of These Indicators

These two bars provide:

- **Immediate confirmation** of critical flight-control states
- **Safety awareness** during approach and landing
- **A quick check** when transitioning between prone and upright
- **A consistent UI anchor** across all pages

They are intentionally minimalistic, so they never distract from the main flight data, yet always remain visible in peripheral vision.

VARIO PAGE — Detailed Description

The Vario Page is the primary in-flight display of the instrument, and the screen pilots will spend most of their airtime using. It combines climb/sink information, heading, wind, speed, waypoint navigation, and customizable data fields into a single, efficient layout. The page is divided into five major screen regions, each with a distinct purpose and interaction model.

Compass Area



The compass area is the visual anchor of the Vario Page. It provides heading, wind, waypoint direction, and variometer information in a single integrated display.

Compass Rose & Glider Icon

The glider icon is fixed at the center of the compass area, always pointing “up.”

The compass rose rotates beneath it, showing the aircraft’s current heading.

The glider icon changes color based on flight state:

- Dark — on the ground
- White — flying
- Green — task active

Variometer Arc

Wrapped around the compass rose is the variometer arc, which provides an at-a-glance indication of climb or sink:

- 0 is located at the 9 o’clock position (90° left of the glider).
- The upper arc represents positive climb (lift).
- The lower arc represents negative climb (sink).
- The arc dynamically reflects the currently selected vario mode and units.

Vario Mode Indicator

Beneath the glider icon, the current vario type is displayed:

- VARIO (instantaneous vertical speed)
- NETTO (airmass vertical speed)
- TE (total energy compensated vario)

Changing Vario Mode

- Mouse: clicking the compass cycles through vario types.
- Buttons: pressing the UP arrow cycles through vario types.

Wind & Waypoint Arrows

Two directional overlays rotate with the compass rose:

- Red Arrow (Wind Direction): Points *toward* the glider icon, showing the direction the wind is coming from relative to the glider.
- Green Arrow (Waypoint Direction): Points *away* from the glider icon, showing the direction the pilot must fly to reach the active waypoint.

These arrows remain visible only when their respective data is available.

Speed Bar



The speed bar provides a combined numeric and graphical representation of the aircraft's speed.

Speed Type

The bar displays either:

- Airspeed
- Groundspeed

The active type is shown in text.

Numeric Speed

A large numeric value shows the current speed in the selected units.

Vertical Bar Chart

A dynamic vertical bar animates to show speed relative to a scale. When in airspeed mode, the bar includes glider-specific markers:

- Red: VNE (never exceed speed)
- Green: Best glide speed
- Yellow: Stall speed

The bar itself changes color depending on the current speed range.

Speed-to-Fly Indicators

If a task is active and a MacCready value is set:

- Blue markers appear on the bar showing the recommended speed-to-fly.

Changing Speed Mode

- Mouse: clicking anywhere on the speed bar or displayed values will toggle.
- Buttons: pressing the UP arrow cycles speed types.

Fixed Data Areas



Two data fields are always visible regardless of user configuration:

Vertical Speed

Shows the current climb/sink rate

Uses the currently selected vario mode (VARIO, NETTO, TE)

Altitude

Displays barometric or GPS altitude depending on settings

Units follow the global unit configuration

These fields remain constant across all Vario Page sub-pages.

User-Definable Data Area

This is the most flexible part of the Vario Page. It contains seven data fields arranged in a structured grid:

- 3 columns of 2 fields each (six total)
- 1 additional field centered below (making seven)



Pages of Data Fields

There are seven user-configurable pages, each containing seven fields. The pilot can configure:

- Which data fields appear
- Their order
- Their grouping
- Their page assignments

There are 56 possible data field types, covering navigation, performance, task, and environmental metrics. **See the DATA FIELD ENCYCLOPEDIA in this document for a complete list of data types.**

How data is displayed

Title. The title of the data is centered text on the top of the data field

Data. The data will be displayed in the center of the data field

Unit. The unit type will be displayed in the lower right corner of the data field.

Background

Interaction

- Mouse:
 - Clicking the page title cycles through pages
 - Clicking an individual data field cycles through all available data types
- Buttons:
 - LEFT/RIGHT cycle through data pages
- (Future enhancement) highlight-and-cycle individual fields via buttons

Persistence

All user changes are saved and automatically restored for future flights. See **APPENDIX A**

Waypoint Indicator



This region appears only when a task or Goto waypoint is active.

Waypoint Name

The name of the current waypoint is displayed prominently.

Direction Indicator Bar

A horizontal bar chart shows how far left or right the pilot must turn to point directly at the waypoint:

- Centered block: on course
- Left arrows: waypoint is left of current heading
- Right arrows: waypoint is right of current heading
- The number of arrows indicates the magnitude of the offset

Interaction

- Mouse: clicking this area opens the Waypoint Page
- Buttons: not yet implemented (future enhancement)

Summary

The Vario Page integrates all essential soaring information into a single, intuitive layout:

- Compass + Vario Arc for situational awareness
- Speed Bar for performance and safety
- Fixed Data for altitude and climb
- User-Defined Fields for personalized metrics
- Waypoint Indicator for navigation

It is designed to be readable, responsive, and operable entirely through the 12-button interface or mouse interaction.

VARIO PAGE — Button Mapping

The following table defines the behavior of each button when the pilot is viewing the **Vario Page**. This layout is the standard format used throughout the manual: the left column lists the physical button, and the right column describes its action on this specific page.

Button	Action on Vario Page
Power	Toggle instrument On/Off
OK / Menu	Toggle to either the Main Page or Moving Map
Up Arrow	Cycle variometer mode (VARIO → NETTO → TE → VARIO...)
Down Arrow	Cycle variometer mode (VARIO → NETTO → TE → VARIO...)
Left Arrow	Cycle user-defined data pages backward (Page 1 → Page 7 → Page 6...)
Right Arrow	Cycle user-defined data pages forward (Page 1 → Page 2 → Page 3...)
F1	Cycles main pages
F2	Goes directly to the AAT data page
WP	Goes directly to the WAYPOINT data page
ROUTE	Goes directly to the GOAL data page
PAGE/ESC	Goes directly to the FREE FLIGHT data page
GOTO	Goes directly to the STARTPOINT data page

Button	Action on Vario Page
H/Twind	Is not used on this page

Direct-Access Buttons

F2, WP, ROUTE, PAGE/ESC, and GOTO act as **jump keys**, taking the pilot directly to high-value pages without cycling through the main page loop.

This dramatically reduces workload during XC flight.



Figure 2 Moving Map page

MOVING MAP PAGE — Detailed Description

The **Moving Map Page** provides a dynamic, zoomable, 2D map display designed for situational awareness during free flight, task navigation, and waypoint analysis. It integrates terrain imagery, task overlays, thermal visualization, and a modified compass control into a single, flexible interface.

The page is composed of several key components:

Scale Bar (Top of Screen)

The scale bar spans the top edge of the display and provides immediate feedback about the current zoom level and map theme.



Zoom Indicator

- A **red horizontal bar** moves from left to right:
- **0%** = maximum zoom-in
- **100%** = maximum zoom-out
- The bar animates smoothly as the pilot zooms.

Zoom Level Text

Centered within the scale bar is a **theme-dependent zoom label**, such as:

- “Thermal View”
- “Task View”
- “Terrain View”

Distance Scale

On the right side, the map displays the real-world scale in the selected units (miles or kilometers).



Bottom Control

Displays:

- Current mode name
- Thermal ON/OFF indicator

Clicking in this area cycles the mode.

Thermal Mapping Toggle

A clickable icon in the lower-left corner toggles the **Thermal Map Overlay**.

- Shows current thermal size/strength
- Shows last 10 thermal positions
- Shows averaged thermal strength
- Scales with zoom level

TODO: assign a button to toggle thermal mapping.

Map Type Selector

The Moving Map supports two base map types:

- **Satellite**
- **Isotropic (vector/terrain)**

These are always displayed in **2D**. We do not support 3D moving map type.

Display Modes (Overlays)

The map supports three overlay modes:

- **Free Flight Mode**
- **Task Detail Mode**
- **Waypoint Detail Mode**

Free Flight Mode



This is the default mode and is always available, even without a task.

Data Fields

Two fixed data fields appear at the top:

- **Altitude**
- **Vario (current vario type)**

Compass Control (Modified Version)

Centered on the screen is the same compass control used on the Vario Page, with key differences:

- **Compass rose does not rotate**
- **Glider icon rotates inside the compass**
- **Wind and waypoint arrows remain functional**
- **Vario mode cycling works the same**
- **Glider icon color logic is identical**

This provides a stable map orientation while still showing heading and navigation cues.

Task Detail Mode



This mode is identical to Free Flight Mode except:

- **No data fields** are shown
- The map displays the **entire task**:
- Course line
- All turnpoints
- Cylinders
- Task status indicators
- The bottom control also displays the **full task name**

This mode is ideal for reviewing the entire task layout briefly.

Waypoint Detail Mode

This mode focuses entirely on the **current waypoint**.

Layout Changes

- The compass control is **removed**
- Four data fields appear, one in each corner
- The bottom control displays the **current waypoint name**

Waypoint Overlay



Only the **current waypoint** is drawn:

- Cylinder or line
- Color indicates:
 - In scoring position
 - Out of scoring position
 - Already scored

Off-Map Waypoint Indicator

If the waypoint is outside the visible map area:

- A **blue directional wedge** appears beneath the rotating glider icon
- This wedge points toward the waypoint's location **relative to the map**, not the glider's POV
- The glider icon still rotates to show heading

This ensures the pilot always knows where the waypoint lies, even at high zoom levels.

