triadis

XCSoar

Manual (Altair version)

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Notes

Preface

Revision history

Revision	Date	Status	Author	Changes, comments
1.6 EN	15/09/2007	released	J.Wharington	Standard XCSoar manual
1.7 EN	08/01/2008	draft	D.Wettstein	Altair version, layout rework
1.7 GR	02/02/2008	draft	D.Wettstein	German translation
1.8	03/07/2008	released	D.Wettstein	New features, XCSoar Altair version 5.2

This manual applies to XCSoar version 5.2. The authors reserve the right to update this manual as enhancements are made throughout the life of this product.

Warnings and precautions

> ***IT IS THE USER'S RESPONSIBILITY TO USE THIS SOFTWARE PRUDENTLY. THIS SOFTWARE IS INTENDED TO BE USED ONLY AS A NavIGATION AID AND MUST NOT BE USED FOR ANY PURPOSE REQUIRING PRECISE MEASUREMENT OF DIRECTION, DISTANCE, LOCATION, OR TOPOGRAPHY. THIS SOFTWARE SHOULD NOT BE USED AS AN AID TO DETERMINE GROUND PROXIMITY FOR AIRCRAFT NavIGATION. THIS SOFTWARE SHOULD NOT BE USED AS A TRAFFIC COLLISION AVOIDANCE SYSTEM.***

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Contents

1 Introduction

This document is a pilot's manual that describes the functionality of XCSoar when used with Altair. XCSoar is an open source glide navigation system for portable devices. The audience is assumed to have a sound knowledge of the fundamental theory of flight for gliders, and at least a basic working knowledge of cross-country soaring.

Updates to the XCSoar software may result in some of this manual being out of date. You should read the release notes distributed with the software to keep track of changes. Updates to the manual and software are available from `http://www.triadis.ch` .

1.1 Organisation of this manual

This manual is broadly organised into the major functions of the software from a pilot's perspective. The remainder of this section deals with how to download, install and run the software on various platforms. Section 2 introduces the user interface concepts and gives an overview of the display.

Section 3 describes the moving map part of the display in greater detail and describes how the software can assist in general navigation. Section 4 describes how cross-country tasks are specified and flown, and presents some of the analysis tools available to pilots to help improve their performance. Section 5 goes into further detail on the glide computer functions as it is important for pilots to be aware of how the computer performs its calculations.

Section 6 describes how the computer can interface to variometers and other air data sensors, and how it uses these measurements to provide various models of the atmosphere, in particular on winds and thermal convection. Section 7 describes how XCSoar can assist in managing flight in special use airspace and the FLARM collision awareness system. Section 8 deals with systems integration and systems diagnostics, the integration of XCSoar with communications devices and with airframe switches.

The remainder of the manual contains mainly reference material. Section 10 lists the types of information that can be displayed in the grid of InfoBoxes next to the map display. The configuration of the software is described in detail in section 11. The formats of the various data files that program uses, as well as where to obtain them from and how to edit them, is described in section 12.

Finally, a short history and discussion of XCSoar's development process is presented in section 13.

1.2 System requirements

- **Altair** The triadis engineering GmbH Altair glide computer is a glide computer factory installed with XCSoar.
- **GPS data source** The Altair Pro version contains an internal GPS. The standard version additionally needs an external GPS data input. This must be a NMEA-0183 data source that outputs GPRMC and GPGGA sentences. Suitable devices include handheld serial GPS devices, glider flight loggers, GPS-integrated variometers, and FLARM. Up to two GPS devices may be used simultaneously, giving XCSoar a degree of redundancy of the GPS fixes.

1.3 Running XCSoar

XCSoar starts up automatically when Altair is powered on. The PWR/ESC button (top left) on Altair has multiple functions:

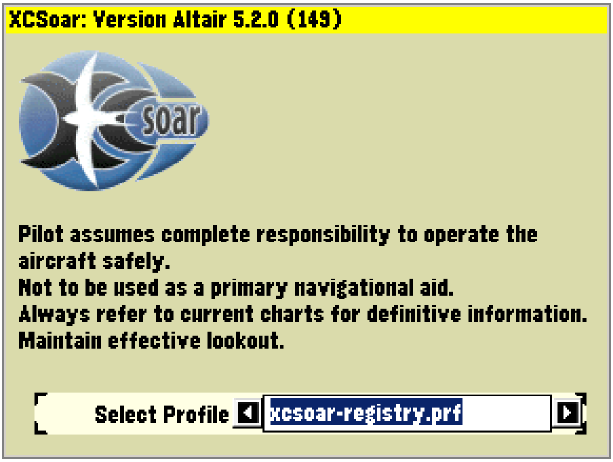
- **Powering on** Press and hold the PWR/ESC button for one second. The LED in the button will light up, and XCSoar will start after Altair has booted.
- **Powering off** Press and hold the PWR/ESC button for approx. two seconds. Altair will switch off.
- **Escape** Pressing the PWR/ESC button quickly acts as an Escape key, typically used to close dialog pages or as a cancel function.

Start-up and user profiles

When XCSoar starts up, it displays a start-up screen with a safety reminder and a profile selector. XCSoar allows multiple independent configurations to coexist for different purposes, such as:

- Different pilots
- Competition versus casual flying
- Flying in different locations

These configurations can be saved in profiles. To proceed, select your profile and press Enter.



The customization of profiles is described briefly in section 12. When multiple profiles are available, changes to configuration settings will only affect the profile selected at start-up; others are unaffected.

Splash screen

When XCSoar starts up, shuts down, or loads large files, such as airspace, waypoints etc, a progress bar with a description of the current process is shown below the safety reminder. The current software version is displayed in the header.

Last flight statistics

The previous flight's statistics are automatically saved when XCSoar is shut down, and loaded again at startup. This allows the flight to be reviewed even after shutting down Altair. Note that these persistent flight statistics use approximately 85 kilobytes of storage.

Previous flight statistics are automatically reset on a new takeoff in order not to affect the current flight.

Persistent settings

The basic settings (MacCready setting, Bugs, Ballast, QNH, maximum forecast temperature) are preserved when XCSoar shuts down and restored when XCSoar initialises.

Exiting the program

To shut down Altair (XCSoar), press the PWR/ESC button for approx. two seconds and confirm the shutdown process by pressing YES on the dialog that comes up.

1.4 Through-life support

Troubleshooting

A small team of dedicated developers produces XCSoar. Although we are happy to help with the use of our software, we cannot teach you about basics of modern information technology. There are ample existing resources dealing with these. If you have a question about XCSoar please email us at `xcsoar-user@lists.sourceforge.net`.

You may find some solutions to standard problems in the Frequently Asked Questions (FAQ) section of the XCSoar website.

Furthermore, we recommend to subscribe to the XCSoar users mailing list so you will be kept up to date with latest developments.

A log file of the startup functions of XCSoar is generated to the file `xcsoar-startup.log`. This is transferred to the 'FromAltair' directory by AltairSync if a USB drive is plugged in when Altair is first switched on. It can then be sent to the XCSoar developers to help determine the cause if the program crashes at startup.

XCSoarPC

XCSoarPC may be used to become familiar with XCSoar's interface and functionality in the comfort of one's home. All files and configuration used by XCSoarPC are identical to the Altair versions, so it can be helpful to try out customizations on the PC version before using them in flight.

XCSoarPC can also be connected to external devices and operates just as Altair does. Suggested uses include:

- Connect the PC to a FLARM device to use XCSoarPC as a ground station display of FLARM-equipped traffic.
- Connect the PC to an intelligent variometer such as Vega to test configuration settings of the variometer.

1.5 Using XCSoar safely

The use of an interactive system like XCSoar in flight carries with it certain risks due to the potential distraction of the pilot from maintaining situational awareness and eyes outside the cockpit.

The philosophy guiding the design and development of the software is to try to reduce this distraction by minimising the need for user interactions as much as possible, and by presenting information in a clear fashion able to be interpreted in a glance.

Pilots using XCSoar must take responsibility for using the system safely. Good practice in the use of XCSoar includes:

- Becoming familiar with the system thoroughly through training on the ground.
- Performing clearing turns before interacting with XCSoar in flight in order to ensure there is no collision risk with other traffic.
- Setting up the system to take advantage of automatic functions and input events so that user interactions can be minimised. If you find yourself mechanically performing certain interactions frequently, ask yourself (or other XCSoar users) if the software can be made to do these interactions for you.

1.6 Graphical elements in this document

The following elements are used in this document to simplify understanding:

- Onscreen menus
- Dialogs
- Buttons
- ***Warnings***
- *Remarks*

2 User Interface

This section describes the fundamental user interface concepts used by XCSoar, and is intended as an overview. More detailed descriptions are given in following sections.

The XCSoar display is composed of several parts:

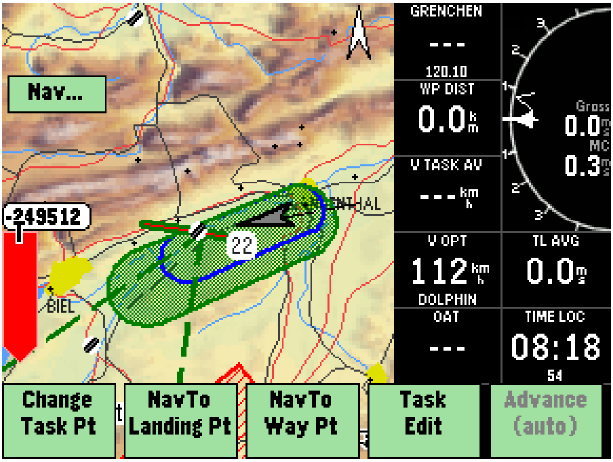
- **Map area** The bulk of the screen is dedicated to the GPS moving map display. Various symbols relating to glide computer information are overlaid on the map area. Icons and text may appear along the lower edge of the screen to indicate status of connected devices, operating modes etc.
- **InfoBoxes** A grid of data values is displayed to the right of the screen. These so-called InfoBoxes display data from the GPS and other input devices as well as data generated by the glide computer.
- **Gauges** Gauges (upper right corner) provide instrumentation displays. All gauges are optional and some may only have meaningful information displayed when XCSoar is connected to a supported instrument.
- **Button labels and menus** These buttons are drawn in black (resp. grey) text on a green background.
- **Status messages** Text is displayed over the map area in status message boxes. This text is used to present detailed information to the pilot when certain events occur.

• **Dialog windows** Larger dialog windows, usually containing graphics and buttons, are used to present detailed data to the pilot regarding waypoint details, statistics and analysis etc.

To interact with XCSoar, you can either use the Altair buttons or external switches and devices connected to XCSoar. For XCSoarPC, clicking the mouse over an item is equivalent to touching it.

2.1 Button labels and menus

The button menu is a set of buttons drawn on the screen and activated by hardware button presses. Using buttons and the button menu are the primary ways the user interacts with XCSoar.



Interface basics

The menu is organised into different groups of functions, usually in the form of a hierarchy. However, the specific menu layout depends on the hardware button configurations.

XCSoar can also accept input from external keyboards, game-pads, joysticks, stick grip switches etc. A wide variety of functions can be assigned to these inputs.

For Altair, there are four major menus, activated by pressing one of the vertical strip of hardware buttons on the left of the display. When a menu is activated, a strip of onscreen buttons appear along the bottom of the display. At the last page, pressing the menu button again will turn that menu off and the horizontal strip of onscreen buttons disappear. Three dots on the right side of a menu title (e.g. NAV...) indicate that there is another row of buttons, whereas three dots on the left side (e.g. ...NAV) indicate that the menu will be closed the next time you press this menu button.

Pressing the particular menu button again will cycle through several pages of items. Pressing the corresponding horizontal button will activate that item.

On the PC version (XCSoarPC), these mode buttons are activated by the F1,2,3,4 keys (menu buttons). The F6,7,8,9,0 keys (F buttons) correspond to the horizontal strip of buttons.

If the user doesn't interact with the computer for a certain time, the menu will close automatically. This menu timeout is configurable. The escape key on PC, or the PWR/ESC button on Altair, can also be used to close the current menu.

Menu button labels appear as grey text instead of black if the corresponding function is not available. For example, the AAT Target button will appear grey if the task is not an AAT task.

Several menu button labels have dynamic text based on context, in order to make it clearer as to what happens when the button is pressed. The convention is used that a button's label describes what will happen when the button is pressed. For example, if the button says Map Off , then pressing the button will turn off terrain and topology, and the button label will then change to Map On . In the menu list described below, generic labels are used.

Menu overview

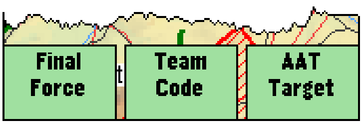
This section describes the default layout of the menu system. The functions performed by each button are explained more in detail in the following sections.

The primary menu buttons are activated by each of the vertical strip of buttons on Altair, from top to bottom:

NAV	Navigation and task settings
DISP	Display and map settings
CONF	Configuration of XCSoar, connected devices, and in-flight settings
INFO	Display of various information dialogs

2.1.1 NAV menu

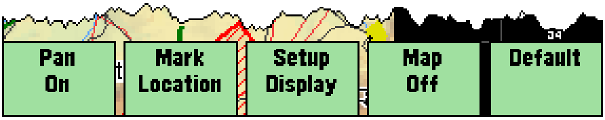
- **Change ..Pt** Change the current task, landing or waypoint. See 4.1 for more details.
- **NavTo ..Pt** Change navigation mode. See 4.1 for more details.
- **Task Edit** Opens Task Editor . See 4.2 for more details.
- **Advance ..** Manually advance to or arm next task point. See 4.2 for more details.



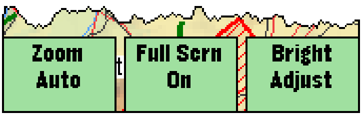
- **Final Force** Switches between automatic and forced final glide mode. See 5.1 for more details.

- **Team Code** Opens Team Code . See 7.10 for more details.
- **AAT Target** Configuration of the AAT target settings. See 4.1 for more details.

2.1.2 DISP menu

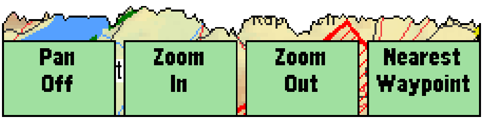


- **Pan On** Activates pan map mode. See 3.2 for more details.
- **Mark Location** Drops a marker at the current glider location. See 3.7 for more details.
- **Setup Display** Opens Setup Display . See 2.3.6 for more details.
- **Map Off** Switches terrain and topology on/off.
- **Default** Restores default display settings.



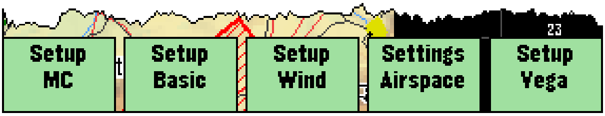
- **Zoom Auto** Switches between automatic and manual zooming. See 3.1 for more details.
- **Full Scrn On** Switches between full screen (without InfoBoxes) and normal display.
- **Bright Adjust** Opens Screen Brightness . See 2.8 for more details.

2.1.3 Pan mode

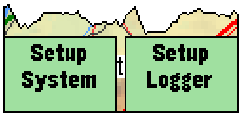


- **Pan Off** Turns pan mode off.
- **Zoom In** Zooms in the map display.
- **Zoom Out** Zooms out the map display.
- **Nearest Waypoint** Opens Waypoint Browser . See 4.4 for more details.

2.1.4 CONF menu



- **Setup MC** Opens Setup MacCready . See 5.2 for more details.
- **Setup Basic** Opens Basic Settings . See 5.4 for more details.
- **Setup Wind** Opens Wind Settings . See 6.5 for more details.
- **Settings Airspace** Opens Airspace Browser . See 7.7 for more details.
- **Setup Vega** Opens Setup Vega if Vega is connected. See 6.1 for more details.



- **Setup System** Opens the XCSoar configuration dialog. See 11 for more details.
- **Setup Logger** Opens Altair Flight Recorder Setup . See 4.8 for more details.

2.1.5 INFO Menu

- **Waypoint Details** Opens Waypoint Info for the active task waypoint. See 4.2 for more details.
- **Nearest Waypoint** Opens Waypoint Browser with the nearest task waypoints. See 4.4 for more details.
- **Nearest Airspace** Opens Airspace Info with the nearest airspaces. See 7.6 for more details.
- **Status Show** Opens Status . See 2.5 for more details.
- **Aux Info On** Toggles the InfoBox display between normal (flight-mode specific) or auxiliary InfoBox display. See 2.2 for more details.