Moving Map Page — Button Mapping

Button	Action on Moving Map Page
Power	Toggle instrument On/Off
OK /Menu	Toggle between Main Page and Moving Map
Up Arrow	Cycle map overlay mode (Free Flight → Task Detail → Waypoint Detail → Free Flight...)
Down Arrow	Cycle map overlay mode (reverse direction)
Left Arrow	Zoom in
Right Arrow	Zoom out

Button	Action on Moving Map Page
F1	Cycle main pages
F2	Not used on this page
WP	Cycle map type (Satellite/Isotropic) — consistent global behavior
ROUTE	Jumps to the WAYPOINT page
PAGE / ESC	Not used on this page
GOTO	Cycles zoom theme names
H/Wind	Not used on this page

Typical interactions on this page:

When you are flying using this page as an active page, these are the buttons you most likely will need to use:

- **Left/Right buttons:** zoom in/out
- **Up/Down buttons:** cycle through the three modes (if available)
- **OK/Menu button:** Switch between this page the standard vario page
- **ROUTE button:** Will go directly to the waypoint page
- **Mouse click on the zoom control** also cycles zoom size
- **Mouse click on bottom control** also cycles mode

XC TASKS Page — Detailed Description

The XC TASKS Page is the pilot's interface for browsing, selecting, clearing, and creating XCSoar-compatible task files. It is designed for quick navigation, efficient task selection, and seamless transitions into the Waypoint Page.



This page is composed of three primary regions:

Task List Navigation Control (Top of Page)

This control shows:

- Total number of task files found
- How many pages are required to display them
- Which page is currently being viewed

Each page displays five task files. If more than five tasks exist, the pilot can scroll through pages.

Task List (Center of Page)

The central area displays five tasks corresponding to the current page.

Navigating the task list

You can move up and down the task list using the UP and DOWN arrow keys. The RIGHT and LEFT arrow keys will change the page displayed.

- Current Task is Highlighted
- Current selection is indicated
 - It is displayed in RED text
 - This selection moves independently of the page number

Selecting a task

You can use the OK button to select the current highlighted row as the current task. This will automatically switch you to the Waypoint Page where the details of your selected task will be displayed.

Action Buttons

Three on-screen buttons appear at the bottom of the screen. You can use these to do additional functions related to tasks.

Clear Task

The current ACTIVE task is disabled and puts you into a no task mode (the default mode).

Nearest Task

Automatically selects the task closest to the pilot's current location. This can be useful when arriving at a new site or when unsure which task belongs to the area you are in. You are not required to use this task; it is just a suggestion.

Declare Task

Opens the Declare Task Sub-Page where you can create a simple XCSoar task on the fly starting from your current position in the sim. This supports users who want to fly real-weather scenarios and would like to create simple tasks that match observable conditions.

Supports Distance and Out-and-Return task types.

NOTE: See the XCSoar documentation for a complete description of how to create XCSoar tasks, find them from other pilots, loading them into the variometer, and flying the task and scoring.

XC TASKS Page — Button Mapping

Button	Action on XC TASKS Page
Power	Toggle instrument On/Off
OK / Menu	Select the currently highlighted task
Up Arrow	Move up one task in the list (will page automatically)
Down Arrow	Move down one task in the list (will page automatically)
Left Arrow	Move backwards one page
Right Arrow	Move forwards one page
F1	Cycle main pages
F2	Jump to WAYPOINTS page (THGF logo action)
WP	Jump to WAYPOINTS page
ROUTE	Jump to MAP page
PAGE / ESC	Clear TASK button action
GOTO	NEAREST TASK button action
H/Wind	DECLARE TASK button action

These are the most common things you will need to do on this page:

- **Left/Right buttons:** move between pages of tasks
- **Up/Down buttons:** move the current task selection up or down the list
- **OK Button:** will select the current row as the current task.
- **F2 button:** will jump to the waypoints page
- **Mouse Actions:**
 - **THGF Logo:** activates the F2 button
 - **List Item** selects that item

- **Page Control** will change the page

DECLARE TASK Page — Detailed Description

The Declare Task Page allows the pilot to create a simple XCSoar task dynamically, based on real-time conditions at launch. It is built on top of the Moving Map Page, with additional overlays and controls.



This page is ideal for:

- Declaring a straight-line distance goal
- Declaring an out-and-return task



- Choosing a goal based on observed wind, lift, and terrain

Map Base Layer

The Declare Task Page uses the Moving Map as its foundation: This gives you a visual representation of where you are on the map and where you may wish to try and fly to. Simply click on the map and a goal can be created to that location.

- Always centered on the pilot's current position
- Always 2D
- Supports only Satellite map types
- Map scale zooming works the same as all other moving map modes.

Pilot Position Marker

A circle icon marks the pilot's current location (typically launch). This is the anchor point for all goal calculations.

Fixed Compass Rose (N/E/W/S Only)

A simplified compass rose appears on the map:

- Shows only N, E, W, S
- Does not rotate
- Provides orientation reference only
- The glider icon does not appear here

Task Type Selector

A dropdown box allows the pilot to choose the type of task to create for the selected map position. It can be either:

- **DISTANCE.** A single Turnpoint of your choice, any distance

- **OUT AND BACK.** The Turnpoint defines the turn around point to return to start

Goal Selection (Map Click)

The pilot selects the goal location by clicking anywhere on the map.

When a point is selected:

- A line is drawn from the pilot's position to the selected point
- The goal distance is displayed in the lower-left corner
- The pilot may click repeatedly to refine the goal location
- For Out-and-Back, the return leg is automatically inferred

CREATE Button (Lower Right)

Pressing CREATE:

- Generates a valid XCSoar task file
- Saves it into the work directory and it can then be flown again at any time or shared with other pilots.
- Automatically selects it as the active task, adds to your list of tasks.
- Switches to the Waypoint Page

DECLARE TASK Page — Button Mapping

Button	Action on Declare Task Page
Power	Toggle instrument On/Off
OK / Menu	If (End point type selected) Will mark the current end point as the Turnpoint location else Toggle between Main Page and Moving Map
Up Arrow	If (distance type selected) Moves up the distance type combo box selection if (End point type selected) Moves the end point up on the map
Down Arrow	If (distance type selected) Moves down the distance type combo box selection if (End point type selected) Moves the end point down on the map
Left Arrow	If (zoom type selected) Zoom in

Button	Action on Declare Task Page
	if (End point type selected) Moves the end point down on the map
Right Arrow	If (zoom type selected) Zoom out if (End point type selected) Moves the end point down on the map
F1	Moves to next available control on this page
F2	Jumps to the XC TASK PAGE (THGF logo action)
WP	Cycle map type (Satellite/Isotropic)
ROUTE	Creates the declared task (Create button action)
PAGE / ESC	Not used on this page
GOTO	Not used on this page
H/Wind	Not used on this page

Controls on this page controlled by buttons: **ZOOM, MAP END POINT, DISTANCE TYPE**

These are the most common things you will need to do on this page:

- **F1 button:** Will cycle through active controls
- **Left/Right buttons:** to manipulate controls
- **Up/Down buttons:** to manipulate controls
- **OK Button:** will select the current destination point.
- **F2 button:** will jump to the task page
- **Mouse Actions:**
 - **THGF Logo:** activates the F2 button
 - **Click anywhere.** Will define the destination point
 - **Combo box.** Will allow mouse selection
 - **Buttons.** Will allow selection

WAYPOINT PAGE — Detailed Description

The Waypoint Page provides a structured, multi-page view of all waypoints in the currently active XC task. It is the pilot's primary interface for reviewing task structure, checking waypoint status, and manually adjusting scoring states when necessary. This page is designed to be readable, navigable, and fully aligned with XCSOAR task semantics.



Waypoint page showing the details of the current task

Page Navigation Control (Top of Page)

This control appears whenever the task contains more waypoints than can fit on a single screen.



Features

- Shows current page number
- Shows total number of pages
- Clicking the control cycles through pages
- Up/Down buttons also cycle pages

This ensures the pilot can quickly navigate large tasks with many turnpoints.

Title Bar (Total Task Distance)

The title bar displays the total task distance, calculated from the XCSoar task definition.

Examples: “Total Distance: 19.5 mi”

“Total Distance: 32.1 km”

Task Description Box



This section summarizes the task metadata extracted from the XCSoar .tsk file:

- Task Name
- Task Type (e.g., Racing Task, AAT)
- Scoring Style (RT / AAT)
- Defined Rules, such as:
 - Start rules
 - Finish rules
 - Minimum times

This box provides a complete overview of the task's structure and scoring logic.

Waypoint List (Three Per Page)

Each page displays three waypoints, each with a detailed status block.



Each waypoint entry includes:

- Type icon
- Cylinder or line
 - Displayed in Green
- Waypoint name
- Radius
- Role
- Start
- Turnpoint
- Finish
- Altitude
- Current waypoint
 - Highlighted with a green background
- Completed waypoint
 - Completion metrics (if completed)
 - Speed to complete
 - Average speed for that leg
 - Visual Indicator

- Light grey background
- Checkmark overlay on the type of icon

Task Status Summary (Bottom of Page)

A four-column table summarizes the overall task state:

Distance	Time	Speed	Status
19.5 mi	In Progress	0 kts	In Progress

Values update dynamically as the pilot progresses through the task.