- **Analysis Show** Opens Analysis . See the different 'Analysis dialog: ...' parts of this document for more details.
- **Checklist** Opens Checklist . See 12.10 for more details.
- **Message Last** Repeats the last status message.

Default buttons

When no menu is active, (so-called default mode), the horizontal row of buttons in Altair perform the following functions (from left to right):

F6	F7	F8	F9	F0
Setup Basic	Final Force	Display Mode	FR Event	FLARM Dsp On

Pressing PWR/ESC on Altair displays labels for these default menu buttons.

Rotary knob

In default mode, the rotary knob performs the following functions:

- **Outer knob counterclockwise** Zoom in
- **Outer knob clockwise** Zoom out
- **Inner knob counterclockwise** (No function assigned)
- **Outer knob clockwise** (No function assigned)
- **Knob button press** Clear status message or acknowledge airspace warning

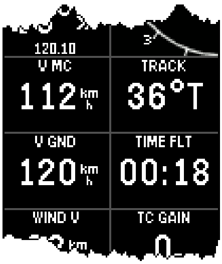
In dialog forms, the rotary knob in Altair performs the role of the cursor and enter keys:

- **Outer knob counterclockwise** Up cursor
- **Outer knob clockwise** Down cursor
- **Inner knob counterclockwise** Left cursor
- **Inner knob clockwise** Right cursor
- **Knob button press** Enter key

Dynamic menu labels

Certain menu items now have dynamic labels to make it clearer what happens when the menu item is selected. The convention used is for the labels to display the action that will be performed once the menu item is selected. Items that are not available are greyed out to indicate that selecting the menu item will not do anything.

2.2 InfoBoxes



The customizable InfoBoxes are used to display informations regarding atmosphere, flight, task, etc. The available fields are listed in section 11.12.

Screen display modes

The screen can be toggled between the following main display modes:

- Map with standard InfoBoxes (flight mode specific; see 5.1 for more details).
- Map with auxiliary InfoBoxes

  INFO ▷ Aux Info On

- Full-screen map, InfoBoxes hidden

  DISP ▷ Full Scrn On

When auxiliary InfoBoxes are displayed, the word 'AUX' appears at the lower left corner of the map area.

2.3 Dialog windows

XCSoar contains two categories of dialog windows: interactive ones that can be used to set up tasks, configure and modify settings, and informational ones that simply display information.

Controls

A cursor shows the active button, tab or data field. This cursor appears as a highlighted area with black borders around the corners. When rotating the outer knob (up/down) on Altair, the cursor cycles through the next or previous elements (buttons, menus, fields, etc). When rotating the inner knob (left/right), the value of the element under the cursor can be modified.

Pressing the enter key selects or activates the element under the cursor (button, data field).

Many of the dialog windows have multiple pages of information and are controlled in a consistent fashion. Press the ◀ or ▶ buttons to select the next or previous page of the dialog, and the Close button to make the dialog disappear. The PWR/ESC button can also be used to close dialogs.

The user must close the dialog to return to the normal map mode. When a dialog has been opened, the Altair buttons change their functions or are disabled until the dialog is closed.

In some dialogs, items that are not relevant or valid are not displayed (e.g. AAT details in a non-AAT task).

We will now list all dialogs of the current XCSoar version like they appear in the onscreen menus. Most of them are described in detail in other sections; in these cases there is only a basic description in this part.

2.3.1 Waypoint Select

Access: In navigation mode WayPoint: NAV ▷ Change WayPoint

Description: Search and change waypoints. For more details see 4.2.

2.3.2 Change Task Point

Access: In navigation mode TaskPoint: NAV ▷ Change Task Pt

Description: Change the current task point. For more details see 4.1.

2.3.3 Change Landing Point

Access: In navigation mode LandingPoint: NAV ▷ Change Landing Pt

Description: Change the current landing point. For more details see 4.1.

2.3.4 Task Editor

Access: NAV ▷ Task Edit

Description: Set up and modify tasks. For more details see 4.2.

2.3.5 Team Code

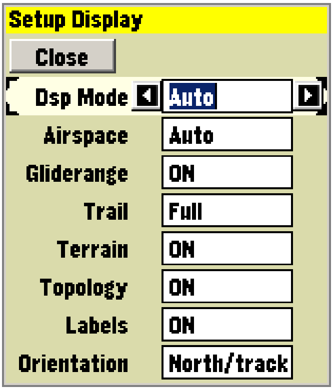
Access: NAV ▷ Team Code

Description: Setting team codes and showing team mates' positions. For more details see 7.10.

2.3.6 Setup Display

Access: DISP ▷ Setup Display

Description: Settings of the map display.



- **Dsp Mode** Change display mode. For more details see 2.2 resp. 5.1.
- **Airspace** Airspace settings. For more details see 11.2.
- **Gliderange** Switch gliderange on/off. For more details see 3.5.
- **Trail** Change trail display settings. For more details see 3.4.
- **Terrain** Switch terrain on/off.
- **Topology** Switch topology on/off.
- **Labels** Switch waypoint labels on/off.
- **Orientation** Change map display orientation. For more details see 11.3.

2.3.7 Screen Brightness

Access: DISP ▷ Bright Adjust

Description: Adjusts the screen brightness. For more details see 2.8.

2.3.8 Setup MacCready

Access: CONF ▷ Setup MC

Description: MacCready settings. For more details see 5.2.

2.3.9 Basic Settings

Access: CONF ▷ Setup Basic

Description: Basic settings. For more details see 5.4.

2.3.10 Wind Settings

Access: CONF ▷ Setup Wind

Description: Wind settings. For more details see 6.5.

2.3.11 Airspace Browser

Access: CONF ▷ Settings Airspace

Description: Search and modify display settings of airspaces. For more details see 7.7.

2.3.12 Setup Vega

Access: CONF ▷ Setup Vega

Description: Vega settings. For more details see 6.1.

2.3.13 Configuration

Access: CONF ▷ Setup System

Description: XCSoar configuration settings. For more details see 11.

2.3.14 Altair Flight Recorder Setup

Access: CONF ▷ Setup Logger

Description: Altair Flight Recorder Setup. For more details see 4.8.

2.3.15 Waypoint Info

Access: INFO ▷ Waypoint Details

Description: Shows informations about the selected waypoint. For more details see 4.5.

2.3.16 Waypoint Browser

Access: INFO ▷ Nearest Waypoint

Description: Searching of waypoints. For more details see 4.4.

2.3.17 Airspace Info

Access: INFO ▷ Airspace Nearest

Description: Searching of airspaces. For more details see 7.6.

2.3.18 Status

Access: INFO ▷ Status Show

Description: Overview information on the aircraft, system, and task. For more details see 2.5.

2.3.19 Analysis

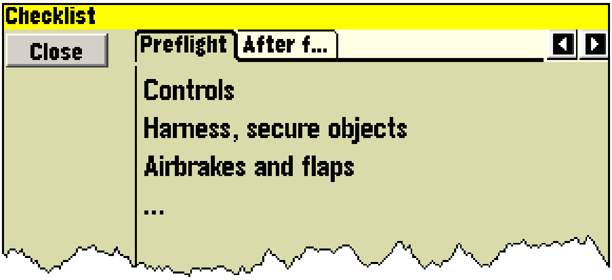
Access: INFO ▷ Analysis Show

Description: Shows information about air data, aircraft or tasks. For more details see the related parts in the different sections of this document.

2.3.20 Checklist

Access: INFO ▷ Check list

Description: Checklist can display several pages of user-defined free text, typically this is used for checklists.



These checklists may include: daily inspection, preflight, outlanding, pre-landing, radio procedures, and aircraft rigging and de-rigging instructions. For more details see 12.10.

2.4 Status messages

Status messages appear over the map area to present text for a short period of time. The message disappears after the time period has elapsed, and different types of message have different periods. If necessary, status messages can be made to disappear by acknowledging the message by pressing Enter.

Typical status messages include:

- Airspace queries
- Airspace warnings
- User interface events (e.g. changing display modes)
- Glide computer events (e.g. takeoff, turning waypoints)

> *Status messages do not appear while a dialog is on screen, the messages are buffered and displayed as soon as the dialog is exited.*

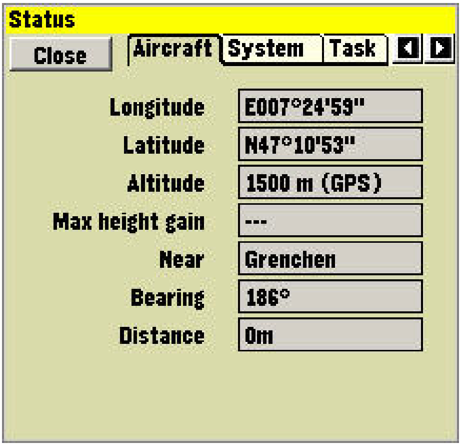
The duration each type of status message appears can be defined in the configuration settings. The default duration for important messages is 30 seconds, for other messages the default duration is 1.5 seconds.

Additional user buttons may be assigned to a status message repeat function.

2.5 Status dialog

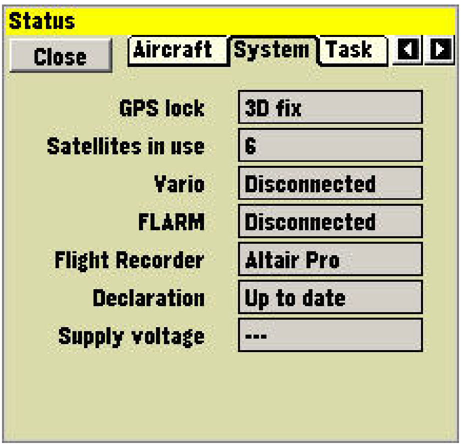
Status shows general information about different topics and can be opened at any time. It contains several pages with specific content and serves as general status overview.

Aircraft



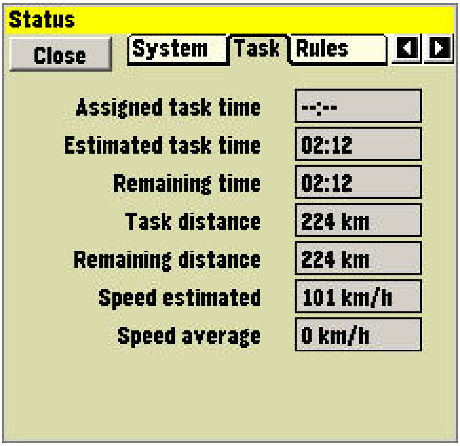
- **Longitude** Aircraft's longitude
- **Latitude** Aircraft's latitude
- **Altitude** Aircraft's altitude
- **Max height gain** xxxxxxx
- **Near** Nearest waypoint
- **Bearing** Bearing to nearest waypoint
- **Distance** Distance to nearest waypoint

System



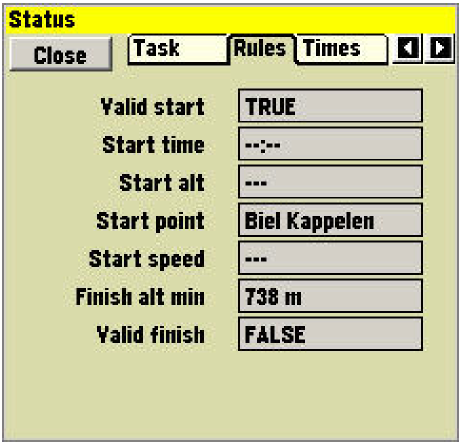
- **GPS lock** Whether a GPS source is connected.
- **Satellites in use** Satellites used for GPS reception.
- **Vario** Whether a variometer is connected.
- **FLARM** Whether a FLARM device is connected.
- **Flight Recorder** Type of flight recorder.
- **Declaration** xxxxxxxx
- **Supply voltage** Supply voltage.

Task



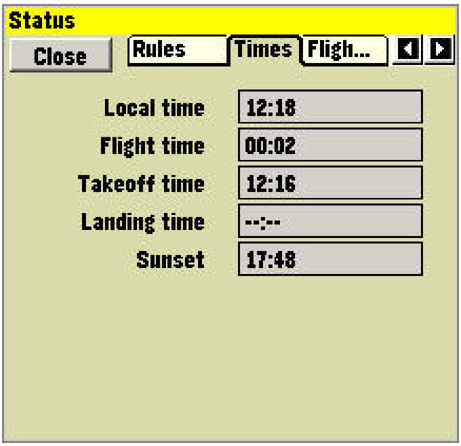
- **Assigned task time** Minimum AAT task time.
- **Estimated task time** Estimated task time with current MacCready settings.
- **Remaining time** Remaining time to final task point.
- **Task distance** Task distance.
- **Remaining distance** Distance to final task point.
- **Speed estimated** xxxxxxxx
- **Speed average** Average speed so far.

Rules



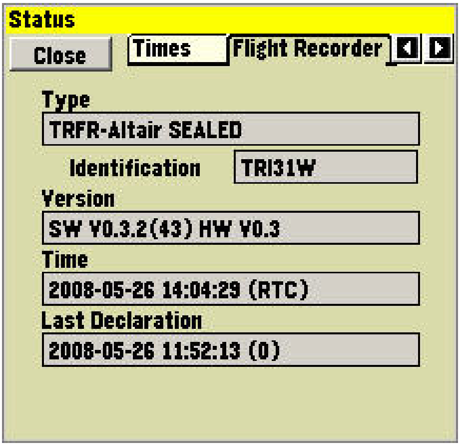
- **Valid start** Whether a valid Start was recognized
- **Start time** Start time
- **Start alt** Start altitude
- **Start point** Start task point
- **Start speed** Start speed
- **Finish alt min** Minimum finish altitude
- **Valid finish** Whether a valid Finish was recognized

Times



- **Local time** Local time
- **Flight time** Flight time
- **Takeoff time** Takeoff time
- **Landing time** Estimated landing time
- **Sunset** Sunset at finish waypoint

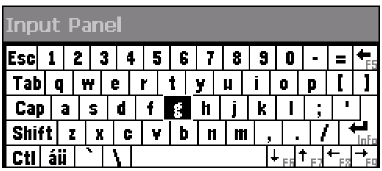
Flight Recorder



- **Type** Flight Recorder Type
- **Identification** Flight Recorder Identification
- **Version** Flight Recorder Version
- **Time** Flight Recorder Time
- **Last Declaration** Time and date of last declaration

2.6 Text entry

When needed, text can be entered over a virtual keyboard. This keyboard can be opened by pressing the  button on the appropriated fields.



To enter text, rotate the knobs to choose a character with the cursor and press Enter. When the keyboard is open, the buttons on Altair have the following functions:

ESC	NAV	DISP	CONF	INFO		F5	F6	F7	F8	F9
Esc	Cap	Shift	áü	Enter		Back	Down	Up	Left	Right

2.7 Sounds

XCSoar generates sounds for different events, and can be configured to have custom sounds for any event. see 12.15 for details on customization.

When XCSoar is connected to the Vega intelligent variometer, it sends commands to Vega's speech system, to give verbal cues and warnings such as:

- Final glide through terrain
- Approaching/passing a task waypoint
- Airspace warnings

2.8 Screen

Certain aspects of the look of items on the screen can be adjusted. See 11 for more details.

The control of the screen hardware brightness can be controlled from Screen Brightness accessible from DISP ▷ Bright Adjust .

Refer to the *Altair User's Manual* for details on Screen Brightness .

2.9 Help system

A help system now provides descriptive text for properties in most dialogs. When a property is selected, press and hold the enter button for two seconds, then release. A window will open with help text describing the property.

3 Display Elements

This section describes the different elements of the display.

3.1 Zoom and map scale

The map is generated in a projected coordinate system (not longitude and latitude). The map scale may be modified (zooming) at any time and the map can be panned. All navigation functions take account of the earth curve.

To zoom in and out in manual zoom mode, use the rotary knob.

The map scale is displayed in the lower left corner of the moving map display.

There is a facility to have two zoom settings; one when the glider is in circling flight mode, and one in the cruise or final glide flight mode. This is the ‘Circling zoom’ option in the configuration settings. When the user zooms in or out, it affects the current mode’s zoom setting only, so when leaving the mode the previous mode’s zoom setting is used. If ‘Circling Zoom’ is not enabled, there is only a single zoom level.