WAYPOINT PAGE — Button Mapping

Button	Action on Waypoint Page
Power	Toggle instrument On/Off
OK / Menu	Will change the completion state of the select waypoint
Up Arrow	Move selection up (changes page if needed)
Down Arrow	Move selection down (changes page if needed)
Left Arrow	Move to the next page
Right Arrow	Move to the previous page
F1	Cycle main pages
F2	Jump to the XC TASK page
WP	Jump to the MAP PAGE showing waypoint only
ROUTE	Jump to the MAP PAGE showing full task
PAGE / ESC	Not used on this page
GOTO	Not used on this page
H/Wind	Not used on this page

These are the most common things you will need to do on this page:

- **Left/Right buttons:** to change active page
- **Up/Down buttons:** to change selected waypoint
- **OK Button:** to change status of waypoint (be careful here)
- **F2 button:** will jump to the task page

- **WP:** will jump to the map page showing the waypoint
- **ROUTE:** will jump to the map page showing the complete task
- **Mouse Actions:**
 - **THGF Logo:** activates the F2 button
 - **Click anywhere.** Will select that waypoint

ABOUT Page — Detailed Description

The About Page provides a complete snapshot of the instrument, the pilot, the glider configuration, the launch site, and the current weather environment. It is designed to give pilots and developers a clear understanding of the context in which the flight is occurring, and to help diagnose issues related to glider configuration, site selection, or weather conditions.



About page information



Instrument Information

- Displayed at the top of the page:
- Instrument Name: “Flytec 6030”
- Software Version: The current firmware/software version of the variometer.
- Pilot Name (ATC ID): The pilot’s identifier, pulled from the simulator’s ATC ID field.

This section confirms the identity of the device and the pilot for logging and reporting purposes.

Glider Type Section



This section describes the glider configuration as understood by the WASM gauge and MSFS 2024. This section helps diagnose issues caused by mismatched presets, incorrect variants, or unexpected physics modes.

- **MSFS Package Name**

- **The <category> folder name** of the currently loaded MSFS 2024 aircraft package.
 - **Variant:** The specific preset and livery.
 - Example: Preset: *Sport* | Livery: *Red/White*
 - Glider Characteristics derived from the aircraft's configuration files:
 - Glider Type: *flexwing, rigid, Swift, etc.*
 - Kingpost: *yes/no*
 - Control Method: *weight-shift control or other*
- Physics Mode: *used by the WASM HUD to determine aerodynamic behavior*

Site Information Section

This section describes the pilot's initial spawn location, which may be an airport, a launch site, or a mid-air teleport.



Displayed Information

- Spawn Airport / Site Name
- Latitude & Longitude
- Spawn Altitude
- Spawn Heading
- Towing State at Spawn
- Foot launch
- Winch tow
- Aerotow
- Mid-air start

This information is used for flight reporting, task validation, and debugging.

Weather Information Section

This section summarizes the ambient weather conditions at launch.



Displayed Information

- Ambient Weather at Launch (dynamic)
- Real Weather: *YES/NO*
- Real Turbulence: *ON/OFF*
- **Weather Summary String:**
 - Temperature
 - Wind speed
 - Wind direction
 - Precipitation state
 - Visibility
 - Pressure

This section helps pilots understand thermal quality, wind patterns, and expected task performance.

ABOUT Page — Button Mapping

Button	Action on About Page
Power	Toggle instrument On/Off
OK / Menu	Toggle between Main Page and Moving Map
Up Arrow	Not used on this page

Button	Action on About Page
Down Arrow	Not used on this page
Left Arrow	Not used on this page
Right Arrow	Not used on this page
F1	Cycle main pages
F2	Jump to GLIDER POLAR page
WP	Not used on this page
ROUTE	Not used on this page
PAGE / ESC	Not used on this page
GOTO	Not used on this page
H/Wind	Not used on this page

These are the most common things you will need to do on this page:

- **F2 button:** will jump to the GLIDER POLAR page
- **Mouse Actions:**
 - **THGF Logo:** activates the F2 button

GLIDER POLAR Page — Detailed Description

The Glider Polar Page displays a live, dynamic polar graph derived from the aircraft's configuration files. This graph is specific to the current variant of the glider and updates continuously during flight.

This page is essential for performance analysis, speed-to-fly decisions, and validating the accuracy of the glider's aerodynamic model.



Live data glider polar graph page



Data Overlay

A fixed overlay displays key performance metrics:

- Airspeed
- Sink (TE)
- Ground Speed
- Altitude AGL
- Weight
- Best L/D

These values help the pilot interpret the polar graph and understand how current conditions affect performance.

This information is not normally used in your flying experience. It won't help you soar or fly better, but it is interesting information to have.

Because each glider model `<VARIANT>` that is used from within the glider `<CATEGORY>` model will have a different and unique set of `aircraft.cfg` and `flight_model.cfg`. These files define how the glider flies and what the glider polar will look like here. If you think a glider model is not performing correctly (too good or too bad), you can use this page to verify actual simulator performance as it happens as opposed to how you “feel” it is performing.

We use it all the time when developing gliders.

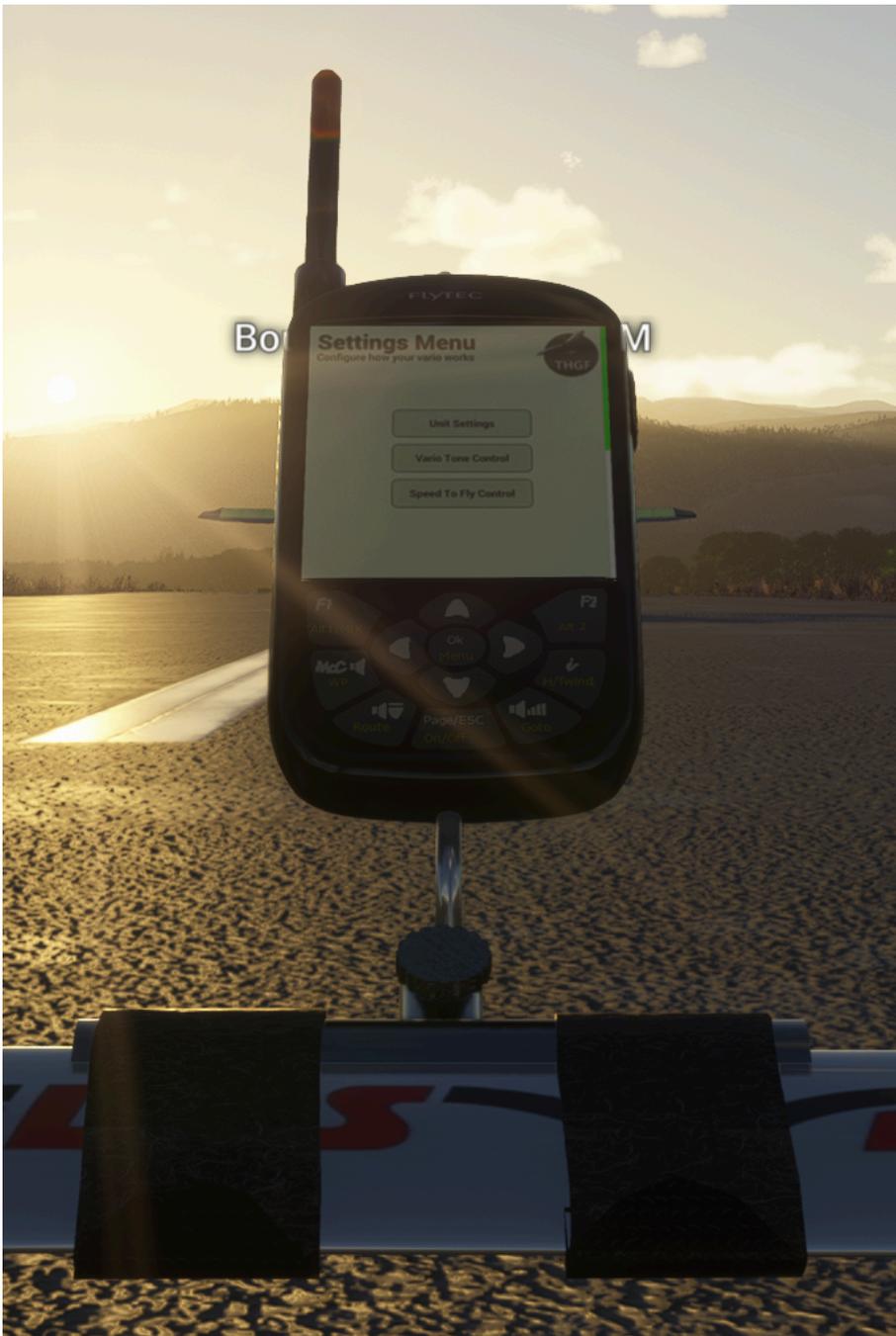
GLIDER POLAR Page — Button Mapping

Button	Action on Glider Polar Page
Power	Toggle instrument On/Off
OK / Menu	Toggle between Main Page and Moving Map

Button	Action on Glider Polar Page
Up Arrow	Not used on this page
Down Arrow	Not used on this page
Left Arrow	Not used on this page
Right Arrow	Not used on this page
F1	Cycle main pages
F2	Jump to ABOUT PAGE
WP	Not used on this page
ROUTE	Not used on this page
PAGE / ESC	Not used on this page
GOTO	Not used on this page
H/Wind	Not used on this page

SETTINGS MENU — Detailed Description

The Settings Menu is the central hub for configuring the variometer's behavior. It provides access to three dedicated settings pages, each focused on a specific aspect of the instrument's operation. The menu is intentionally simple and modular, allowing new pages to be added in future updates without redesigning the interface.



Settings Menu

The Settings Menu consists of three large on-screen buttons:

- Unit Settings
- Vario Tone Settings
- Speed-to-Fly Controls

Selecting any of these buttons opens the corresponding settings page.

Unit Settings

This page allows the pilot to configure all unit-related preferences, including:

- Altitude units (feet / meters)

- Speed units (mph / km/h / knots)
- Vario units (fpm / m/s)
- Distance units (miles / kilometers)
- Pressure units (inHg / hPa)

These settings affect all pages across the instrument.

Vario Tone Settings

This page controls the audio feedback of the variometer:

- Tone frequency
- Tone cadence
- Sink alarm threshold
- Lift tone behavior
- TE/Netto tone options

These settings allow pilots to tailor the audio profile to their flying style and glider type.