Auto-zoom automatically zooms in when approaching a waypoint to keep the waypoint at a reasonable screen distance. The user can still zoom out if desired. When auto-zoom is active, ’AUTO’ appears next to the map scale.

To turn auto zoom on or off, select from the menu

DISP ▷ Zoom Auto

When a waypoint changes (automatically, via the task selector, or by manually switching waypoints), auto-zoom returns the zoom level to what it was immediately prior to its alteration. This has the effect of allowing users to zoom in and out manually in cruise, and when approaching a waypoint, the system automatically zooms in.

3.2 Panning the map

A pan mode allows the user to explore areas beyond the glider. This is particularly useful when task planning. Here is how the pan mode can be used:

1. Enable pan mode by pressing

   DISP ▷ Pan On

2. The map can then be panned with the inner/outer rotary knob. To zoom in/out, you can use the F6/F7 buttons in Pan mode.

3. When done, pan mode should be disabled, by activating the menu again:

   DISP ▷ Pan Off

   or by pressing ESC.

When pan is active, the text 'PAN' appears next to the map scale and a special row of buttons is displayed (see 2.1.3). The location of focus moves and rotates with the glider when panning.

3.3 Glider symbol

The glider symbol shows the position of the glider on the map. The orientation of the glider indicates the estimated heading of the glider.

Course

The map is oriented in one of two ways, depending on the flight mode and the configuration settings:

- **North-up** Here the map is always oriented with true north up. The glider symbol is rotated according to its track corrected for wind.
- **Track-up** Here the map is oriented so that the glider's track made good is up. The north arrow symbol points to true north. The glider symbol may be shown rotated according to the computed heading of the glider taking wind into account.

Configuration settings can be used to further specify north or target-up when in circling mode. These are useful to prevent disorientation when looking at the map while circling. Target-up when circling makes it easy to determine which direction to exit the thermal.

When in North or target-up in circling modes, the glider symbol is centered on the screen. Otherwise the glider symbol is positioned 20% from the bottom of the screen, giving a good view of the map ahead of the glider. This position is adjustable in the configuration settings.

For more details about these modes and combinations, see 11.3.

Position

If you need to know further details about your exact position, there are mainly two information sources:

Nearest Waypoint Waypoint Browser shows the nearest waypoints to your position.

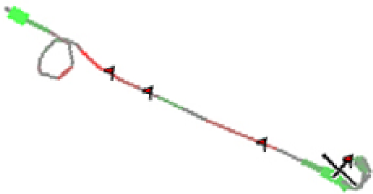
   Access: INFO ▷ Nearest Waypoint

Status Aircraft The 'Aircraft' page of Status shows the exact position of the glider.

   Access: INFO ▷ Status Show

3.4 Trail

An optional trail is drawn on the map showing the glider's path history. The colour and thickness of the trail depends on the variometer value; with lift areas being presented in green and thicker lines, sink areas being presented in red with thin lines. Zero lift is presented as a grey line.



If Vega or an intelligent variometer is connected with Netto output, the Netto vario value is used; hence the colours and thickness of the trail indicates the air-mass vertical movement rather than the glider's vertical movement.

The trail display can be toggled between off, short (about ten minutes), long (about one hour) or full (entire flight). This can be performed through the configuration settings or by the menu:

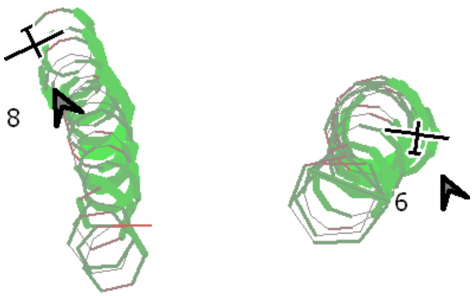
DISP ▷ Setup Display

The trail width can be adjusted in the configuration settings (see 11.3).

Note that for each of these modes, the trail is short in circling mode in order to reduce screen clutter.

In order to assist centering thermals in the presence of wind, the trail can be artificially drifted with the wind as it is displayed (drift compensation). In this way, the trail is referenced to the prevailing wind rather than referenced to the ground. Since thermals drift with the wind also, the drifted trails give a better indication of where the glider has been relative to the thermals.

An example of this is illustrated below. Note that when trail drift compensation is active (right picture), the glider appears to be circling in a column rather than an elongated spiral (left picture).



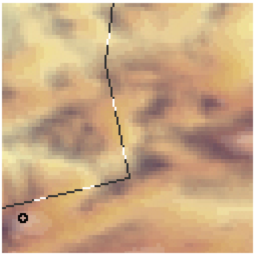
Enabling trail drift compensation is performed through the configuration settings. The compensation is only performed whilst in circling mode; the display of the trail in cruise mode is unaffected. This can also be performed from the wind settings dialog:

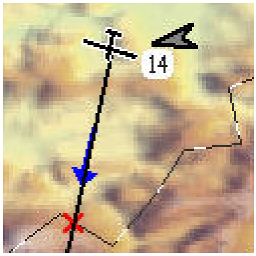
CONF ▷ Setup Wind

The trail drift display is useful also to show more clearly when thermals are cranked due to wind shear.

3.5 Glide range

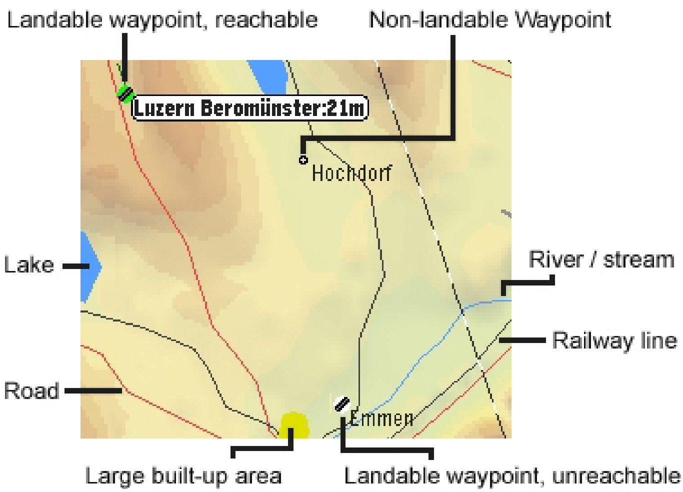
A reachable glide ‘footprint’ is displayed on the map display as a dashed line, indicating where the glider would descend through the terrain clearance height. This glide range line is calculated for tracks extending in all directions. This feature is useful in assessing range with respect to topology when searching low for lift, and when flying in mountainous areas.





The final glide path is checked for whether the glider clears terrain by the terrain clearance height. If clearance is not attained, a red cross appears on the map at the point where the violation occurs. No icon is drawn if there is no task defined.

3.6 Map elements



The moving map shows:

- Waypoints
- Terrain and topology
- Markers

The map is drawn in a projected coordinate system (not latitude and longitude), and the scale can be changed (zooming in and out), as well as panned. All navigation functions take the curvature of the Earth into account.

Waypoints

Waypoints are displayed with different symbols depending on the waypoint type; the major distinction being landable and non-landable waypoints.

triadis engineering GmbH recommends the option 'Alternative' for waypoint display (see 11.11). With this option, the waypoint symbols are drawn as shown below:

Non-landable waypoints: small black hollow circles.

Unreachable airfields: white with a grey diagonal band.

Reachable airfields: green with a grey diagonal band.

At large zoom scales, all waypoints are drawn as small black crosses.

Waypoints are optionally labelled according to one of several abbreviation schemes.

XCSoar continually calculates which landing points are within gliding range using the current wind estimate. The estimated arrival altitude *above the arrival safety height* of reachable landable points is optionally displayed next to the waypoint (see 11.3 for these configuration options). This arrival altitude is calculated at the MacCready setting of zero.

Terrain and topology

The following topological features are drawn on the map:

- Major roads, shown as red lines
- Railway lines, shown as black lines
- Rivers, shown as blue lines
- Large water bodies (lakes), shown as blue areas
- Large cities, shown as yellow areas

Terrain is coloured according to height, and optionally shaded by sun direction or lift-generating slope. Invalid terrain, or terrain below sea level is coloured blue.

Terrain is phong-shaded to improve visibility. Currently the shading is set up so that the virtual lighting position is the wind bearing, thus brighter areas are on the upwind side of hills and dark areas in the lee of the hill. The amount of phong shading and the overall terrain brightness are configurable (see 11.4). Support for a sun ephemeris is underway.

Terrain and topology display can be switched on or off individually in the configuration settings, or together over the following menu:

DISP ▷ Map Off

If the terrain file is not specified (or terrain display is turned off), the background colour of the map window is white. All terrain below mean sea level is coloured blue. If you are flying outside the terrain region, the background colour will also be blue.

Some other layers and labels can be turned on or off to improve the visibility. See 11.3 for more details.

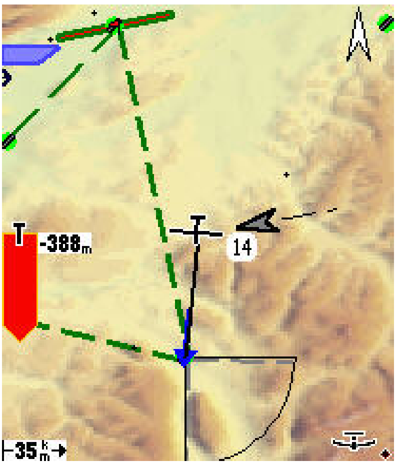
3.7 Markers

Markers are shown as small flags on the map. The markers can be dropped manually by the menu:

DISP ▷ Mark Location

Markers are not preserved after XCSoar is exited, however the location of all marks are appended to the file `xcsoar-marks.txt`.

3.8 Active task elements

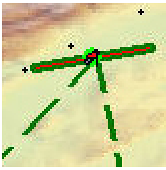
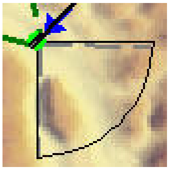
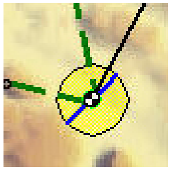


Course

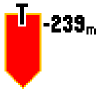
The active task course is drawn on the map as a green dashed line. At all times a thick black line is drawn from the glider to the next task waypoint and a blue arrow indicates the recommended course to this waypoint.

Taskpoints

The start and finish taskpoint show circles or lines representing the start and finish zones or lines. Task observation sectors are drawn as segments. Assigned area tasks also show the task sectors or areas as a shaded region.

Start/finish Line	*Start/finish Cylinder*	*Taskpoint Sector*	*Taskpoint AAT*
			

Final glide bar



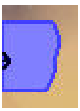
An arrow on the left side displays the calculated height difference required for the glider to complete the task. For more details, see 5.8.
On this arrow, a letter is displayed, which indicates the current task navigation mode:

- **T** NavTo Task Point
- **L** NavTo Landing Point
- **W** NavTo Way Point

For more information about the navigation modes see 4.1.

3.9 Thermal profile

Statistics on climb rates in thermals are collected and displayed in a thermal band meter. It is not shown when the glider is above final glide. It is also not shown when the glider is below the break-off height, as you should then be focused on just staying airborne or finding an outlanding field.



The thermal band meter shows a graph, where the vertical axis is height above the break-off height, and is scaled according to the maximum height achieved. The horizontal axis is the average climb rate achieved at a particular height band. The horizontal axis is scaled according to the MacCready setting, and an arrow indicating this setting, and the glider's current height is overlaid on the shaded area. This scaling and arrow makes it easy to see how the pilot's MacCready setting compares with achieved thermals and to plan the desired working height band.
When cruising between thermals, the vertical position of the arrow, indicating the glider's height relative to the thermal band, can be used as a reference to suggest how urgent it is to find the next thermal. As the arrow approaches the bottom of the band, then the glider is nearing the break-off height and the pilot should consider taking even a weak thermal.

3.10 Other

The following symbols display different informations concerning flight mode and GPS:

	GPS not connected
	GPS waiting for fix
	Cruise
	Climb
	Final glide

4 Cross Country Tasks

This section describes the handling of tasks in XCSoar.

> *Please note that there is* always *an active task in XCSoar, which contains at least a start and a landing point (standard: homebase). This active task and its modifications are automatically saved and restored when you switch the device off and on.*

For more details about setting up and modifying tasks, see 4.2.

4.1 NAV Menu

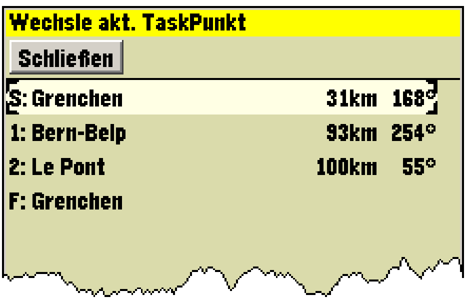
You can modify a task before and during flight through the NAV menu.

The first three buttons of the menu have the following functions:

- **NavTo ..** With these buttons the navigation mode can be changed at any time:
  - **.. TaskPt** Navigation mode 'TaskPoint'. The course to the next task point is shown on the map. This is standard during tasks. With Change TaskPt another task point can be chosen instead of the current one.
  - **.. LandingPt** Navigation mode 'LandingPoint'. The course to the current landing point is shown on the map. This is used for flying back when no specific task is flown or when a task is aborted. All potential landing points are shown on the map. With Change LandingPt another landing point can be chosen from a list of possible landing points.
  - **.. WayPt** Navigation mode 'WayPoint'. The course to the current waypoint is shown on the map. With Change WayPt another waypoint can be chosen.

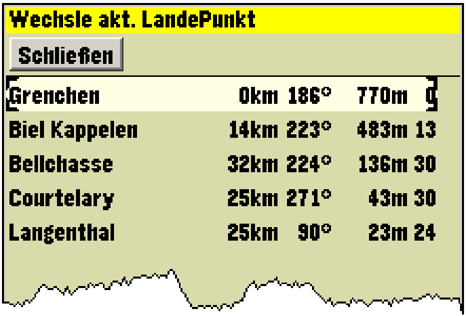
  → The active mode is shown as a single letter on the final glide bar (on the left of the display).

- **Change ..** With these buttons, the current task, landing or waypoint can be changed at any time. These buttons are only available for the current mode. This means that for example a landing point can only be changed in 'LandingPoint' mode.
  - **.. TaskPt** Opens the following dialog:



Here you can chose a taskpoint from the list of the waypoints available in the task.

- **.. LandingPt** Opens the following dialog:



This dialog contains a list of maximum ten landing points. For each landing point, type (A: Airfield, L: Landable field), distance, course and altitude difference to safety altitude are displayed as well as the required glide rate to reach this point. The list is sorted by glide rate and landing point type (airfields are at the top). Red highlighted list elements are landing points which are near but not reachable according to the computers calculations.

- **.. WayPt** Opens the Waypoint Browser in which you can select a new waypoint. For more details about this dialog, see 'Page: Waypoint' in 4.2.

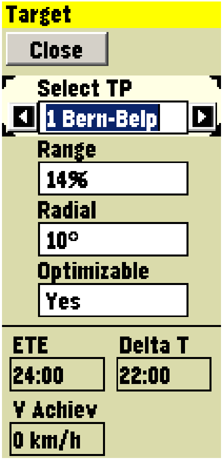
In addition to the first three, the following buttons can be found in the NAV menu:

- **Advance (..)** Advance to the next task point. This button is not available in 'auto advance' mode.

- **Final Force** Forces final glide. For more details, see 5.1.

- **Team Code** Opens Team Code . For more details, see 7.10.

- **AAT Target** Allows the setting of individual target options for AAT task points. The following dialog is opened:



The following fields are displayed:

- **Select TP** Taskpoint to modify.
- **Distance** Distance of the AAT target within the AAT area.
- **Radial** xxxxxx
- **Optimizable** xxxxxx
- **ETE** xxxxxx
- **Delta T** xxxxxx
- **V Achiev** xxxxxx

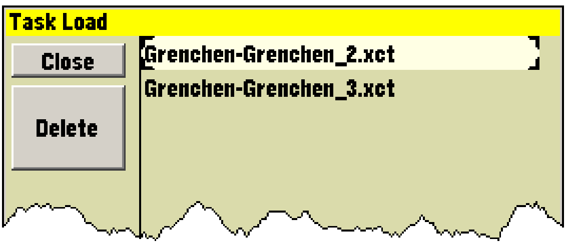
4.2 Task Editor

This part describes setup and modification of tasks with the task editor. This dialog can be opened through the following menu:

NAV ▷ Task Edit

On every page of the task editor four buttons are available below Close :

- **Load** With this button, saved tasks can be loaded. The task file can be chosen from the list in the following dialog:

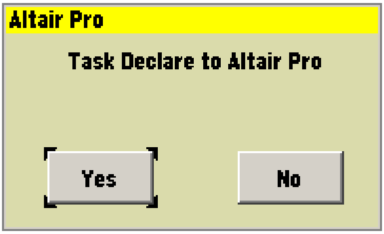


When a task is loaded, a copy of this file is opened as active task. For this reason, changing the active task does not affect the original task file as long as it is not deliberately saved with the same filename and therefore overwritten.