Speed-to-Fly Controls

This page configures the STF (Speed-to-Fly) system:

- MacCready value
- STF cue behavior
- STF bar display options
- Integration with polar data
- Task-based STF adjustments

These settings directly influence the blue STF indicators on the Vario Page and Moving Map Page.

SETTINGS MENU — Button Mapping

Button	Action on Settings Menu
Power	Toggle instrument On/Off
OK / Menu	Activates current button
Up Arrow	Selects previous button
Down Arrow	Selects next button
Left Arrow	Not used on this page

Button	Action on Settings Menu
Right Arrow	Not used on this page
F1	Cycle main pages
F2	Jumps to the VARIO PAGE
WP	Not used on this page
ROUTE	Not used on this page
PAGE / ESC	Not used on this page
GOTO	Not used on this page
H/Wind	Not used on this page

These are the most common things you will need to do on this page:

- **OK / Menu:** will activate the current button
- **Up Arrow:** will move to the previous button
- **Down Arrow:** will move to the next button
- **Mouse Actions:**
 - **THGF Logo:** activates the F2 button
 - **Clicking a button will activate that button**

UNIT SETTINGS PAGE — Detailed Description

The Unit Settings Page allows the pilot to configure all measurement units used throughout the variometer. These settings affect every page, every data field, and every calculation performed by the instrument. The page is intentionally simple and uses a consistent layout of drop-down controls, each representing a specific category of units.

All controls are currently mouse-driven, with future support planned for full button-based navigation and selection.



Unit settings page

Drop-Down Controls

Each drop-down box displays the currently selected unit. Clicking the box opens a list of available units for that category. Selecting a new unit immediately updates the global configuration and persists across flights.

- **Altitude Units**

- Feet
- Meters

- **Airspeed Units**

- Miles per hour (mph)
- Kilometers per hour (km/h)
- Knots (kt)

- **Distance Units**

- Nautical Miles
- Miles
- Kilometers

- **Lift / Sink Units**

- Feet per minute (fpm)
- Meters per second (m/s)
- KPS

- **Altitude Units**

- Feet
- Meters

- **Airspeed Units**

- Miles per hour (mph)
- Kilometers per hour (km/h)
- Knots (kt)
- FPS

- **Temperature Units**

- Celsius
- Fahrenheit

- **Wind Speed Units**

- mph
- km/h
- knots
- m/s

- **Time Units**

- AM/PM
- Military format

These settings ensure the instrument can be tailored to regional preferences, competition requirements, or personal comfort.

UNIT SETTINGS PAGE — Button Mapping

Button	Action on Unit Settings Page
Power	Toggle instrument On/Off
OK / Menu	Toggle between Main Page and Moving Map
Up Arrow	Selects previous control
Down Arrow	Selects next control
Left Arrow	Moves to previous selection on current control
Right Arrow	Moves to next selection on current control
F1	Cycle main pages
F2	Jump to SETTINGS MENU PAGE
WP	Not used on this page
ROUTE	Not used on this page
PAGE / ESC	Not used on this page

Button	Action on Unit Settings Page
GOTO	Not used on this page
H/Wind	Not used on this page

These are the most common things you will need to do on this page:

- **Up Arrow:** will move to the previous control
- **Down Arrow:** will move to the next control
- **Right Arrow:** will move to the next item in current control
- **Left Arrow:** will move to the previous item in current control
- **Mouse Actions:**
 - **THGF Logo:** activates the F2 button
 - **Clicking a drop down will open the drop down and allow selecting**

STONE SETTINGS PAGE

The Stone Settings page controls how the variometer generates its audio cues in flight. It provides a simple, focused layout with three configurable sections and two quick-access action buttons, giving pilots an intuitive way to tailor the sound profile to their preferences.



Vario Tone Settings Page

Tone Section

Selects the audio character used for the variometer's lift and sink cues.

Tone Set (dropdown) Chooses the active tone profile. Each profile provides a distinct sound signature and maps directly to a .wav file in the aircraft's sound package.



- Default.
- Classic
- Competition
- Pure (sin wave)

Pick a tone that seem nice to you. You will hear it a lot.

Volume

Sets the overall loudness of the variometer's audio output.



Master Volume (slider) Adjusts the final vario output level from 0–100%. This value scales the processed vario audio before it is passed to the simulator's sound engine.

**This does *not* affect other aircraft sounds — only the vario.

** Wind and other external volume levels are controlled by your personal simulator and output device sound levels. Set those how you want your sound environment level to be and then set you variometer output level.

Thresholds



Defines when the variometer begins producing lift and sink tones based on vertical speed.

- **Lift Threshold (slider)** Sets the minimum climb rate required before the lift tone activates. Values below this threshold remain silent to avoid noise from minor fluctuations.
- **Sink Threshold (slider)** Sets the descent rate at which the sink alarm begins. This helps distinguish meaningful sink from normal, low-level variations in vertical speed.

This is a personal preference for when you want to hear the onset of audio lift or sink cues.

Action Buttons



Use the test buttons to check out what your choices for tone settings sound like.

Test Tone

Plays a short sample of the currently selected tone set

- Uses the same .wav file and pitch curve as the real vario.
- Allows the pilot to preview tone character before flying.

Sink Sound On/Off

Toggles sink tone generation.

- Green = ON
- Red = OFF

This is useful for pilots who prefer silent sink behavior.

STONE SETTINGS PAGE — Button Mapping

Button	Action on Unit Settings Page
Power	Toggle instrument On/Off
OK / Menu	Toggle between Main Page and Moving Map
Up Arrow	Selects previous control
Down Arrow	Selects next control
Left Arrow	Moves to previous selection on current control
Right Arrow	Moves to next selection on current control
F1	Cycle main pages
F2	Jump to SETTINGS MENU PAGE
WP	Turn tone test on/off
ROUTE	Not used on this page
PAGE / ESC	Not used on this page
GOTO	Not used on this page
H/Wind	Turn sink alarm on/off

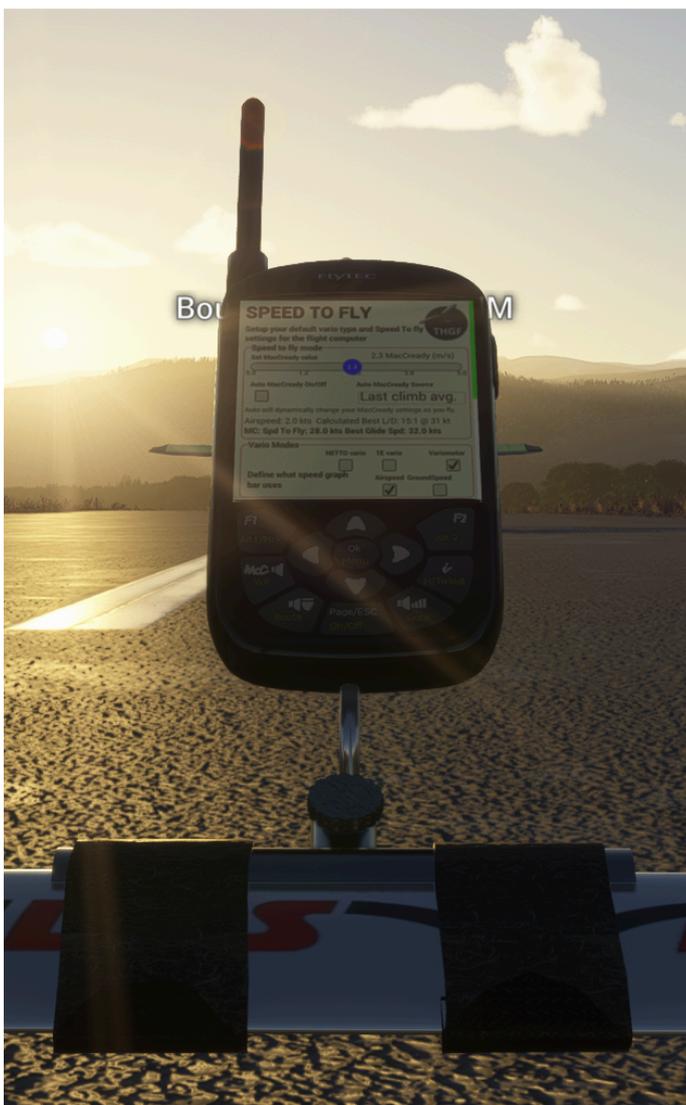
These are the most common things you will need to do on this page:

- **Up Arrow:** will move to the previous control.
- **Down Arrow:** will move to the next control.
- **Right Arrow:** will move to the next item in current control.

- **Left Arrow:** will move to the previous item in current control.
- **Mouse Actions:**
 - **THGF Logo:** activates the F2 button.
 - **Clicking a drop down will open the drop down and allow selecting.**

SPEED TO FLY SETTINGS PAGE

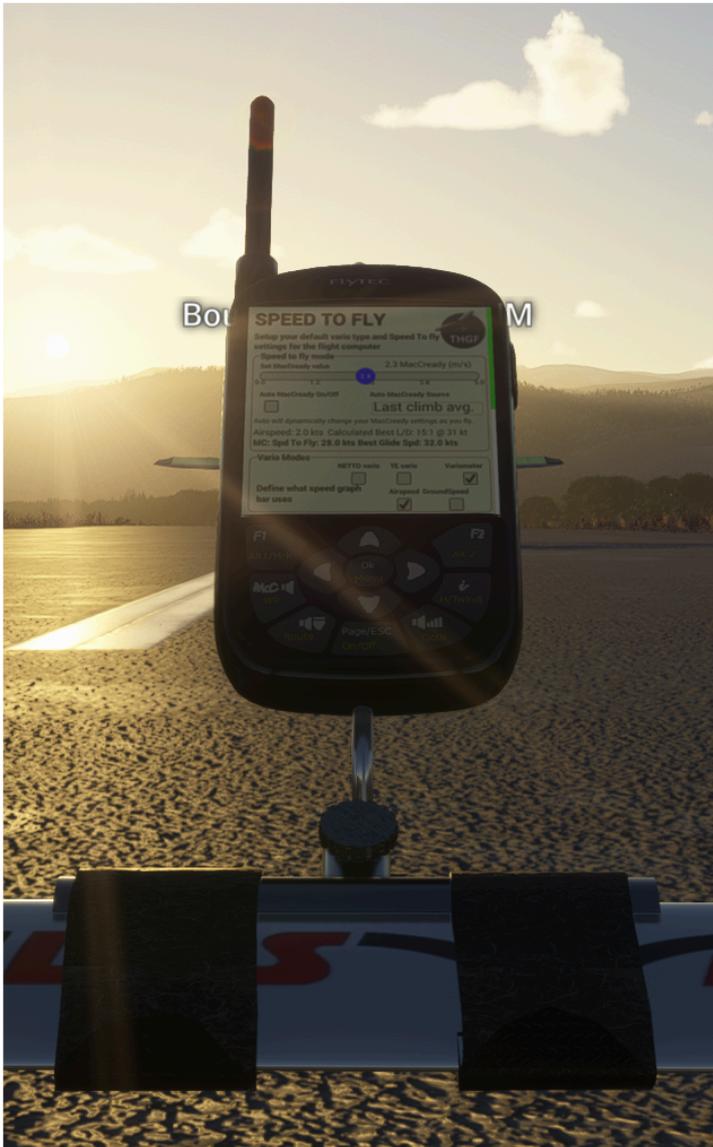
The Speed to Fly Settings page defines how the flight computer calculates real-time STF guidance. It provides a clear, streamlined layout for configuring all parameters that influence STF behavior and performance.



Speed To Fly settings page

Speed to Fly Mode

This section defines how the flight computer selects the optimal airspeed, using MacCready theory and the active variometer mode to drive real-time STF guidance.



Speed To Fly settings page

MacCready Setting



Configures how the flight computer determines the expected climb rate used for Speed-to-Fly calculations.

MacCready Setting (slider)

Range: 0.0–5.0 m/s

The slider thumb displays the current value in a blue circle.

Sets the climb rate assumption used by the STF algorithm.

Higher values command a faster cruise between thermals.

Lower values favor slower, more conservative cruising.

Auto MacCready (checkbox) Enables or disables automatic MacCready adjustment.

ON: The flight computer updates the MC value dynamically based on the selected input source

OFF: The slider value is used as a fixed MC setting

Auto MacCready Input Source (dropdown) Selects how the automatic MC value is derived:

- **Last Climb Avg** — Uses the average climb rate of the most recent thermal.
- **Positive NETTO Value** — Uses only the positive NETTO component to estimate expected lift.
- **Thermal History Avg** — Uses a rolling average of recent thermals to smooth short-term variability.

Live Readouts

Displayed below the configuration controls:

- Current Airspeed Real-time IAS or TAS depending on vario mode.
- Best L/D Speed The glider's best glide speed based on the current polar.
- MC Speed to Fly The computed STF target based on:
- MacCready value

- Vario mode
- Polar
- Current airspeed
- Sink/lift environment.

These values update continuously during flight.

Vario Modes

These checkboxes mirror the vario mode selections available on the main Vario Page. They can be changed here or on the primary display.



Variometer Type (3 checkboxes)

- Basic Vario
- NETTO
- Total Energy (TE)
- Only one mode is active at a time.

Speed Bar Graph Type (2 checkboxes)

- Airspeed
- Groundspeed

These determine which speed source the vertical bar graph uses.

SPEED TO FLY SETTINGS PAGE — Button Mapping

Button	Action on Unit Settings Page
Power	Toggle instrument On/Off
OK / Menu	Toggle between Main Page and Moving Map
Up Arrow	Selects previous control
Down Arrow	Selects next control
Left Arrow	Moves to previous selection or value on current control
Right Arrow	Moves to next selection or value on current control
F1	Cycle main pages
F2	Jump to SETTINGS MENU PAGE
WP	Not used on this page
ROUTE	Not used on this page
PAGE / ESC	Not used on this page
GOTO	Not used on this page
H/Wind	Not used on this page

These are the most common things you will need to do on this page:

- **Up Arrow:** will move to the previous control.
- **Down Arrow:** will move to the next control.
- **Right Arrow:** will move to the next item in current control.
- **Left Arrow:** will move to the previous item in current control.
- **Mouse Actions:**
 - **THGF Logo:** activates the F2 button.
 - **Clicking a drop down will open the drop down and allow selecting.**

FLIGHT DATA PAGE

Displayed automatically after landing, the Flight Data page provides a complete summary of the just-completed flight. It includes glider information, timing, launch/landing details, task scoring (if applicable), and overall performance metrics.



End Of Flight Data Page

Flight Header



Basic information about your last flight can be found at the top of the page:

- **Date of Flight** The local date when the flight ended.
- **Category** The glider category used (e.g., *Kingpost*, *Topless*, *Rigid*, *Swift*, etc.).
- **Variant** The specific preset + livery combination flown. This is effectively the Make / Model of the glider as selected in the aircraft menu.

Clicking the THGF LOGO button or using F2 KEY here will activate the IGC FLIGHT RECORD PAGE.

Primary Flight Metrics

This section describes the most common post flight information fields. These fields basically define the parameters of your flight, even if you are not flying a task.



Three horizontally aligned data blocks:

- **Duration**
- **Takeoff Distance**

- **Landing Location**

In this section you can also interact with the screen by cycling through the takeoff distance field between the Geographic location (lat/lon) and the distance to launch from your current location.

Task Section



The task section of this page is meant to show you how you did your selected task goals. If you did not select a task, this section will show you NO TASK SELECTED.

- **NO TASK SELECTED**

You see only this message here when there was no known task selected. You can still activate this area to see the MISSION SCORE PAGE using either the mouse or the PAGE/ESC key.

Task Information

If a task *was* active, this section displays the full scoring summary.

- **Task Name**
- **Task Type**
 - *RT* (Race to Goal)
 - *AAT* (Assigned Area Task)
- **Start Time** The simulator time the glider crossed the start cylinder.
- **Status**
 - In Progress (task not completed before landing)
 - Partial Task (some turnpoints achieved)
 - Completed (all turnpoints achieved)

Task Performance Metrics

- **TP Made** Number of turnpoints successfully achieved.
- **Distance** Distance of the task completed (full or partial).
- **Time** Time from task start to landing. *Not the same as total flight duration.*
- **Avg Speed** Average speed over the completed portion of the task.
- **Score Percentage**-based score derived from task completion.

Clicking anywhere inside the task area (mouse only) → Opens the Mission Score page.

General Info



A summary of overall flight status and key performance metrics.

Flight Status

OK, Damaged, or Crash Based on the glider's final state at landing.

Data Fields

- Takeoff Time Local time of launch.
- Launch Type
- Elevation at landing.
- Max Elevation Highest altitude reached during the flight.
- Max AGL Maximum height above ground level achieved.
- Max Vario Peak climb rate recorded.

Types of launches supported:

- *Slew*
- *Foot Launch*

- *Tow*
- *Placement*

FLIGHT DATA PAGE — Button Mapping

Button	Action on Unit Settings Page
Power	Toggle instrument On/Off
OK / Menu	Toggle between Main Page and Moving Map
Up Arrow	Selects previous control
Down Arrow	Selects next control
Left Arrow	Moves to previous selection on current control
Right Arrow	Moves to next selection on current control
F1	Cycle main pages
F2	Jump to SETTINGS MENU PAGE
WP	Not used on this page
ROUTE	Not used on this page
PAGE / ESC	Not used on this page
GOTO	Not used on this page
H/Wind	Not used on this page

These are the most common things you will need to do on this page:

- **Up Arrow:** will move to the previous control.
- **Down Arrow:** will move to the next control.
- **Right Arrow:** will move to the next item in current control.
- **Left Arrow:** will move to the previous item in current control.
- **Mouse Actions:**
 - **THGF Logo:** activates the F2 button.
 - **Clicking a drop down will open the drop down and allow selecting.**

IGC FLIGHT RECORD PAGE

The IGC Flight Record page displays a graphical summary of the altitude profile from the most recent flight. This page is shown only after landing and provides a quick visual verification of the recorded IGC data.



IGC flight log graph page

Altitude Graph

A single graph is displayed:

- **Altitude AGL over time** Plotted from takeoff to landing.
- **Launch Elevation Line** A horizontal red line indicating the original launch elevation. This allows the pilot to visually compare climb performance relative to launch height.

The graph uses the internally logged IGC data collected during the flight.

EXPORT Button

A single button is available:

- **EXPORT** Creates a complete, ready-to-use **IGC file** in the work directory. The file follows standard IGC formatting and can be opened in any gliding analysis software.

IGC FLIGHT RECORD PAGE — Button Mapping

Button	Action on Unit Settings Page
Power	Toggle instrument On/Off
OK / Menu	Toggle between Main Page and Moving Map
Up Arrow	Not used on this page
Down Arrow	Not used on this page
Left Arrow	Not used on this page
Right Arrow	Not used on this page
F1	Cycle main pages
F2	Jump to FLIGHT DATA PAGE
WP	Not used on this page
ROUTE	Not used on this page
PAGE / ESC	Will export the IGC log file
GOTO	Not used on this page
H/Wind	Not used on this page

These are the most common things you will need to do on this page:

F2 will move to the previous item in current control.

PAGE/ESC will export the IGC file.