- **Save** / **Declare** With this button, tasks can be saved and/or declared to a logger. When pressed, the following dialog appears:

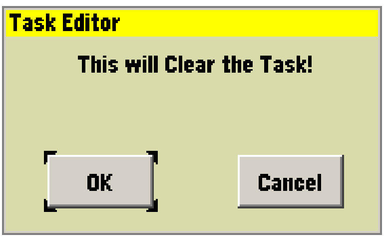
- **Save and Download** Save and declare task.
- **Save only** Only save task.
- **Download only** Only declare task.

If you want to declare a task, you have to confirm this in the following dialog:



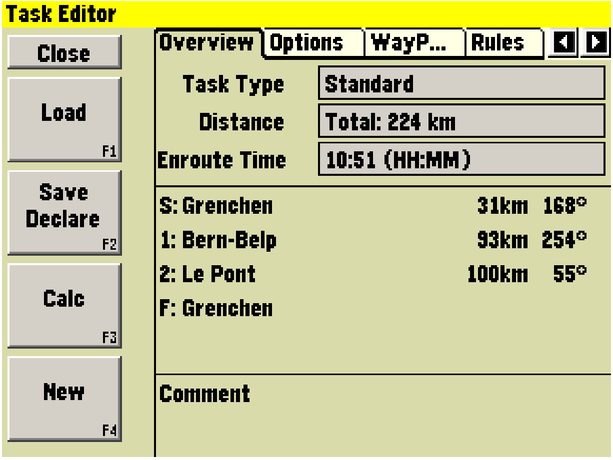
> ***A task may be modified at any time, but it can only be declared to a logger* before flight*.***

- **Calc** Opens the task calculator. For more details, see 4.3.
- **New** Cleans out the current waypoint list *and sets the homebase as start and finish waypoint*. If a task is already loaded, the following message appears:



Make sure the current task was saved (if necessary) before pressing New .

Page: Overview

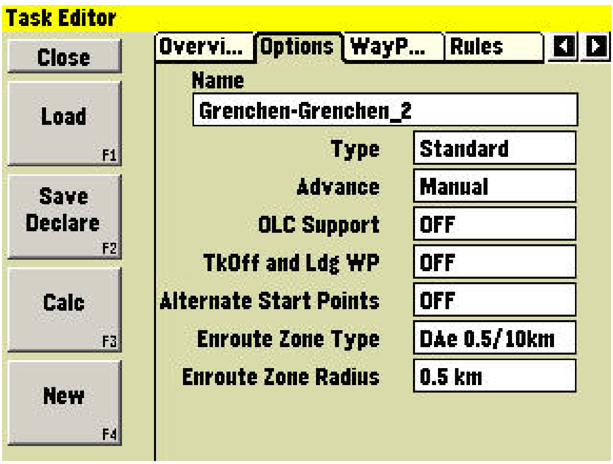


On this page, a brief summary of the task is displayed:

- **Task type** Standard or AAT
- **Distance** Task distance
- **Enroute Time** Estimated task time

Below these fields, the task points are listed (S: Start, F: Finish).
On the bottom of the page, comments about this task may be displayed.

Page: Options



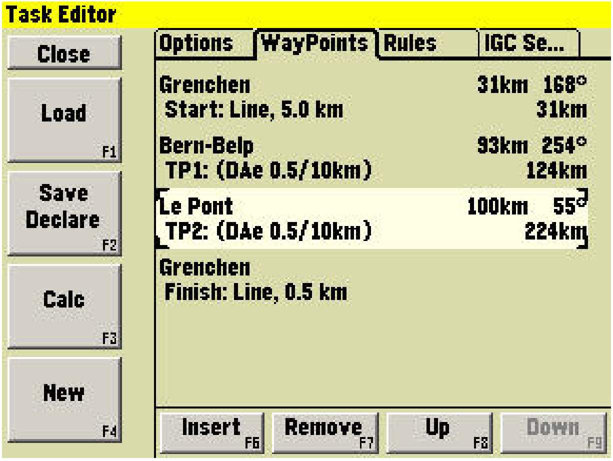
On this page, you can set the task options:

- **Name** Task file name.
- **Type** Standard or AAT
- **Advance** Type of advance to the next taskpoint when flying through a taskpoint area:
  - **Manual** Manual advance throuth NAV ▷ Advance (manual) .
  - **Auto** Automatic advance when the glider flies through the taskpoint area (or, for start, finish or AAT taskpoints, when the specific requirements are met). The next taskpoint is automatically chosen from the task point list.
  - **Arm** The pilot has to arm advance manually in order for the computer to advance when the waypoint requirements are met. This can be done through NAV ▷ Advance .. .
  - **Arm Start** The start taskpoint has to be armed manually. All other taskpoints are advanced automatically.

  When the glider reaches the taskpoint area in “arm start” or “arm” mode, status messages are issued to remind the pilot of advancing the waypoints. At start, XCSoar announces that the glider is in the start area or behind the start line.
- **OLC Support** Switch on/off OLC computation. See 4.7 for more details about OLCs.
- **TkOff and Ldg WP** Define start and landing point. xxxxxxxx
- **Alternate Start Points** Switch on/off the use of alternate start points. If turned on, alternate start points can be defined over the Altern. Starts in the ‘Taskpoint Detail’ dialog of the start point.
- **Enroute Zone Type** Task point zone type:
  - **Cylinder** Cylinder with specified radius.
  - **FAI Sector** 90 degree arc centered about the bisector of inbound and outbound legs, with specific distance from circle center.
  - **DAe** German sector type. Equivalent to a 0.5km cylinder plus a 10km FAI sector.

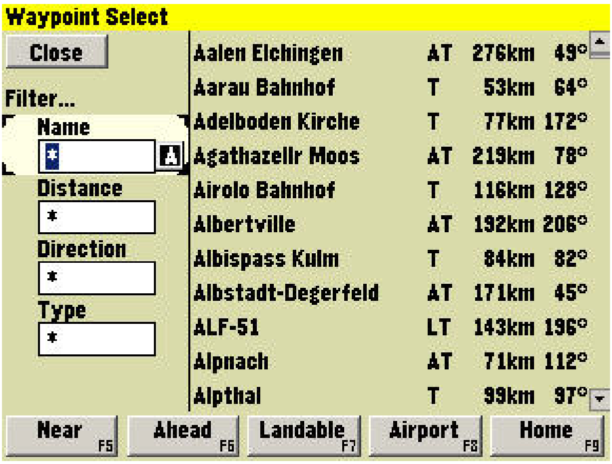
    Start and finish type may be set separately (see next page of the task editor).
- **Enroute Zone Radius** Zone radius of the task points.
- **AAT Min time** (Only AAT) Sets the minimum AAT time. If during the flight the computer notes that the estimated task time is shorter than the minimum AAT time, a status message is issued.

Page: Waypoints



On this page, all task points are listed. The following buttons are available:

- **Insert** With this button, new task points can be added through the following dialog:



In this dialog you can search and select waypoints. Filters (name, distance, direction, type) on the left side make this search easier. Distance and direction are always relative to the aircraft. On the bottom of the page, five buttons have preset filter functions:

- **Near** Sets the field ‘Distanz’ to 25km. When pressed again, the value changes to 50, 75 and 100km. All waypoints within this distance are displayed in the list.
- **Ahead** Sets the field ‘Direction’ to HDG(360°). All waypoints within a certain angle (30°) on both sides of the aircrafts heading direction are displayed.

- **Landable** Sets the field ‘Type’ to ‘Landable’. All landable waypoints are displayed.
- **Airport** Sets the field ‘Type’ to ‘Airport’. All airports are displayed.
- **Home** xxxxxxxx

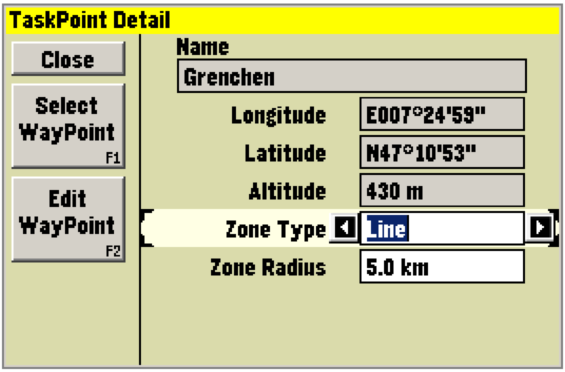
  These filters may be used in combination.

- **Remove** Removes the selected waypoint from the list.

  > *A task always has at least a start and a finish task point (standard: homebase). These can not be deleted.*

- **Up** Moves the selected task point up (earlier in the task).
- **Down** Moves the selected task point down (later in the task).

To modify a task point, select it and press Enter. The following dialog appears:



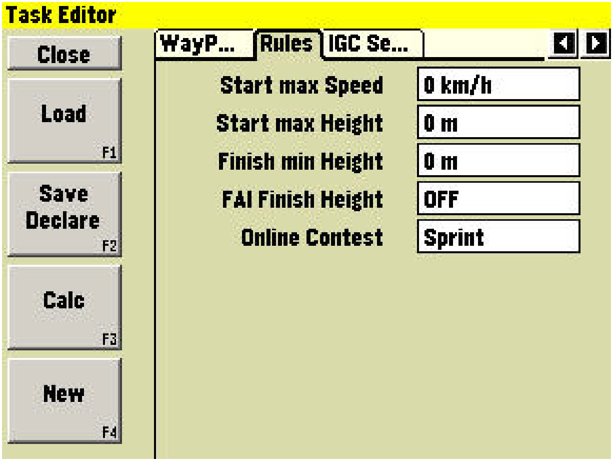
In this dialog, name, position and altitude of the taskpoint are displayed. For start- and finish, as well as for AAT task points, type and radius can be defined additionally.

On the left side, below Close , two more buttons are available:

- **Select Waypoint** Opens Waypoint Select to replace the current taskpoint with a new one.
- **Edit Waypoint** Allows editing of the taskpoint’s properties.

  > *These modifications of a task point only affect the task point for the current task; the original waypoint in the database is not modified.*

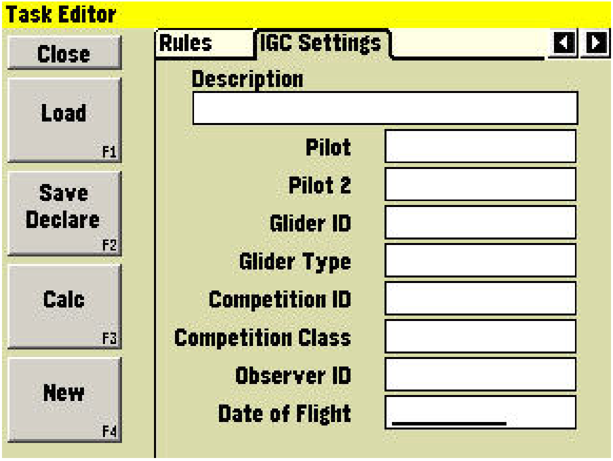
Page: Rules



On this page you can set the rules for the current task:

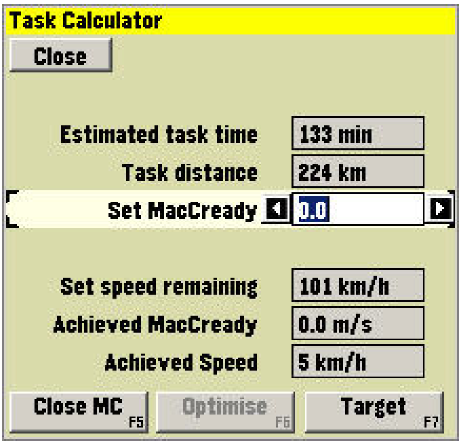
- **Start max Speed** Maximum allowed velocity in start area. 0 = no maximum velocity.
- **Start max Height** Maximum allowed height over ground at task start. 0 = no maximum height.
- **Finish min Height** Minimum height over ground at task finish. 0 = no minimum height.
- **FAI Finish Height** FAI Finish height (1000m rule).
- **Online Contest** Rules for OLC path optimization:
    - **Sprint** Conforms to FAI IGC League rules. Up to 5 points including start and finish, maximum duration 2.5 hours, finish height must not be below start height.
    - **Triangle** Conforms to FAI OLC triangle rules. Four points with common start and finish. For tasks longer than 500km, no leg less than 25% or larger than 45%; otherwise no leg less than 28% of total. Finish height must not be lower than start height less 1000 meters.
    - **Classic** Conforms to OLC classic rules. Up to seven points including start and finish, finish height must not be lower than start height less 1000 meters. Points awarded 80% on second last leg and 60% on last leg.

Page: IGC Settings



On this page you can specify the IGC specific task parameters used for declaration.

4.3 Task calculator



The task calculator is essetially used for AATs. It shows informations about the current task:

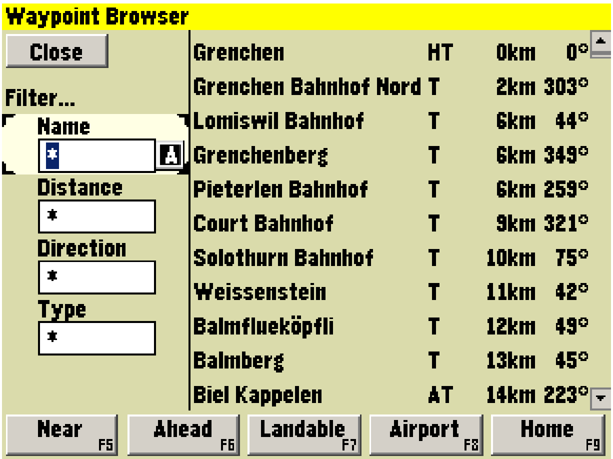
- **Assigned task time** (Only AAT) Minimum AAT task time.
- **Estimated task time** Estimated task time at current MacCready.
- **Task distance** Remaining distance to finish task point.
- **Set MacCready** Allows modification of MacCready and shows the influence of these modifications on the estimated task time.

- **Set range** (Only AAT) Allows modification of turning point positions inside the remaining AAT areas (-100% to +100%) and shows the influence of these modifications on estimated task time and distance.
- **Speed remaining** Estimated speed for the remaining part of the task at current MacCready.
- **Achieved MacCready** Achieved MacCready value.
- **Achieved Speed** Achieved average speed.

These buttons are available:

- **Close MC** Closes the task calculator and saves the MacCready modification. When pressing Close, the dialog is closed without saving the MacCready modification.
- **Optimise** Sets the modifiable fields to optimal values for AAT.
- **Target** Opens Target. For more details see 4.1.

4.4 Waypoint Browser



This dialog may be accessed several ways:

- DISP ▷ Pan On ▷ Nearest Waypoint
- INFO ▷ Nearest Waypoint

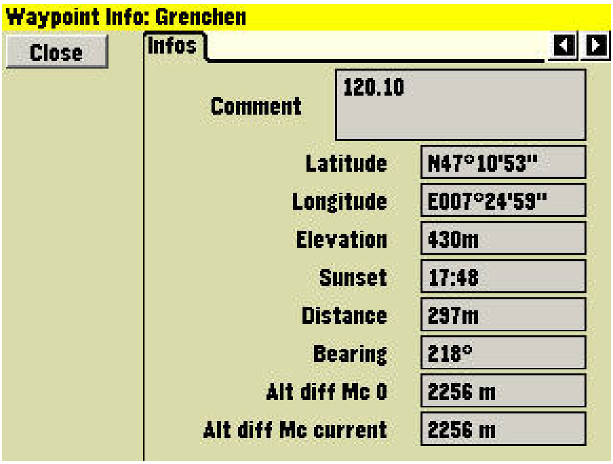
In the waypoint browser you can search for waypoints and display information about these waypoints. Filters (name, distance, direction, type) on the left side make this search easier. Distance and direction are always relative to the aircraft. On the bottom of the page, five buttons have preset filter functions:

- **Near** Sets the field 'Distanz' to 25km. When pressed again, the value changes to 50, 75 and 100km. All waypoints within this distance are displayed in the list.
- **Ahead** Sets the field 'Direction' to HDG(360°). All waypoints within a certain angle (30°) on both sides of the aircrafts heading direction are displayed.
- **Landable** Sets the field 'Type' to 'Landable'. All landable waypoints are displayed.
- **Airport** Sets the field 'Type' to 'Airport'. All airports are displayed.
- **Home** xxxxxxxx

These filters may be used in combination.

If you need detailed information about a waypoint, select it and click Enter. Waypoint Info is opened.

4.5 Waypoint Info



This dialog can either be opened through the waypoint browser or the following menu:

INFO ▷ Wegpunkt Details (Informations about the nearest Waypoint are displayed.)

In Wegpunkt Info , additionally to position and general waypoint information, two 'Alt diff' values are displayed. These show the additional altitudes which are needed to reach the waypoint above the required safety height from the current gliders position. The first value is referred to MacCready = 0, the second to the current MacCready.

4.6 AAT

AAT Targets

A *target* is a point within an AAT area that the pilot intends to fly to. These targets can be moved within the AAT areas so the pilot can adjust the effective distance of the task. Targets may be set on the ground, during task planning, and modified during flight.

When flying an AAT task, the navigation system directs the glider to the target, and statistics like distance to waypoint are also relative to the target rather than the waypoint of the AAT area itself.

Automatic task waypoint advancement normally triggers when entering an AAT area, so if the pilot wishes to fly to the targets, either the 'arm start', 'arm' or 'manual' advancement modes should be used when flying AAT tasks.

Manually moving targets

In order to make the specification of targets more straightforward, their location is defined by a range parameter that determines how far from the minimum to maximum possible distance the target is. This is expressed as a percentage. For example, with range set to 100%, the target is located to give the maximum overall task distance. With range set to -100%, the target is located to give the minimum overall task distance.

Zero range yields a nominal task distance: for sectors the target is half way along the bisector radial; for cylinders the target is in the center of the cylinder.

The targets can be modified in two ways:

- In Task calculator (see 4.3), the 'Set Range' field adjusts the targets of all remaining waypoints in the task.
- In Target (see 4.1), the range of each waypoint may be individually adjusted.

AAT targets and task calculator

Task calculator can be helpful to check the influence of changes (atmosphere, polar, MacCready, etc) on the estimated task time. It is recommended to keep an eye on the task calculator during an AAT task in order to be able to modify settings (e.g. MacCready, AAT target position, etc) if necessary.

Target projection

XCSoar continually analyses the path of the glider through AAT sectors to find the points in previous AAT sectors through which the achieved scoreable distance will be greatest. Internally, the program moves the targets for previous AAT sectors, which are then the optimal targets.

In certain conditions, targets for the current AAT sector may be moved automatically:

- When inside an AAT sector, the target in that sector is moved to a line projecting from the previous sector's target through the aircraft, at the same distance from the previous sector's target to the target prior to entering the sector. The effect of this is to allow pilots to choose to enter an AAT sector in a different direction or offset from the direct line from the previous target to the current target.

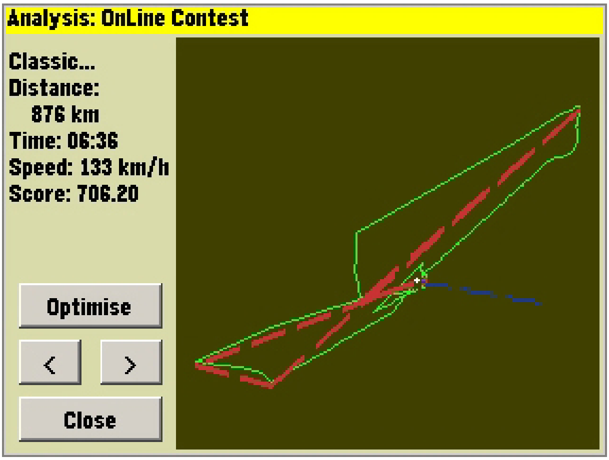
- While the aircraft is in the AAT sector and the distance from the previous target to the aircraft is greater than the distance from the previous target to the current target, the target is moved further along the projected line from the previous target to the aircraft, just beyond the aircraft. Hence, the black track line will not be visible but the blue optimal track arrow will point along this projected direction.

4.7 OnLine Contest

Analysis contains a page 'OnLine Contest' which can be used to show the optimal path and estimated score. The rules for OLC optimizing can be set on the page 'Rules', field 'Online Contest' of the Task Editor :

- **Sprint** Conforms to FAI IGC League rules. Up to 5 points including start and finish, maximum duration 2.5 hours, finish height must not be below start height.
- **Triangle** Conforms to FAI OLC triangle rules. Four points with common start and finish. For tasks longer than 500km, no leg less than 25% or larger than 45%; otherwise no leg less than 28% of total. Finish height must not be lower than start height less 1000 meters.
- **Classic** Conforms to OLC classic rules. Up to seven points including start and finish, finish height must not be lower than start height less 1000 meters. Points awarded 80% on second last leg and 60% on last leg.

The Sprint rules require the start altitude to be the lowest altitude in the flight after release from tow. The detection of this start point can be enabled in Task Editor by turning the 'OLC Support' field to ON.



When flying OLC, either AAT or non-AAT tasks may still be used to manage the flight navigation. During flight, if the 'Optimise' button in the OLC page of the analysis dialog is pressed, the computer will optimise the current flight with respect to the selected OLC rules.

In the OLC analysis page, the aircraft track is shown as a thin green line, and after optimisation, the optimal path is shown as a thick red dashed line.

If continued flight in final glide will result in higher score, the displayed results are shown as 'In progress' and a blue line shows the projected path to improve the score. For Sprint and Classic OLC types, this path is extended in the direction to the current waypoint. For Triangle OLC type, this path is extended in the direction to produce the largest triangle.

The score and computed optimal distance is approximate.

If continued flight in final glide will not achieve a higher score, or if the aircraft has landed, the displayed results are shown as 'Finished'.

Depending on the duration of the flight, the time required to calculate the optimum path may take up to 10 seconds.

4.8 Logger

A flight logger conforming to the IGC file specification can be used to record flights.

Several flight loggers are accessible via XCSoar:

- A software-based logger. All versions of XCSoar have this functionality. The logger conforms to the IGC standard but is not certified.
- The PRO version of Altair has an internal IGC certified logger device. XCSoar communicates with the logger as if it were an external serial device.
- XCSoar can also send declarations to some external logger devices, such as the EW logger. For this to work, the device name must be specified in the "Devices" section of the configuration settings.

When the internal software logger is active, a small diamond in the lower right corner of the map area flashes once per second.

By default, XCSoar is set up to automatically start and stop the internal software flight logger when it detects the aircraft is flying and when it has landed, respectively. Only when the logger is manually started it does ask if the flight is to be declared; when automatically starting it automatically declares the current task.

If a task has been declared, then subsequent attempts at modifying the task result in a warning message asking to confirm whether the action is to be taken and invalidate the declaration. This is intended to make it harder to accidentally modify the task resulting in a failed declared task.

The XCSoar software logger, when started, checks for 500kB of free space on the file storage. If there is insufficient space, it will automatically delete IGC files, oldest first, in order to free up 500kB. It does not ask the user for confirmation before performing this operation.

The internal software logger buffers data so that when it starts (automatically or manually) up to 60 seconds of data prior to starting is recorded. This means that the software logger now adequately captures the full takeoff.

Configuration

The connected Logger can be configured through the following menu:

CONF ▷ Setup Logger

XXXXXXXX –¿ 1zu1 bernehmen aus Altair maintenance?!

5 Glide Computer

This section focuses on how XCSoar's glide computer works and is recommended reading so you understand the specific details of calculations being performed and how to use the software properly. It assumes a basic knowledge of cross-country soaring, but is suitable reading for competition pilots as well as pilots engaging in casual cross-country touring.

5.1 Flight modes

XCSoar automatically detects the difference between thermal (circling) flight and cruising flight. After about 30 seconds of circling flight the software will switch from cruise to climb mode. After about 30 seconds of straight line flight the software will switch from climb to cruise mode.

The cruise modes are further divided into final glide and normal cruise. Final glide is active when the last waypoint in the task is active, or when the task is in abort mode.

- **Cruise** The glider is not circling and active waypoint is not the finish point.
- **Circling** The glider is circling (though it may not be climbing).
- **Final glide** The glider is not circling and the active waypoint is the final one in the task.

The specific computations performed by XCSoar are of course dependent on this flight mode. The display changes in each mode, principally, the InfoBoxes may be set up differently for each mode (see paragraph *InfoBoxes*); secondly there is a facility to automatically change zoom between circling and other flight modes (this is called 'circling zoom').

Switching between the different flight modes is automatic. Circling is enabled when the glider turns (typically three quarters of a turn). It is possible to have circling mode switched based on an external input (e.g. from a pilot-operated switch).

A small symbol is drawn on the lower right corner of the map area to indicate which flight mode the computer is in.

Final glide mode can be forced even if the active waypoint is not the final waypoint. There are two ways to do it:

- NAV ▷ Final Force
- F6 (A status message confirms that final glide mode is enabled)

This toggles between forced final glide, and normal (automatic) operation.

Final glide mode can also be forced automatically if at any stage in the flight the aircraft is above the final glide slope. This is a configuration option called 'Auto Force Final Glide', disabled by default. This option is useful when flying short tasks in which the aircraft may well be above final glide turning the penultimate waypoint.

InfoBoxes

In addition to the three standard display modes, an auxiliary set of InfoBoxes may be displayed in any flight mode. This is useful if the pilot has information he wants to be able to view no matter what mode the computer is in.

There are two ways to choose the display mode:

- DISP ▷ Setup Display
- F7

For informations about individual customization of the InfoBoxes see 11.12.

5.2 MacCready settings

When connected to a supported intelligent variometer, adjusting the MacCready setting on the variometer will change the setting in XCSoar. If no variometer is connected, the MacCready value can be adjusted through the following menu:

CONF ▷ Setup MC

Auto MacCready

XCSoar can adjust the MacCready ring setting automatically to relieve the workload on the pilot. Two methods of updating the MacCready ring setting are available:

- **Final glide** During final glide, MacCready is adjusted in order to arrive at the finishing point in minimum time. For OLC sprint tasks, the MacCready is adjusted in order to cover the greatest distance in the remaining time and reach the finish height.
- **Average climb** When not in final glide, MacCready is adjusted to the average climb rate achieved in all thermals.

Additionally, both methods may be used, so that before reaching final glide, the MacCready setting is adjusted to the average climb rate, and during final glide it adjusts the setting to give minimum time to arrival.

The method that is used is defined in the configuration settings (page 'Glide Computer', field 'Auto Mc Mode'). The default setting is 'Final Glide'.

You can enable/disable Auto MacCready in Setup MacCready .

When Auto MacCready is enabled, the MacCready InfoBox displays 'AUTO' instead of 'MANUAL'; and the MacCready indicator in the variometer gauge displays 'AutoMc' instead of 'Mc'.

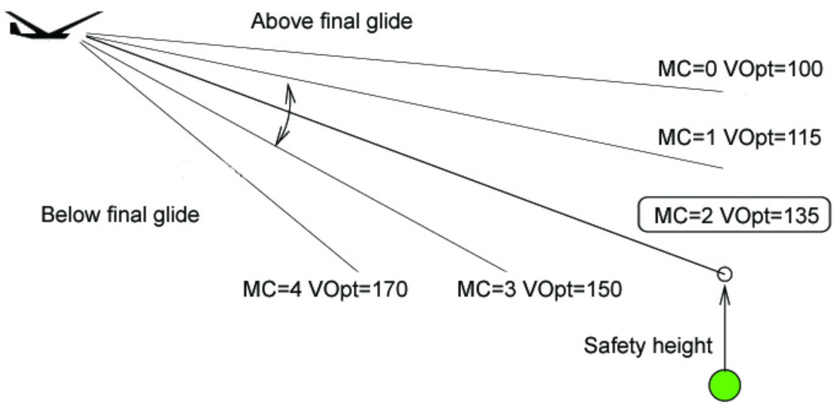
The Auto MacCready methods are described in further detail below.

Final glide

When above final glide altitude, the MacCready ring setting may be increased, resulting in a higher speed to be commanded. Because the ring setting has increased, this also increases the minimum strength of the thermal that would be efficient to stop and circle in.

Similarly, when below final glide altitude, the MacCready ring setting my be decreased, resulting in a lower speed to be commanded. Because the ring setting has decreased, the pilot may be prepared to stop and circle in weaker thermals.

Auto MacCready performs this adjustment automatically and continuously. Typically it is meaningless to enable this mode before reaching final glide altitude, or nearly so, because early in the flight the glider will be very much below the final glide altitude and the Auto MacCready function would then drive the MacCready ring setting to zero.



Average climb

This method sets the MacCready to the average climb rate achieved across all thermals in the current flight. As such, it takes into account the time spent centering the thermal. The value is updated after leaving a thermal.

Since MacCready theory is optimal if the MacCready setting is the average climb rate of the next expected climb, this method may give suboptimal performance (commanding speed too slow) if the conditions are improving; and similarly may be non-conservative if the conditions are deteriorating (commanding speed too high). Similarly, if the pilot continues to climb in weak thermals, this will reduce the average and may therefore encourage the pilot to continue to select weak thermals.

As a result of these limitations, the pilot should be aware of how the system operates and adjust his decision-making accordingly.

5.3 Glide polar

The glide polar can be defined in the configuration settings (see 11.7). The glide polar specifications of a small selection of glider types, representing major classes of gliders, are built into XCSoar, and these may be used as an approximation for other gliders if no better glide polar can be found. However, for most accurate results, it is advisable to use the correct glide polar for your particular aircraft type.

The glide polar is adjusted in flight by XCSoar to account for degraded performance due to bugs and ballast.

The build-up of bugs on the wing's leading edge, as well as rain droplets on the wing, affect the aerodynamic performance. It is the pilot's responsibility to judge and update the bugs value during flight. The bugs value is expressed as a percentage of the clean glider's performance. For example, at 100% bugs value, the glider performs as a clean glider, and at 50% bugs value, the glider's sink rate is doubled when compared to a clean glider.

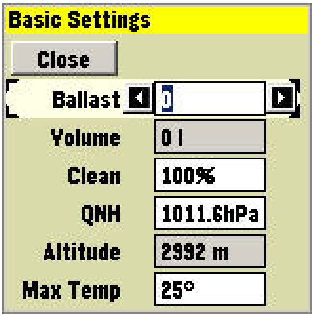
The ballast value is expressed as a percentage of the glider's total ballast capacity. Depending on the specific construction of the glide polar file, this may optionally include a weight margin to provide for different pilot weights. When flying with no ballast, a heavy pilot may set a ballast value of perhaps 10% so that the polar is appropriately adjusted for the increased cockpit weight.

The current glide polar and all up weight can be reviewed in Analysis .

5.4 Basic settings

Use Basic Settings to modify ballast, bugs (Clean), QNH or temperature settings before or during flight. It is accessed via the menu under

CONF ▷ Setup Basic



- **Ballast** The ballast setting is used to modify the polar to account for any water ballast carried during the flight. A ballast setting of 100% modifies the polar to account for a full load of water ballast.

- **Clean** The bugs setting ('clean') determines the amount the polar is degraded due to contamination during a long flight. A 'clean' setting of 100% will cause the software to use the clean polar. A 'clean' setting of 50% will degrade the polar by 50%, effectively doubling the sink rate for a given airspeed.

- **QNH** Use this dialog both before and during the flight to record the mean sea level atmospheric pressure, also known as QNH pressure. The software uses the values entered to convert airspace flight levels into altitudes. If connected to a supported intelligent variometer with an altimeter, the altitude is updated on this dialog as the QNH pressure is adjusted. This makes it easy to set the QNH pressure if the airfield elevation is known.

  On system startup, after the GPS has acquired lock, and if a barometric altitude source is connected (e.g. Vega, Altair Pro, FLARM), the QNH is automatically adjusted. This adjustment sets the QNH such that the barometric altitude equals the terrain altitude.

The QNH is only updated if the aircraft is on the ground for more than 10 seconds, so that if XCSoar is restarted during flight, QNH will not be adjusted. The update only occurs also if the terrain database is valid at the current aircraft location.