- **Mouse Actions:**
 - **THGF Logo:** activates the F2 button.
 - **Button Click:** will export the IGC file.

MISSION SCORE PAGE

The Mission Score page displays the **game scoring** for the completed flight. This scoring system evaluates both **performance** and **realism**, producing a final score that reflects how well the pilot flew and how accurately the glider was

operated.

This page is accessible by clicking inside the **Task** area on the Flight Data page.



The Mission Score includes a gamified multiplier that rewards realistic flying and penalizes shortcuts or unsafe behavior. These adjustments modify the Base Score (your task points) to produce the Final Score.

The multiplier always starts at 1.00 and is adjusted by the bonuses and penalties listed below. Each item appears in the Mission Score details after the flight.

Launch Realism

Your launch method affects realism and therefore your score.

Condition	Effect
Foot-launch or tow-launch	No penalty
Any non-realistic launch (slew, teleport, etc.)	-0.20

Realism Settings

Disabling core realism features reduces the challenge and applies penalties.

Setting	Condition	Penalty
Real Weather	Disabled	-0.10
Crash Detection	Disabled	-0.10
Crash With Others	Disabled	-0.10

Slew Mode During Task

Using slew mode after the task has started is a major realism break.

Condition	Effect
Slew used during task (change in altitude or position)	-0.30

Weather & Time Manipulation

Changing the environment mid-task undermines competitive fairness.

Action	Penalty
Weather changed during task	-0.25
Time zone changed during task	-0.10

Low Save Bonus

You earn bonuses for climbing out from below 100 m AGL and sustaining lift long enough to count as a genuine “*low save*.”

Action	Effect
Each valid low save	+0.05
Multiple low saves stack (e.g., 3 saves = +0.15)	

A low save is awarded when:

- You drop below 100 m AGL,
- Begin climbing,
- Maintain climb for at least 5 minutes,
- Without losing altitude below the entry point.

Cloud Base Behavior

Reaching cloud base is rewarded — but cloud flying is penalized.

Condition	Effect
Reached cloud base with <50% cloud penetration	+0.10
Entered clouds deeply (>50% density)	-0.10

Oxygen Deprivation Risk

Flying above 12,500 ft (MSL) for extended periods is unsafe.

Condition	Effect
More than 30 minutes above the limit	-0.10

Vne Exceedances

Flying above Vne (based on 2× VS1 for now) is dangerous.

Condition	Effect
Each full minute above Vne	-0.05
Penalties stack (e.g., 4 minutes = -0.20)	

Crash or Damage

Major events override most other scoring considerations.

Condition	Effect
Crash	Multiplier forced to -0.70
Any structural damage	-0.50

Par-Speed Bonus

If the task has a par time, you earn a bonus for flying closer to the par speed.

Condition	Effect
Nearest to flying a defined par time	Percentage × 250
Example: 0.80 of par → +200	

This can be a significant positive multiplier.

Final Calculation

The Mission Score is:

$$\text{Final Score} = \text{Base Score} \times \text{Multiplier}$$

All bonuses and penalties are listed individually in the Mission Score page so pilots can understand exactly what influenced their result.

MISSION SCORE PAGE— Button Mapping

Button	Action on Unit Settings Page
Power	Toggle instrument On/Off
OK / Menu	Toggle between Main Page and Moving Map
Up Arrow	Not used on this page
Down Arrow	Not used on this page
Left Arrow	Not used on this page
Right Arrow	Not used on this page
F1	Cycle main pages
F2	Jump to FLIGHT DATA PAGE
WP	Not used on this page
ROUTE	Not used on this page
PAGE / ESC	Not used on this page
GOTO	Not used on this page
H/Wind	Not used on this page

These are the most common things you will need to do on this page:

- **F2:** will return to the FLIGHT DATA PAGE
- **Mouse Actions:**
 - **THGF Logo:** activates the F2 button

DAMAGE PAGE

The Damage Page consists of **two sub-pages** that the pilot can toggle between:

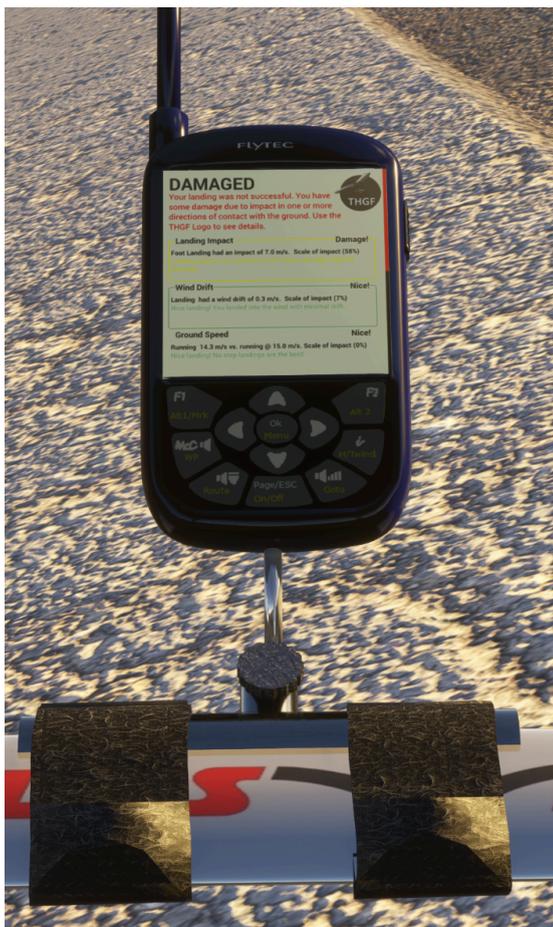
1. **Vector Analysis**
2. **Damage Report**

These pages summarize the landing impact forces and any resulting structural damage to the glider.

Clicking the **THGF logo** switches between the two pages.

Damage Report

This page provides a **textual summary** of the damage assessment.



Damage Breakdown

For each velocity component that exceeded its threshold:

- The component is listed: Landing impact, Wind Drift, and Ground Speed.
- The **percentage** of the damage threshold reached is shown
- Multiple components may be listed if more than one contributed to the damage state.

This allows the pilot to understand:

- Which axis caused the damage
- How severe each component was
- Whether the landing was marginal or catastrophic

Vector Analysis



This page displays a **3D vector diagram** representing the glider's velocity components now of landing.

3D Vector Graph

- Shows **X**, **Y**, and **Z** velocity vectors as arrows.
- Each arrow represents the magnitude and direction of the velocity component at touchdown.
- Any vector that exceeds the configured **damage** or **crash** thresholds is shown in **red**.
- Vectors within safe limits are shown in the normal color.

This provides a visual indication of which axis contributed to damage or crash state.

DAMAGE PAGE — Button Mapping

Button	Action on Unit Settings Page
Power	Toggle instrument On/Off
OK / Menu	Toggle between Main Page and Moving Map
Up Arrow	Selects previous control
Down Arrow	Selects next control
Left Arrow	Moves to previous selection on current control
Right Arrow	Moves to next selection on current control
F1	Cycle main pages
F2	Jump to SETTINGS MENU PAGE
WP	Not used on this page
ROUTE	Not used on this page
PAGE / ESC	Not used on this page
GOTO	Not used on this page
H/Wind	Not used on this page

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- **Down Arrow:** will move to the next control
- **Right Arrow:** will move to the next item in current control
- **Left Arrow:** will move to the previous item in current control
- **Mouse Actions:**
 - **THGF Logo:** activates the F2 button
 - **Clicking a drop down will open the drop down and allow selecting**

Variometer Positioning

The variometer can be repositioned on the control frame and tilted toward or away from the pilot. These adjustments allow the pilot to customize visibility and ergonomics based on flying style, harness angle, and cockpit layout. All position and tilt settings are **saved persistently** and remain in effect across flights.

Tilt Adjustment

The variometer can be displayed in one of two tilt states:

- **Tilted** The instrument face is angled upward toward the pilot for easier viewing in prone flight.
- **Not Tilted** The instrument face is aligned vertically with the mounting bracket.

How to Toggle Tilt

- **Click the mounting stem** beneath the variometer. Each click toggles between *tilted* and *not tilted*.

This control has an in-sim tooltip for clarity.

Mounting Position on the Control Frame

The variometer can be mounted in **three different locations** on the glider's control frame:

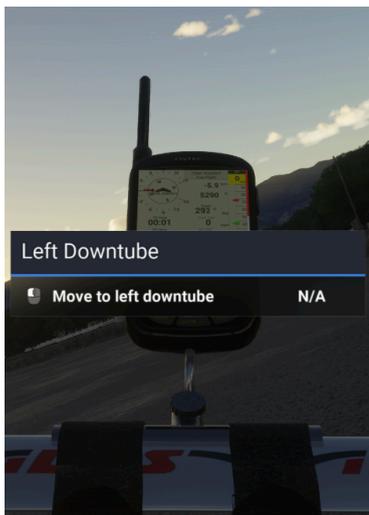
1. **Left Downtube**
2. **Center of the Basetube**
3. **Right Downtube**

These positions allow the pilot to choose the most natural viewing angle depending on preference and cockpit layout.

All three positions persisted **between flights**.

How to Change Mounting Position

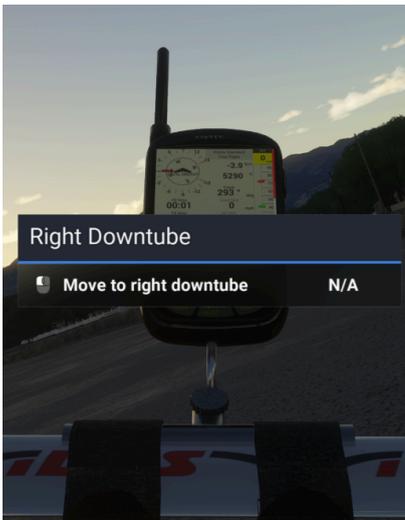
Each mounting location is selected by clicking a specific part of the bracket or attachment hardware:



Left Downtube

- Click the **left bracket attachment Velcro**.