- **Max Temp** The maximum forecast ground temperature is used by the convection forecast algorithm (see 6.7) in its determination of estimated convection height and cloud base.

5.5 Speed to fly

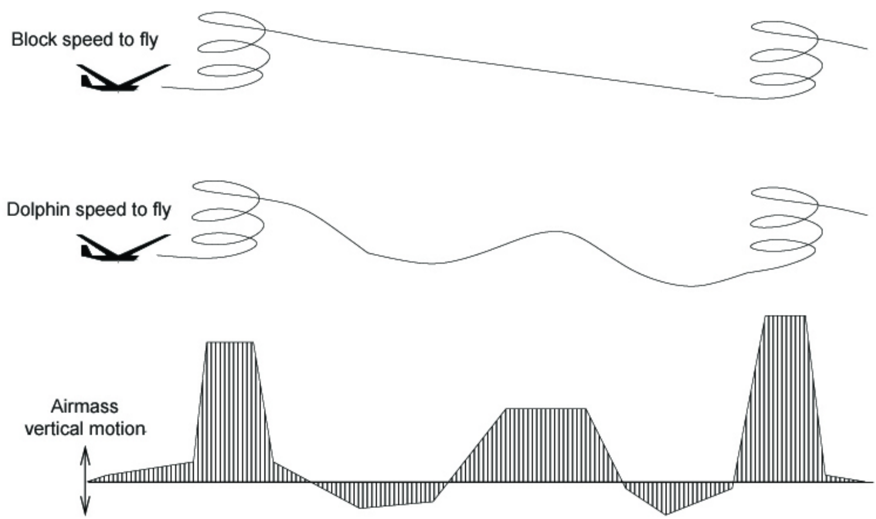
When used in conjunction with an intelligent variometer that produces indicated airspeed measurements, a speed command chevron is drawn on the variometer gauge.

XCSoar continuously calculates two types of speed to fly:

- **Dolphin speed** This is the instantaneous, best speed to fly in rising or descending air, adjusted for wind if in final glide mode.
- **MacCready speed** This is the best speed to fly during cruise in still air, adjusted for wind if in final glide mode.

The user can specify a maximum manoeuvring speed in the configuration settings, which limits the speed-to-fly in MacCready calculations to realistic values.

Different pilots have personal preferences as to whether they prefer to fly in so-called 'block MacCready' style, in which they fly constant speed between thermals according to the MacCready speed; or to fly in 'dolphin' style, in which they fly at varying speeds according to the continuously changing Dolphin speed value.



A configuration option 'Block speed to fly' (see 11.5) can be used to specify whether dolphin or block speed to fly is used. The InfoBox 'V Opt' shows the optimum speed according to whichever mode is selected. When connected to the Vega intelligent variometer, the speed command sounds are based on this optimum speed value.

Speed to fly with risk

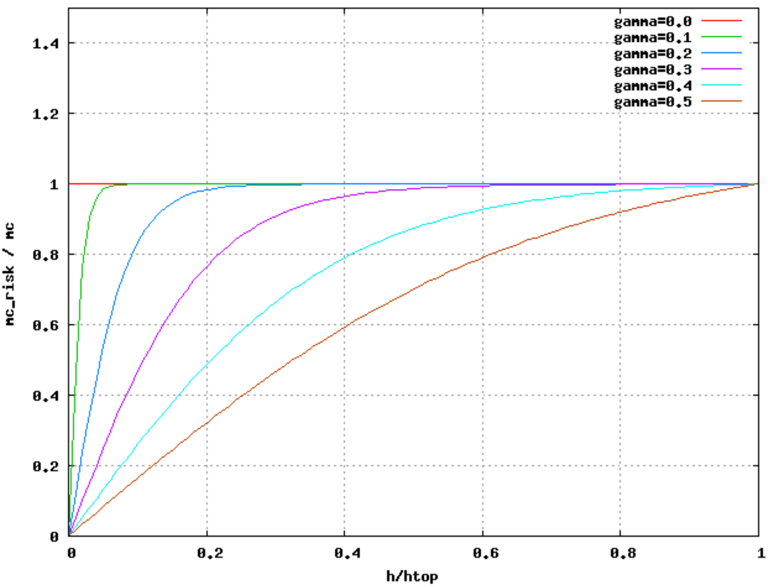
The speed to fly system can be compensated for risk, in which the MacCready setting used for calculating the speed to fly (in both Block or Dolphin modes) is reduced as the glider gets low. This feature performs automatically what many pilots use to do manually. The theory governing how this is implemented in XCSoar is based loosely on the paper by John Cochrane, "MacCready Theory with Uncertain Lift and Limited Altitude" *Technical Soaring* 23 (3) (July 1999) 88-96.

A configuration parameter γ ('STF risk factor', in the configuration settings under page 'Glide Computer') controls how the risk Mc value is calculated. The γ factor determines the fraction of the current MacCready setting as a function of the height fraction. The height fraction used in this calculation is the ratio of the height above the break-off height above terrain (h) to the height of the maximum climb above the break-off height above terrain (h_{top}).

For the default value, $\gamma = 0.0$, there is no compensation – the risk Mc is the same as the Mc setting. For $\gamma = 1.0$, the risk Mc is scaled linearly with the height fraction h/h_{top}. For intermediate values of γ, the risk Mc varies smoothly with the height fraction, such that the risk Mc is small only when low.

Low values of γ are best when pilots do not want to slow down as they get low (but risk out-landing); high values of γ can be used for very cautious pilots but will result in lower average speeds.

A value of $\gamma = 0.3$ is recommended.



5.6 Safety heights

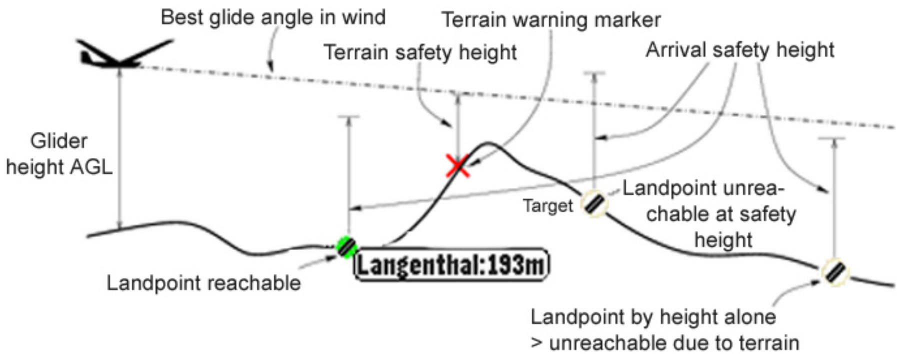
Three safety heights are defined to provide a degree of safety margin in glide computer calculations.

The safety heights are:

- **Arrival height** This is the elevation above ground at which the glider is required to arrive at for a safe landing circuit, plus some safety margin. This value is used in final glide calculations as well as the determination and display of reachable landable fields.

- **Terrain clearance** This is the elevation above ground, below which any computed glide path is considered to provide inadequate clearance to the terrain. The terrain clearance value affects the glide range display, and if the final glide at any point dips below the terrain clearance elevation above ground, a warning marker (large red cross) is drawn on the screen. If the terrain elevation model is invalid or out of range, then the glide range display and the terrain warning marker is disabled.

- **Break-off height** This is the elevation above ground, below which it is recommended for pilots to consider the cross-country task failed and to concentrate on finding a suitable field to land in. Currently this break-off height does not affect XCSoar in any way but it is reserved for future use to provide warnings etc.



> ***These may be set to zero but this is highly discouraged since all glide computers, instruments and data sources (such as terrain elevation models) are subject to some degree of error and the atmosphere through which the glider flies is also unpredictable.***

XCSoar determines the height above sea level of any turn point or landing point either from the waypoint file, of if no height is specified in the waypoint file, from the terrain file.

Landable fields are only marked as reachable if the estimated arrival elevation above ground is above the arrival altitude safety height, and the glide path does not intersect the terrain clearance safety elevation. The estimated arrival altitude (above safety height) displayed next to landable waypoints is calculated for best glide angle at zero MacCready ring setting (Mc$=0$), adjusted for wind.

At all times, if the final glide through terrain marker (a red cross) is displayed on the screen, then the glider must climb in order to safely reach the destination.

When calculating the arrival heights of landable fields (for map display purposes and in abort mode), a safety MacCready value can be specified in the configuration settings. This safety value is set to zero by default. Larger values make the arrival height calculation more conservative.

All these safety heights can be defined in the configuration settings on the page 'Safety factors'.

5.7 Final glide calculator

The final glide calculator uses many sources of information when determining the altitude required to reach your goal or the next waypoint. These are:

- The glider's polar data;
- The wind speed and direction;
- The distance and bearing of the goal or waypoint;
- The MacCready setting;
- The altitude of the waypoint or goal;
- A user specified safety margin (arrival height).
- The glider's total energy if XCSoar is connected to an instrument with an air speed indicator.

From the parameters shown above, two altitudes are derived.

- **Altitude required** This calculation is the total altitude required for the glider to reach the goal plus any user safety margin.
- **Altitude difference** This calculation is the altitude required to glide to the goal plus any safety arrival altitude plus the altitude of the goal, minus the altitude above mean sea level of the glider. The result represents either your height above glide slope, or your arrival height at goal. If no goal altitude is provided in the turn-point file, XCSoar will use the terrain file altitude at the goal.

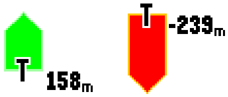
The final glide calculation is extended to calculate the altitudes required and difference to complete the entire task. This capability is sometimes referred to as final glide around multiple turn points. The altitude difference to complete the task is displayed continuously as an arrow and in numeric form on the left hand side of the map area of the screen.

The height required is adjusted for energy height, compensating for the fact that the kinetic energy of the glider can be converted to height (potential energy). The kinetic energy that is convertable to height is calculated from the difference in the true airspeed to the true airspeed for best glide. This compensation is most accurate when airspeed data is available to XCSoar, otherwise the true airspeed is estimated from the wind speed and ground speed.

5.8 Display of altitude required

On the left side of the map display, a box displays the calculated height difference required for the glider to complete the task, or reach the final waypoint. If the glider is above the minimum height required, a green arrow bar is drawn above the box indicating the amount of excess height. If the glider is below the minimum height required, a red arrow bar is drawn below the box indicating the amount of height deficit.

Above *Below*



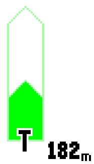
The scale of the final glide bar is $+/-$ 500 meters.

Dual height required bars

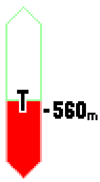
The final glide bar has been modified to show the effect of MacCready setting on the altitude difference to complete the task. The display shows in an arrow outline the altitude difference calculated at zero MacCready, as well as the usual filled arrow that displays the altitude difference calculated at the current MacCready setting. The number shown in the box next to the final glide bar still shows the altitude difference at the current MacCready setting.

Examples of the appearance in various configurations is shown below:

- **Above final glide at Mc$= M$ and Mc$= 0$** Here the display shows that at the current MacCready setting, the aircraft is above final glide (filled arrow). The hollow arrow shows the additional excess height.

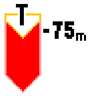


- **Below final glide at Mc$= M$, and above at Mc$= 0$** Here the display shows that at the current MacCready setting, the aircraft is below final glide (filled red arrow). The hollow green arrow shows that at Mc$= 0$, the aircraft is above final glide.

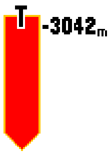


In this situation, if the glider is climbing, the pilot can assess whether to leave the thermal early and commence a final glide descent at a reduced MacCready setting; or continue to climb. It is useful to switch on the auto MacCready setting as this will automatically adjust the MacCready value to the optimal value – and then it is simple for the pilot to compare the achieved lift rate with the MacCready value. When the achieved lift rate drops below the MacCready value, the thermal should be left.

- **Below final glide at Mc$=M$, and just below at Mc$=0$** Here the display shows that at the current MacCready setting, the aircraft is below final glide (filled red arrow). The hollow red arrow shows that by reducing the MacCready setting to zero, the aircraft is nearly at final glide.



- **Below final glide at Mc$=M$, and at Mc$=0$** Here the display shows that at the current MacCready setting, the aircraft is below final glide (filled red arrow). No hollow red arrow shows that even at Mc$=0$ the aircraft is well below final glide.



5.9 Task speed estimation

Some of XCSoar's internal calculations make use of estimates of the time required to reach each waypoint in the task. This information is used in some InfoBox displays, Assigned Area Task calculations, and sunset warnings.

The glide computer assumes the glider's average cross-country speed is equal to that achievable under classic MacCready theory taking wind into account, with the current MacCready setting. This method is used for estimating arrival times and task finish time.

The following task speed measures are defined:

- **Task speed remaining** This is the estimated speed for the rest of the task according to MacCready theory.
- **Task speed average** This is the task speed to date compensated for altitude required to complete the task.
- **Task speed achieved** This is the task speed to date, compensated for altitude differences from the task start altitude.

- **Task speed instantaneous** This is the instantaneous estimated speed along the task. When climbing at the MacCready setting, this number will be similar to the estimated task speed. When climbing slowly or flying off-course, this number will be lower than the estimated task speed. In cruise at the optimum speed in zero lift, this number will be similar to the estimated task speed. This measure, available as an InfoBox is useful as a continuous indicator of the cross-country performance. It is not used in any internal calculations.

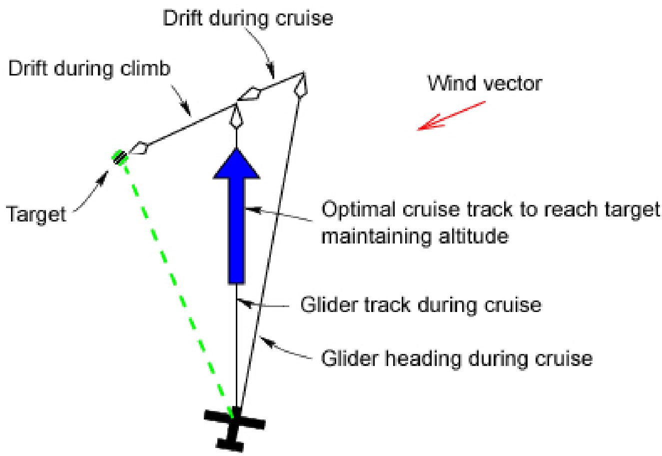
In addition, a measure called *achieved MacCready* is calculated. This is computed by finding the MacCready setting that under classical MacCready flight would produce the same task speed as has been achieved. This value is higher than the actual MacCready setting when the glider has climbed faster than the MacCready setting or when the glider has flown in cloud streets etc. The achieved MacCready is used in the task calculator dialog.

Task speed estimates for achieved speed, are compensated for altitude variations, such that the effects of climbs are taken into account in calculating the average task speed. Considering two gliders A and B flying the same task. Glider A has cruised faster, trading off height for speed. Glider B is behind A but higher and will save time later since it has less climbing to do to complete the task.

While flying AAT tasks, the task speed measures may change when the glider is inside an AAT area or when the AAT range or targets are adjusted by the pilot. This is due to the task distance achieved and remaining when such events occur.

5.10 Optimal cruise track

In order to help reduce the cross-track error when flying between non-final waypoints, XCSoar calculates an adjustment to the cruise track, called the 'optimal cruise track'. This track is adjusted so that it compensates for the wind drift incurred when circling, and as such it needs to estimate the proportion of time spent circling according to classical MacCready theory.



The optimal cruise track is displayed on the map area as a large blue arrow, and it recommends the glider steers so that the glider's track is lined up with the blue arrow during cruise such that it will arrive at the waypoint in minimum time. When the wind is negligible, or when the computer is in final glide mode, this arrow will point along the black line that indicates the track to the next waypoint.

The calculation and display of optimal cruise track is a unique feature of XCSoar. Commonly, when cruising between thermals, glide navigation systems direct the glider to steer so that the glider's track points directly at the target. Ideally, the glider's track is collinear with the line from the previous to next waypoint, such that the cross-track error is small and hence the glider travels the minimum distance between waypoints.

However, because the glider usually has to stop cruising in order to climb in lift, whilst circling the glider drifts downwind and therefore the cross track error can increase. After several cycles of cruise-climb, the overall track becomes curved.

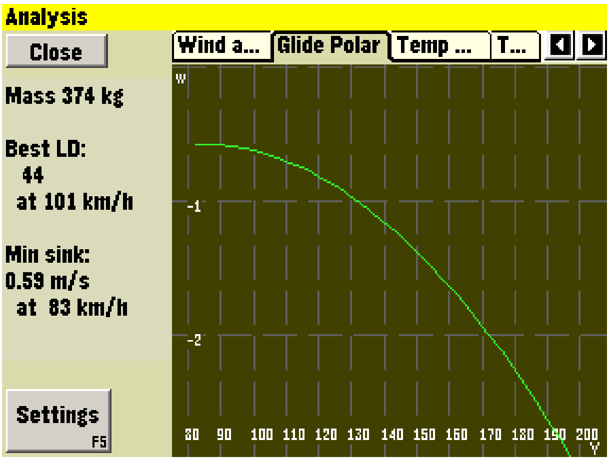
For the case where the final waypoint is active and one is above final glide, circling is not necessary so this simple scheme is optimal.

5.11 Analysis dialog: Glide polar

The analysis dialog can be used to check the glide polar, which can be accessed via:

INFO ▷ Analysis Show

The polar page shows a graph of the glide polar at the current bugs and ballast setting. It also shows the calculated best LD and the speed at which it occurs, and the minimum sink and the speed at which it occurs. The current aircraft all up weight is displayed in the title.



In this dialog page, Settings opens Basic Settings (e.g. to adjust the bugs/ballast).

The glide polar page of the analysis dialog shows the average total energy sink rate at each speed achieved in flight, when connected to a supported intelligent variometer (e.g. Vega). This facility allows pilots to perform test flights in stable atmospheric conditions, such as on calm days with no wind, and inspect the measured glide polar. By comparing the measured glide polar with the model glide polar, this enables investigation of whether the glider is being flown optimally with respect to flap settings and also to investigate the benefits of performance optimisation such as sealing control surfaces etc.

Data is collected only when in cruise mode and at G loading between 0.9 and 1.1; so pilots performing test flights should attempt to fly smoothly with wings level.

5.12 Flight notifications

Notifications, appearing as status messages, appear when the following conditions are detected:

- Estimated task time too early for AAT
- Estimated arrival at finish past sunset
- Significant wind change

5.13 Sunlight and time

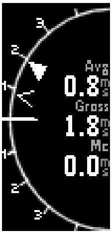
A sun ephemeris computes the time of sunset, which is displayed in the Aircraft Status dialog (see 12.15). Note that local terrain and atmospheric conditions may result in poor visibility before the displayed sunset time.

If the expected arrival time at the final waypoint in the task is past sunset, a status message warning is issued.

6 Atmosphere and Instruments

XCSoar maintains an internal model of the atmosphere based on statistics gathered from the flight path and other instruments connected to the device. These statistics and measurements are approximate and the weather can on some days change rapidly. The pilot should at all times keep observing the weather. In particular, when out-landing in fields, the pilot should look for indicators on the ground to confirm wind strength and direction.

6.1 Variometer



A needle-dial style display shows the variometer measurements. The gross variometer reading drives the main arrow on the dial, and in the center of the dial the instantaneous measurement is shown as text. Additionally, speed command arrows (chevrons) appear above or below the gross variometer measurement. Chevrons pointing up indicate slowing down is recommended. Chevrons pointing down indicates that speeding up is recommended.

When the averager value is displayed, the value shown is the average gross climb rate over the previous 30 seconds when in circling mode, and the netto (airmass) vertical speed over the previous 30 seconds when in cruise mode.

The average value can also be displayed as an optional additional needle. See 11.12 for details on customising the variometer gauge.

When no variometer is connected to XCSoar, the computer produces variometer *estimates* based on GPS vertical speed, which is slow and uncompensated for aircraft total energy.

The MacCready value, bugs and ballast, optimum speed to fly and wind data are transferred between XCSoar and supported external intelligent variometers. In the ideal setup, both XCSoar and the variometer have a consistent perspective on the flight at all times; and that by adjusting the MacCready setting on one device should be kept in sync with the other, by the software and to not require additional input from the pilot.

Currently XCSoar supports the triadis Engineering Vega intelligent variometer, the Cambridge 302 DDV, Borgelt B50/B500, LX Navigation LX1600 variometers, Zander, and Tasman Instruments variometer. Note that the level of support for each device varies, and not all manufacturers release their protocols to allow the XCSoar developers to provide full support. Barometric altitude is also read from certain GPS units and loggers, including the Volkslogger and Posigraph.

For Vega, a small icon displaying a circling glider is displayed when the variometer is in climb audio mode.

Vega configuration

A connected Vega can be configured via Settings Vega . This is accessed via the following menu:

CONF ▷ Setup Vega

XXXXXXXX

6.2 Air data inputs

Where additional aircraft dynamics or air mass data are provided by an intelligent variometer, XCSoar can often make use of it or display it in a separate InfoBox. Key sensor measurements that XCSoar uses include:

- **Gross total energy variometer** (rate of change of the total energy of the aircraft) Used for display, and for calculation of netto variometer.
- **Netto variometer** (estimated vertical velocity of the air mass at the aircraft) Used to display, and to colour the trail so that it may effectively show areas of lift and sink.
- **Aircraft acceleration** (load factor) Used for netto variometer calculations where an external netto variometer is not provided.
- **Barometric altitude** Used for display
- **Indicated airspeed** Used for display, in compensating final glide calculations for aircraft kinetic energy, and in netto variometer calculation where an external netto variometer is not provided.
- **Air density** Used for calculating true airspeed from indicated airspeed.

6.3 Wind display

A continuous display of wind strength and direction is provided on the map. The wind information is derived from the gliders wind drift during thermal flight (climb mode).

The wind direction and speed are displayed as a wind vector on the moving map display and optionally in numeric form in the data display fields. The length of the vector indicates the wind magnitude, and this magnitude is also displayed near the wind vector.

The wind data is one of many data sources used to calculate final glide information. It is possible to manually adjust the wind used in all calculations. For more details, see 6.5.

6.4 Wind estimation

XCSoar offers two ways of estimating wind during flight.

- **Circling** This method uses GPS position fixes to estimate the wind based on drift, typically while thermalling; and is available on all XCSoar installations.
- **ZigZag** This method uses GPS position fixes and true airspeed measurements to estimate the wind, typically during cruise. It is only available where XCSoar is connected to an intelligent variometer that outputs true airspeed.

The wind magnitude and direction can also be adjusted manually from Wind Settings (see below).

Statistics are gathered so that winds are recorded at different heights and times. When the glider's altitude changes significantly, the statistics are consulted to determine the best estimate of the wind based on previous measurements.

One of the following estimation methods can be set either in the configuration settings (page 'Glide Computer', field 'Auto Wind') or in Wind Settings :

- Manual
- Circling
- ZigZag
- Both (ZigZag and Circling)

When wind estimates change significantly, a status message notification of this is issued.

Circling wind algorithm

XCSoar estimates the wind magnitude and direction when circling. It does this using a sophisticated algorithm that incrementally improves the wind estimate from completed turns. Poor quality turns, where the bank angle changes significantly, are rejected or have minimal impact on the overall wind estimate. The best turns are those with constant bank angle.

Estimates are only obtained if the average GPS fix rate is better than one every two seconds. This results in improved fidelity of estimates in the presence of GPS dropouts.

Zig-Zag algorithm

For aircraft fitted with intelligent variometers connected to XCSoar, a so-called 'zig-zag' wind estimation algorithm is available. With this algorithm, the wind estimate can be updated continuously during long glides without circling.

This allows the wind estimate to be updated during cruise while the aircraft performs a zigzag manoeuver. No specific manoeuver is required, in many cases the estimate will be updated as the aircraft's heading changes naturally as the pilot hunts for lift. In general, however, the technique requires the aircraft heading to change over 40 degrees.

If the wind changes significantly while in straight flight, the zig-zag algorithm is used to update the wind estimate even if the aircraft's heading does not change much. This provides greater accuracy in long final glides.

Wind estimates are updated when a large difference between the estimated ground speed and the true ground speed are detected even without much zig-zag manoeuvering.

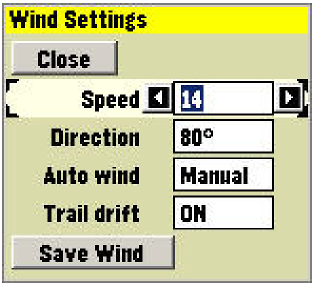
Compass algorithm

For aircraft fitted with intelligent variometers and digital compasses connected to XCSoar, a wind estimation algorithm making use of magnetic heading and airspeed is being developed. This provides another method of updating the wind estimate during cruise and does not require zig-zag manoeuvres.

6.5 Wind settings dialog

Wind Settings allows the initial estimate of the wind speed and direction to be entered, usually prior to flight. It is accessed via the menu under:

CONF ▷ Setup Wind



The wind value can be saved so that the estimate is restored next time XCSoar starts.

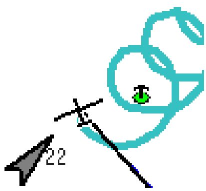
At any time during flight, the pilot can make corrections to the wind estimate by entering the correction in the wind settings dialog and pressing the Save Wind button. Once Save Wind is pressed, the internal estimate is ignored until a new internal estimate is obtained from the circling or zigzag algorithm.

The automatic wind algorithm and the compensation of wind drift of the trail may also be set in this dialog.

6.6 Thermal locator

An algorithm estimates the center of the lift when circling. The thermal marker symbol is a green circle with a 'T' in the center. The option 'Lift center' on the 'Glide Computer' page of the configuration settings determines how this is used:

- **OFF** Lift center locator disabled.
- **Circle at center** A thermal marker is displayed at the center of lift.



- **Pan to center** A marker is displayed at the center of lift, and when circling, the display is panned to this lift center.

When the thermal locator is enabled, the location of the last 20 thermals is marked on the map with the thermal marker during cruise.

This location is calculated to compensate for the thermal drift at the glider's height. This means that internally XCSoar remembers the location of the thermal source on the ground. In other words, if you leave a thermal at the top and later return at low altitude, the position on the map shows the predicted location of the thermal at that low altitude (which is further upwind than the top).

If the wind changes and the thermal source is still active, its position on the map reflects the wind change; that is, the thermal at altitude will be projected downwind at the new wind estimate.

6.7 Convection forecast

If the glider is equipped with an outside temperature and humidity probe, a simple convection forecast system estimates the convection ceiling and the cloud base. The humidity probe is optional and is mainly required for estimating cloud base.

Prior to takeoff or during flight the pilot can modify the maximum forecast temperature on the ground by adjusting the value in Basic Settings described in subsection 5.4.

The forecast convection ceiling is determined by the altitude at which the atmospheric temperature equals the maximum forecast temperature on the ground, cooled adiabatically as it rises according to the dry adiabatic lapse rate. Typically the glider will not climb as far as the convection ceiling and so the measured values are extrapolated to find the ceiling. If the atmosphere is stable, the convection ceiling is reported as zero altitude.

The forecast cloud base is determined by the altitude at which the dew point intersects the maximum forecast temperature on the ground, cooled adiabatically as it rises according to the dry adiabatic lapse rate. If no clouds are forecast, the cloud base is reported as zero.

6.8 Analysis dialog: Wind, Temperature, Barograph and Climb history

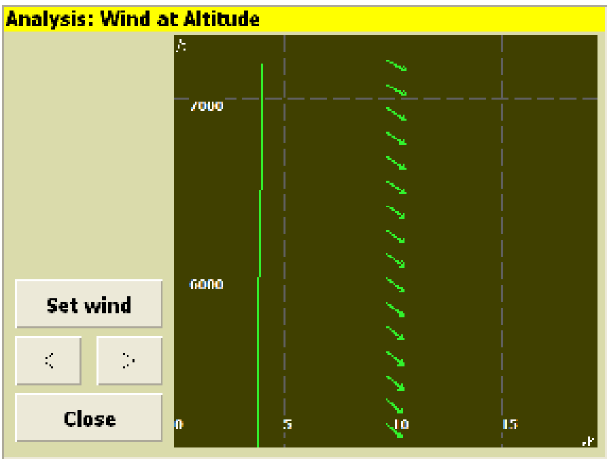
Analysis is used to see several aspects of the atmosphere. It is accessed via the menu under:

INFO ▷ Analysis Show

Several pages are of interest:

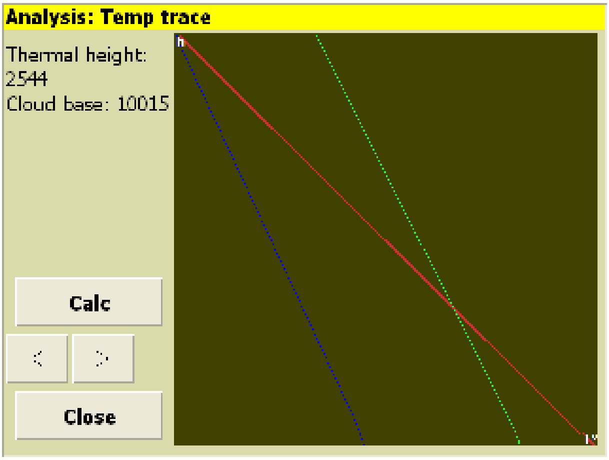
- **Wind at altitude** This shows a graph of the wind speed versus height, and shows the wind vector at several heights.

  Set wind opens Wind Settings (e.g. to manually set the wind).



- **Temp trace** This page is only available if a supported instrument is connected to XCSoar that produces outside air temperature and humidity. The chart shows the variation of dry air temperature, dew point temperature and outside air temperature with height. The convection forecast is summarised as the estimated thermal convection height and estimated cloud base.

  Settings opens Basic Settings .



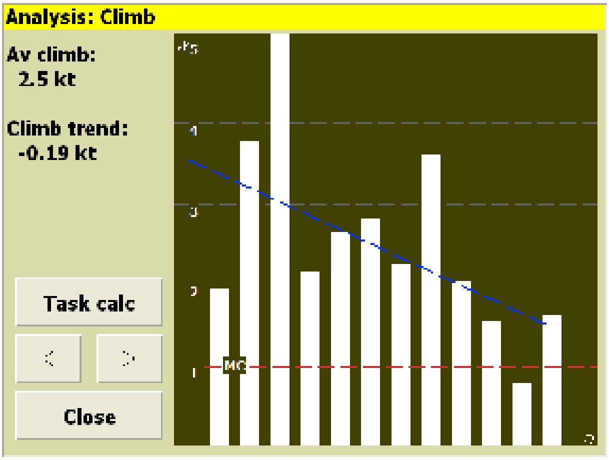
- **Barograph** Shows a graph of the history of the altitude of the glider. Statistics are used to estimate the thermal working band (average base and ceiling of climbs) and to estimate how the ceiling is changing over time. The base and ceiling lines are drawn on the barograph.

  Settings opens Basic Settings .

  XXXXXX GRAPHIC

- **Climb history** Shows a bar chart of the average climb rate achieved during each climb. Statistics are used to estimate the overall average climb rate, and to estimate how this average is changing over time. The current MacCready setting is drawn on the bar chart as a thick red dashed line, and the climb rate trend is drawn on the chart as a blue line.

  Task calc opens the Task calculator .


Analysis: Climb
Av climb:
2.5 kt
Climb trend:
-0.19 kt
Task calc
Close
MC

7 Airspace, Traffic and Team Flying

A database of Special Use Airspace (SUA) can be loaded into XCSoar and used for both display of the airspace regions as well as detecting when the glider enters and leaves the regions.

Two airspace files can be set in the configuration settings (page 'Site'). The first of these is intended for use as the primary SUA database, the second is intended for use with short-term or changing airspace such as the airspace defined in NOTAMs.

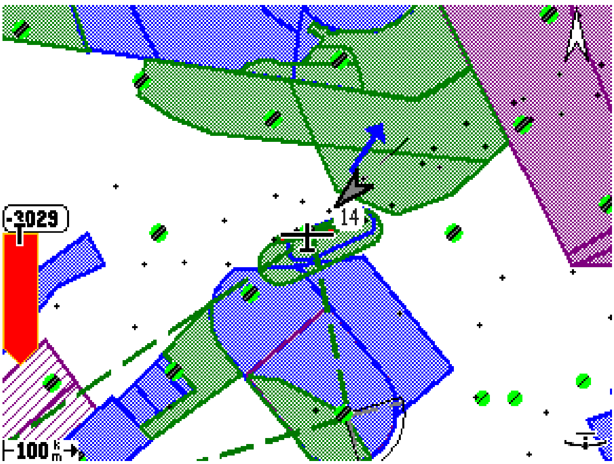
> ***It is the user's responsibility to ensure that the SUA database (airspace file) is up-to-date.***

Through a connected FLARM device, the glide computer can also display information relating to FLARM-equipped nearby traffic and obstacle threats.