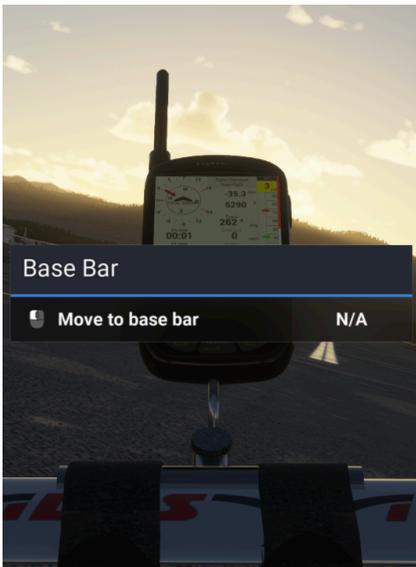
Each of these interactive points includes an **in-sim tooltip** to help the pilot identify the control.



Right Downtube

- Click the **right bracket attachment Velcro**.

Each of these interactive points includes an **in-sim tooltip** to help the pilot identify the control.



Center Basetube

- Click the **mounting bracket tightening knob**.

Each of these interactive points includes an **in-sim tooltip** to help the pilot identify the control.

Persistence

- The selected **tilt state**
- The selected **mounting position**

...are both saved automatically and restored on the next flight.

No additional configuration is required.

Summary

The THGF Variometer is a complete, pilot-focused flight instrument designed for Microsoft Flight Simulator 2024. It recreates the behavior, workflow, and feel of a real-world soaring instrument while also providing tools that help new pilots learn, experienced pilots refine their technique, and simulator pilots enjoy richer, more varied flights.

Although it is built as a **fully accurate replica** of a real hang-gliding variometer—complete with TE/NETTO modes, MacCready logic, STF guidance, IGC logging, and post-flight analysis—it also includes features that take advantage of the simulator environment to enhance learning, exploration, and gameplay.

For Simulator Users New to Soaring

Many MSFS users have never flown a hang glider or used a variometer before. This instrument is designed to make soaring approachable:

- Clear, readable displays
- Simple navigation between pages
- Automatic logging and post-flight summaries
- Visual maps, task guidance, and waypoint tools
- Built-in explanations through tooltips and intuitive UI layouts

The variometer teaches new pilots the fundamentals of soaring:

- What lift and sink feel like
- How to center a thermal
- How to read NETTO and TE
- How to use MacCready theory to fly efficiently
- How to plan a glide to a waypoint or goal
- How to interpret altitude, AGL, and terrain clearance

The post-flight pages (Flight Data, IGC Graph, Mission Score, Damage Report) help new pilots understand *why* their flight went the way it did, and how to improve the next one.

In short: **New pilots can learn soaring from scratch using this instrument alone.**

For Experienced Hang-Glider Pilots

Real-world pilots expect accuracy, realism, and familiarity. This instrument is built to meet those expectations:

- True TE and NETTO calculations
- Realistic MacCready and Speed-to-Fly logic
- Accurate polar-based glide predictions
- Realistic vario tones, thresholds, and audio behavior

- IGC-compliant logging
- Launch/landing detection
- Realistic wind, drift, and thermal metrics
- Configurable mounting positions and tilt, just like real hardware

Experienced pilots will recognize:

- The workflow
- The page structure
- The tone behavior
- The STF guidance
- The thermal averaging
- The task scoring logic
- The post-flight analysis tools

The instrument behaves like a real vario because it *is* modeled after one—just implemented inside a simulator.

For real-world pilots, this becomes a **practice tool**:

- Learn to read NETTO more effectively
- Practice MacCready decision-making
- Improve thermal centering technique
- Understand glide planning and arrival altitudes
- Analyze flights with IGC tools identical to real competitions

This is not a “sim toy”—it is a **training-grade instrument**.

For Real-World Training and Skill Development

Because the instrument is a faithful replica, it can be used to:

- Teach new pilots how variometers work
- Demonstrate the difference between Basic, NETTO, and TE
- Practice Speed-to-Fly without real-world risk
- Learn how MacCready affects cruise speed
- Understand how wind, terrain, and thermals interact
- Build intuition for lift lines, ridge lift, and convergence
- Review flights using IGC graphs and damage vectors

The simulator environment allows repeated practice in a safe, controlled setting—something real-world training cannot always provide.

This makes the THGF variometer a **valuable learning tool** for both students and instructors.

Gamification and Replay Value

Beyond realism, the variometer adds **gameplay depth** that makes every flight unique:

- **Task scoring** Encourages improvement and competition.
- **Mission Score multipliers** Reward smooth flying, efficiency, and realism.
- **Damage analysis** Adds consequences and feedback for poor landings.
- **IGC export** Allows pilots to compare flights, compete, and track progress.
- **Dynamic STF and thermal metrics** Make each day feel different.
- **Future enhancements** (traffic, online tasks, weather feeds) Will expand replay ability even further.

These features turn soaring into a **progression-based experience**, not just a free-flight activity.

The result is a system where:

- Every flight has goals
- Every landing has meaning
- Every task has strategy
- Every pilot has room to improve

This is where simulation and sport meet.

In Summary

The THGF Variometer is:

- A **realistic soaring instrument**
- A **training tool** for real-world pilots
- A **learning tool** for new pilots
- A **gameplay engine** for simulator users
- A **post-flight analysis suite**
- A **task and competition companion**
- A **modular, future-expandable system**

It bridges the gap between simulation and real-world soaring, giving every pilot—new or experienced—a deeper, more meaningful flying experience.

Appendix A: Work directory

The simulator sandbox allows the C++ WASM (apps) to read and write from only 1 directory:

In this directory you will find all settings, configurations etc. that you have set for this type of glider. It applies to all make and models of this type of glider. Different categories of gliders such as rigid wings, etc. **will have different work**

directory paths.

This is the only directory that WASM Gauge can read from as well. That is why any task files used by the variometer/flight computer are put here as well.

Flight logs and IGC flight recording can also be found here.

work

This is an example of a typical path:

```
C:\Users\<USER NAME>\AppData\Roaming\Microsoft Flight Simulator 2024\WASM\MSFS2024\<PACKAGE NAME>\work
```

<USER NAME> is your username on your PC

<PACKAGE NAME> is the name of the glider category package you are flying

Typical package names:

- thgf-single-surface: all single surface type gliders
- thgf-intermediate: all double surface type gliders with king posts
- thgf-topless: all double surface type gliders without king posts
- thgf-spoilers: all rigid wing type gliders that use spoiler control
- thgf-rigid: all rigid wing type gliders that use 3-axis control

File types in the work directory

XCSoar task files (.tsk)

The variometer can see and use any *.tsk (XCSoar task format) files found in this directory. Drop any file of this type here to be able to use it inside the simulator

IGC flight logs (.igc)

The variometer will automatically or manually create these flight export files after flights. Look here to find the track logs of your recent files.

Variometer Settings

All your personal settings for variometer configurations and preferences are saved in files in this directory. They can be manually edited if necessary.

- Data_config_settings: data page definitions
- Map_view_settings: moving map page settings
- Vario_settings:
- Tone_settings

- Control_bar_settings
- Xcsoar_settings

Appendix B: Data Configuration System

This appendix describes how the THGF variometer stores, loads, and manages user-defined data page layouts. It is intended for pilots, developers, and advanced users who want a deeper understanding of how the system persists and restores custom configurations.

Overview

The THGF variometer allows pilots to customize the data fields displayed on each Flytec-style page. These customizations are stored in a single JSON file located in the WASM **Work Directory**: see [Appendix A](#)

File Characteristics of: data_config_settings

This file contains the current definition for the 7 pages of data fields that are displayed on the main vario page. It comes with a factory defined set of data fields and page names. You can cycle any data field slot on any data page to be any data field type. You can do this by using the mouse to click on any data field. It will automatically change to the next available data field: see [Appendix C](#):

Single Active Configuration File

Only **one** configuration file is used at runtime. It is overwritten whenever the user:

- Changes to a data field
- Resets to factory defaults

Because the file is overwritten in place, the system always reflects the most recent user configuration.

Human-Readable and Manually Editable

The file is plain JSON. Users may:

- Open it in any text editor and make modifications directly, including page names
- Modify slot assignments to any data field type on any page.
- Rename pages
- Copy/paste entire configurations

The system will validate the file on load. Invalid or unknown slotType values are ignored and replaced with UNDEFINED_DATA_TYPE.

Shareable by Copy/Paste

Because the file is text-based and self-contained, users can share configurations simply by:

- Copying the JSON
- Sending it via email or messaging
- Pasting it into their own data_config_settings file

This makes it easy to distribute competition presets, club standards, or personal layouts.

Resetting to Factory Defaults

Users may restore the original Flytec-style layout at any time.

A factory reset:

- Deletes the current data_config_settings file
- Recreates the default page configuration
- Reinitializes all pages and slot assignments

This is the recommended recovery method if:

- The file becomes corrupted
- Manual edits introduce errors
- The user wants to start fresh

Use the “**Reset to Factory Layout**” button in the Settings Menu.

JSON Structure

Each page entry contains:

Field	Description
groupName	Category label (e.g., <i>Flytec Standard</i>)
name	Page title shown in the UI
personalConfig	Array of 7 slot objects
personalConfig[i].slotType	Integer referencing VARIO_DATA_TYPES
personalConfig[i].name	Reserved for future use

Example (excerpt)

Example Configuration: Page-by-Page Interpretation

The following tables decode the example data_config_settings file into human-readable form. Each page corresponds to one entry in the pConfig array.

Page 1 — “Free Flight”

Slot	slotType	Enum	Display Name
1	29	CYL_DISTANCE	Distance to cylinder
2	1	GROUND_TRACK	Ground Track
3	3	TIME	Current Time
4	6	GROUND_SPEED	Ground Speed
5	3	TIME	Current Time
6	5	WIND_SPEED	Wind Speed
7	1	GROUND_TRACK	Ground Track

Page 2 — “Make the start point”

Slot	slotType	Enum	Display Name
1	14	ARRIVAL_H_WP	Arrival Height at WP
2	15	ALLOWED_H	Floor of overhead airspace
3	24	WP_DISTANCE	Distance to destination
4	22	OPT_START_SPEED	Ground speed for optimal start
5	23	WP_DIRECTION	Direction to destination
6	20	TIME_BEFORE_START	Time before race start
7	2	DURATION	Flight Time

Page 3 — “Make a waypoint”

Slot	slotType	Enum	Display Name
1	37	GROUND_LD	Ground L/D
2	15	ALLOWED_H	Floor of overhead airspace
3	33	WIND_COMPONENT	Wind Component
4	14	ARRIVAL_H_WP	Arrival Height at WP
5	4	WIND_SPEED	Wind Speed
6	24	WP_DISTANCE	Distance to destination
7	23	WP_DIRECTION	Direction to destination

Page 4 — “Go to goal”

Slot	slotType	Enum	Display Name
1	38	GOAL_LD	Goal L/D
2	5	WIND_SPEED	Wind Speed
3	37	GROUND_LD	Ground L/D
4	18	ALT_ABOVE_GO	Altitude above best glide around course
5	3	TIME	Current Time
6	26	GOAL_DISTANCE	Distance to goal
7	3	TIME	Current Time

Page 5 — “Find last thermal”

Slot	slotType	Enum	Display Name
1	49	THERMAL_MACCREADY	MacCready
2	51	THERMAL_SPEED_TO_FLY	Speed to Fly
3	9	HEIGHT_GAIN	Total Height Gained
4	47	THERMAL_DIRECTION_TO	Dir to Thermal
5	48	THERMAL_LAST_AVERAGE	Last Avg
6	25	THERMAL_DISTANCE	Distance to last thermal
7	46	THERMAL_IN_THERMAL	In Thermal

Page 6 — “AAT Task information”

Slot	slotType	Enum	Display Name
1	18	ALT_ABOVE_GO	Altitude above best glide around course
2	3	TIME	Current Time
3	43	AAT_DISTANCE_GOAL	AAT Goal
4	44	AAT_TIME_TO_WP	AAT T to WP
5	26	GOAL_DISTANCE	Distance to goal
6	41	AAT_TIME_REMAINING	AAT T Remain
7	40	AAT_DURATION	AAT Time

Appendix C: DATA FIELD ENCYCLOPEDIA

This table provides the authoritative mapping from slotType integer values in the JSON file to the internal VARIO_DATA_TYPES enum and their display names.

Value	Enum	Display Name	TASK	AAT
0	TEMPERATURE	Temperature		
1	GROUND_TRACK	Ground Track		
2	TIME	Current Time		
3	DURATION	Flight Time		
4	WIND_SPEED	Wind Speed		
5	GROUND_SPEED	Ground Speed		
6	MSL_ALT	MSL Altitude		
7	ALT_FT	Altitude in feet		
8	REF_HEIGHT	Reference Height		
9	HEIGHT_GAIN	Total Height Gained		
10	GPS_ALT	GPS Altitude		
11	FLIGHT_LEVEL	Flight Level		
12	ALTQNH	Air Pressure (millibars)		
13	ALTQNH1	Air Pressure (Hg)		
14	ARRIVAL_H_WP	Arrival Height at WP	X	
15	ALLOWED_H	Floor of overhead airspace	X	
16	VARIO	NETTO		
17	ALT_ABOVE_BG	Altitude above best glide WP	X	
18	ALT_ABOVE_GO	Altitude above best glide around course	X	
19	CESS	Vertical distance up to CESS		
20	TIME_BEFORE_START	Time before race start	X	
21	TIME_BEFORE_WP	Time before next WP	X	
22	OPT_START_SPEED	Ground speed for optimal start	X	

Value	Enum	Display Name	TASK	AAT
23	WP_DIRECTION	Direction to destination	X	
24	WP_DISTANCE	Distance to destination	X	
25	THERMAL_DISTANCE	Distance to last thermal		
26	GOAL_DISTANCE	Distance to goal	X	
27	RESTRICT_DIST	Distance to restricted area		
28	TO_DISTANCE	Distance to Takeoff		
29	CYL_DISTANCE	Distance to cylinder	X	
30	STCLY_DISTANCE	Distance to start cylinder	X	
31	OPTCLY_DISTANCE	Distance to optimized cylinder intercept	X	
32	OFF_TRACK_DISTANCE	Distance off track of course line	X	
33	WIND_COMPONENT	Wind Component		
34	AIR_SPEED	Air speed		
35	WP_LD_REQ	L/D required to reach WP	X	
36	ACTUAL_LD	Actual L/D		
37	GROUND_LD	Ground L/D		
38	GOAL_LD	Goal L/D	X	
39	FLARM	FLARM		
40	AAT_DURATION	AAT Time	X	X
41	AAT_TIME_REMAINING	AAT T Remain	X	X
42	AAT_DISTANCE	AAT Dist	X	X
43	AAT_DISTANCE_GOAL	AAT Goal	X	X
44	AAT_TIME_TO_WP	AAT T to WP	X	X
45	AAT_DISTANCE_IN_WP	AAT Dist in WP	X	X
46	THERMAL_IN_THERMAL	In Thermal		
47	THERMAL_DIRECTION_TO	Dir to Thermal		
48	THERMAL_LAST_AVERAGE	Last Avg		
49	THERMAL_MACCREADY	MacCready		

Value	Enum	Display Name	TASK	AAT
50	WIND_DIRECTION	Wind Dir.		
51	THERMAL_SPEED_TO_FLY	Speed to Fly (<i>internal / advanced</i>)		
53	THERMAL_SPEED_TO_FLY_GLIDE	STF L/D (<i>internal / advanced</i>)		
54	THERMAL_TOTAL_ENERGY	Total Energy (<i>internal / advanced</i>)		
55	THERMAL_VARIOMETER_RATE	Vario Rate (<i>internal / advanced</i>)		

You can now drop these sections straight into the appendix after your JSON structure and reset/factory sections. If you'd like, next step could be a tiny "Editing safely" box with 3–4 concrete do's and don'ts.

Appendix D: Future Enhancements (Planned)

The following features represent planned or potential improvements to the THGF Variometer and its supporting ecosystem. These items are not currently implemented but are under consideration for future development phases.

Data Configuration

The current system uses a single active configuration file. A future update may introduce:

Multiple Configuration Profiles

A new Settings Menu page could allow users to:

- Browse available configuration files
- Select one as the active layout
- Duplicate, rename, or delete profiles

File Identification via Extension

To support multiple profiles while remaining JSON-based, we may adopt a dedicated extension .

This would allow:

- Clean separation of user profiles
- Easy sharing
- Automatic discovery by the UI
- Backward compatibility with the existing data_config_settings file

Import / Export UI

A simple interface could allow:

- Importing a configuration from clipboard
- Exporting the current configuration
- Restoring factory defaults
- Switching between saved profiles

Traffic Integration

Display nearby gliders from your flying group directly on the **Map Pages**.

- Show relative position, altitude, climb rate, and bearing
- Useful for team flying, gaggle management, and thermal sharing
- Could integrate with multiplayer or external group-tracking APIs

Enhanced Site Information

Currently, the variometer receives only a **numeric site ID** when teleported via the EFB.

Future improvements may include:

- Automatic download of **full site metadata** from the web
- Display of:
 - Site name
 - Launch type
 - Elevation
 - Wind limits
 - Local hazards
 - Recommended approach/landing notes
- Integration with the THGF global site database

This would make the vario more informative when flying at unfamiliar locations.

Real-World Weather Integration

Pull live weather data from external sources such as:

- NOAA
- Open-Meteo
- Local METAR/TAF feeds

- Ridge wind models
- Thermal forecasts

This would allow the vario to display:

- Real-time wind
- Cloud base estimates
- Thermal strength predictions
- Weather-based task suggestions

Competition and Group Flying Features

Add competitive and social flying tools directly into the vario or EFB:

- Join active groups
- See nearby group members
- Live scoring updates
- Group task assignment
- Team communication indicators
- Leaderboards

This would support both casual group flying and structured competitions.

Task Search and Online Task Database

Currently, tasks must be placed manually into the **vario work directory**.

Future enhancements may include:

- Searching tasks from an **online task repository**
- Downloading tasks directly into the vario
- Browsing tasks by:
 - Region
 - Difficulty
 - Distance
 - Type (RT, AAT, OLC)
- Community-shared tasks
- Integration with EFB task management

This would greatly expand the available task library without requiring manual file management.

Additional Ideas

A few more possibilities that align with the system's architecture:

Adaptive STF and Thermal Prediction

- Machine-learned thermal patterns
- Predictive MacCready adjustments
- Real-time glide optimization based on terrain and weather

Replay and Debrief Tools

- In-vario playback of the last flight
- Thermal tracing
- Climb efficiency heatmaps
- Speed-to-fly compliance graphs

Customizable UI Themes

- Day/Night modes
- High-contrast mode
- User-defined color palettes

Expanded Hardware Interaction

- Support for external buttons or switches
- VR-optimized interaction zones
- Haptic feedback for vario tones (future hardware)

Future

The future? The future ain't here yet! Well, it is. We can't wait to see what is next.

How to help

Join our Patreon and help us continue on this journey.

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