A team code function allows teams of pilots to exchange their positions via radio in a short code, encoded and decoded by the computer.

7.1 Airspace display

Local special use airspace regions are drawn on the map as shaded areas with thick borders. The colour and pattern of the areas are specific to different airspace categories and may be configured by the user. Depending on the settings, the user may choose to display no airspace, only airspace above, only airspace within a particular height separation, or automatic display where XCSoar decides when it is important to display the regions.



The patterns used to display airspace areas include opaque, transparent (hollow) and several hatched and stippled patterns. The non-opaque patterns are partially transparent with respect to terrain and topology but are *not* transparent with respect to overlapping airspace. However, where overlapping airspace occurs, all borders are visible. That is, even though airspace patterns are not mutually transparent, all airspace borders are drawn on top of the airspace areas.

Both the display and warning of airspace classes can be individually enabled or disabled by the user as described in subsection 7.7.

The default colouring of Class C, D, E and F airspace is consistent with ICAO charts.

7.2 Incursion events

Three types of events are detected by XCSoar in relation to SUA:

- **Predicted incursion** This event is detected when the glider is estimated to be on a track that will result in entering the airspace at a set time in the future. The time is the ’airspace warning time’ configuration setting.

  The use of a long term average track in these calculations means that the system can still predict incursion even when drifting in the wind when circling.

- **Entering** This event occurs when the glider enters an airspace region.

- **Leaving** This event occurs when the glider leaves an airspace region.

In all cases, the boundary of the region is defined by maximum and minimum altitudes or flight levels, as specified in the airspace file.

Airspace warnings are still issued even if the incursion region is off-screen.

Where a barometric altitude source is available, it is used preferentially to GPS altitude in detecting airspace incursions. This makes the system conform to normal conventions of having airspace violations based on QNH-adjusted altitude.

7.3 Airspace warning levels

The concept of airspace warning levels is introduced:

- **0** Aircraft is outside and distant from airspace.

- **1** Aircraft is predicted to penetrate the airspace but is not close.

- **2** Aircraft is predicted to penetrate the airspace and is close to doing so.

- **3** Aircraft is inside airspace.

At all times XCSoar monitors the aircraft relative to all airspace and maintains warning levels for each. The airspace warnings are still filtered according to the airspace filter preferences; such that certain categories of airspace may be effectively disabled.

The sequence of events when entering an airspace results typically in three warnings: when near (level 1), when close (level 2), and when inside (level 3).

Whenever the warning level increases (above level 0) for any airspace, the airspace warning dialog appears, accompanied by a system beep. When there are no more airspace regions at warning levels above 0, the dialog disappears automatically.

7.4 Airspace warning dialog

This dialog shows the most recent airspace warnings. The following details are shown:

```
<NAME> ...
<TOP,in user units> <TOP,in alt units> <Base info>

<Position> <Class> <distance if outside> ...
<BASE,in user units> <BASE,in alt units> <Base info>
```

The glider's position in relation to the airspace is shown with symbols:

 The glider is inside the airspace.

 The glider is horizontally beside the airspace.

 The glider is below the airspace.

 The glider is above the airspace.

 The glider is diagonally below the airspace.

 The glider is diagonally above the airspace.

The color of the airspace indicates it's class. As the glider approaches the airspace, more color is shown in the symbol and the background of the airspace information gets darker.

Two examples of airspace warnings:

Example 1 The glider is inside the airspace Grenchen CTR (class D) with base of terrain surface and ceiling at 1350 meters above sea level.

Example 2 The glider is below and diagonally 1.87km away from the airspace Bale TMA 2b (class C) with a base of FL 100 (3047m ASL) and a ceiling at FL 195 (5943m ASL).

All airspace warnings as well as a list of all airspaces can be found in Airspace Info (see below).

7.5 Airspace warning acknowlegement

When Airspace Warnings is visible and an airspace warning is active, the dialog can be closed by pressing Close resp. ESC. This has the effect of closing the warning without actually acknowledging the warning.

The warning can be acknowledged by one of the buttons (F buttons) on the bottom of the dialog:

- **Avoid** xxxxxxxx
- **Enter** xxxxxxxx
- **Disable** xxxxxxxx

Near shows the nearest (distance 25km) airspaces in Airspace Info

The general guidelines for using the dialog are:

- Don't acknowledge a warning if you are not sure which airspace the warning is about.
- Note that the warning system beep only occurs when the warning level increases.
- The warning system is designed to allow circling near an airspace without over-stressing the pilot with extraneous warnings.

When an airspace region is acknowledged, the region is drawn on the screen without a pattern.

When the aircraft is predicted to enter a SUA region, or it actually enters an SUA region, a warning is raised, presented as an audio alert and a status message describing the type of airspace warning, the SUA details (including class of airspace, base and ceiling altitude or flight level, radio frequencies).xxxxxxxx stimmt?

Acknowledged warnings will repeat after a certain time specified as the 'Acknowledge time' on the 'Airspace' page of the configuration settings.

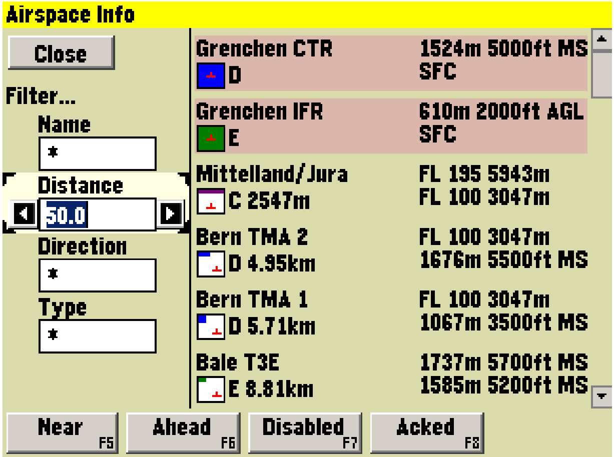
Airspace warning acknowledgements apply to individual SUA regions. If, for example, a glider enters airspace A and the pilot acknowledges the warning, and shortly thereafter is predicted to enter airspace B, an airspace warning for SUA region B will be raised.

> *If you want acknowledged airspace warnings to not be repeated, set a very large value for the configuration setting 'Acknowledge time'.*

7.6 Airspace Info dialog

Airspace Info shows Informations about all airspaces. It can be accessed over:

INFO ▷ Nearest Airspace



The airspaces can be filtered by Name, Distance, Heading and Type (class or status). Four buttons have specific filter functions:

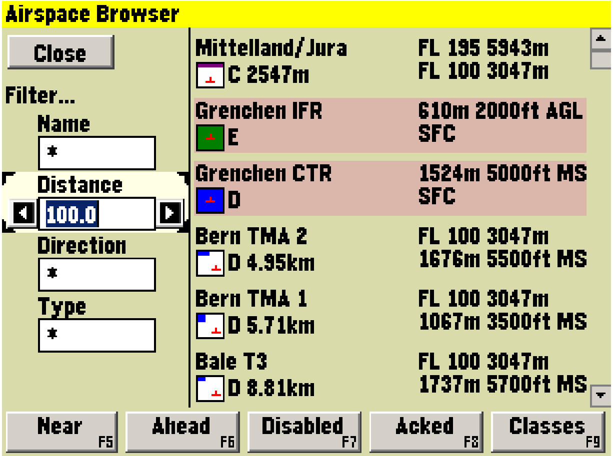
- **Near** Sets the distance on 25km. Pressing the button another time sets it on 50, 75 and 100km. All airspaces within this distance are shown.
- **Ahead** Sets the field 'Direction' to HDG(360°). All airspaces within a certain angle (30°) on both sides of the aircrafts heading direction are displayed.
- **Disabled** Sets the type to 'Disabled'. All disabled airspaces are shown.
- **Acked** Sets the type to 'Acknowledged'. All acknowledged airspaces are shown.

→ Filter combinations are possible

7.7 Airspace Browser dialog

Display and warning settings of airspaces or airspace classes can be set in Airspace Browser . It can be accessed over the following menu:

CONF ▷ Settings Airspace



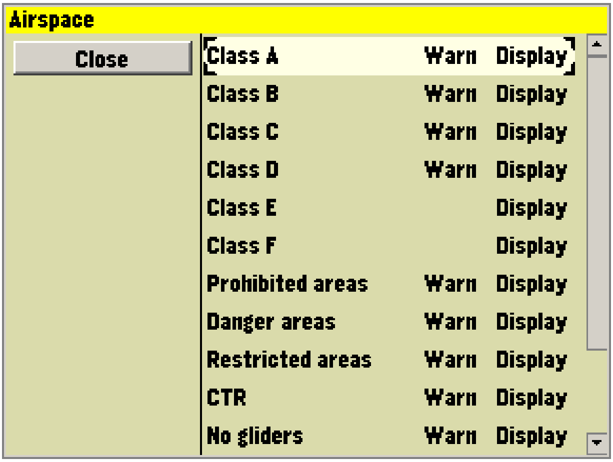
To search airspaces, you can use the same filtering methods as in Airspace INFO (see previous subsection).

Modify settings

To modify warning and display settings of a single airspace, select the airspace from the list and press Enter. The following dialog shows up:

You can now modify the settings (warnings, visibility) for the selected airspace.

To modify the settings for a whole class, press Classes (F9). The following dialog shows up:



Choose a class and press Enter. You can now modify the warnings and visibility settings.

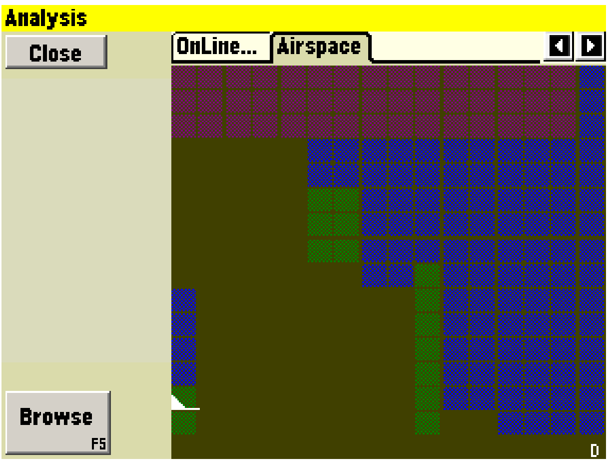
Changes of airspace display colors can be done on the 'Airspace' page of the configuration settings. See 11.2 for more details.

7.8 Analysis dialog: Airspace

The analysis dialog contains a page showing a cross-section of the airspace. This is accessed via the menu under

INFO ▷ Analysis Show

The display shows along the horizontal direction, the distance from the glider out to 50 km in the direction of the glider's track; along the vertical direction is height. The height of the glider is indicated by a white arrow. This page is useful to help visualise complex layering of airspace.



Browse opens Airspace Browser .

7.9 FLARM traffic display

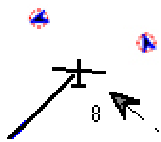
If connected to a FLARM device, FLARM traffic is displayed on the map area. Each FLARM aircraft received is drawn as a dashed red disk.

> ***Do not use XCSoar for collision avoidance, as FLARM audio devices are much more suitable in assisting the pilot to be aware of traffic.***

Note that unless one is circling, the usual zoom level is such that FLARM traffic will not be easily distinguished. When one is circling, or if the user has North-Up screen orientation, this makes the map display a poor aid at helping to locate the traffic.

FLARM map display

The FLARM targets on the map are drawn as red discs and also have black/blue arrow heads to indicate the direction the FLARM target is heading. Note that these arrow heads are oriented according to the display orientation. For example, if the orientation is track-up, then the arrows show the relative track bearing of the target to the aircraft. If the orientation is north-up, then the arrows show the absolute track bearing of the target.

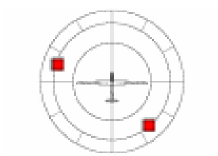


Display on the map FLARM of aircraft registration or pilot name is made possible via a look-up of the ICAO aircraft ID of FLARM traffic in a file. See 12.16 for details on this file format. Aircraft with the FLARM privacy flag set will not have any identification displayed.

FLARM radar

To remedy this situation, when FLARM traffic is received, the lower right corner of the screen shows a small radar-style view of the FLARM traffic from the perspective of the aircraft. The FLARM radar can be opened with F9 even when there is no traffic. FLARM traffic is displayed as coloured squares on the radar.

This FLARM radar is oriented track-up and a small glider icon clearly shows that the display is oriented as such. The scale of the display is nonlinear (expanded close to the aircraft). On the background there are three rings; the first is 500 meters, the second is 1000 meters and the third is 2000 meters. Traffic further away than 2000 meters is drawn at the 2000 meter ring.



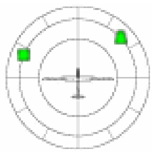
The FLARM gauge display shows FLARM traffic in colours according to the threat level:

- Green for level 0
- Yellow for level 1
- Red for level 2 and 3

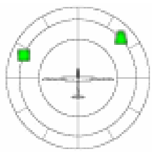
The style of the FLARM radar can be customised with the 'FLARM symbols' configuration option on page 'Appearance' of the configuration settings.

This controls the symbols used to display FLARM targets on the radar display.

- **Relative altitude** The relative altitude of the target is represented as a shape that becomes triangular for extreme above/below heights, square at the same altitude. Square shapes indicate similar altitude; a triangle pointing up indicate the traffic is very high; a triangle pointing down indicates the traffic is very low. Similarly, intermediate trapezoids indicate relative height in a similar way proportionally: thinner at the top indicates the traffic is higher, thinner at the base indicates the traffic is lower.



- **Bearing** The track bearing of the target relative to the track bearing of the aircraft is displayed as an arrow head. In all modes, the color of the target indicates the threat level.



The FLARM radar-like display, when enabled, can be suppressed when visible by pressing the enter button. If the FLARM radar is suppressed, pressing the enter button again cancels the suppression and the radar is shown again. When new traffic appears in the radar, or if the FLARM issues a collision warning, the suppression is cancelled.

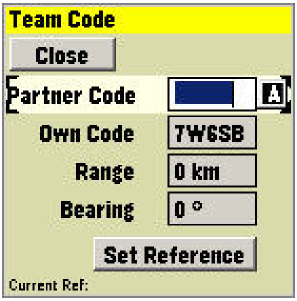
When the alert level of the FLARM target indicates a collision warning (level 3), a black line is drawn from the target to the edge of the radar. This is done to make it easier to see at a glance which direction the target is relative to the glider, since when a collision warning is active, typically the target will be close to the glider.

7.10 Team flying

Team code is a system to allow pilots flying within a team to communicate their position to each other in a concise and accurate manner. The principle of the system is that each pilot uses their computer to determine a 5 digit code which describes their position relative to a common waypoint. The pilots call each other reporting these codes, and entering the codes into the computer allows their mates to be located accurately by the computer.

This is done in Team Code , which is accessed via the menu:

NAV ▷ Team Code



To use team code, all pilots in the team should select a waypoint to be used as the reference. This can be done by pressing Set Reference and selecting a waypoint from the list.

During flight, the pilot can read out his ‘Own code’ from the team code dialog to his team mate, in order to report his position. When the pilot hears a code report from a team mate, he can enter the mate’s code in the field ‘Partner Code’ in order to see bearing and distance of the partner.

InfoBoxes are available to give the relative range, bearing and relative bearing to the team mate.

8 Avionics and Airframe

This section discusses XCSoar as a subsystem of the aircraft. It covers the integration of XCSoar with external devices, including GPS, switches and sensors, and aircraft radio transceivers and other devices. Integration with FLARM is covered in section 7.9, and integration with variometers is covered in section 6.1.

8.1 GPS connection

XCSoar requires a 3D GPS fix for its navigation functions.

GPS status

GPS status icons and text may appear on the bottom edge of the map display to indicate:

- **Waiting for GPS fix** The GPS may have a 2D fix, better reception or additional time to search for satellites is required. The aircraft symbol disappears while there is no 3D fix.
- **GPS not connected** No communication with the GPS is received. This indicates an error in the Comm port settings or the GPS device may be disconnected or switched off.

When the GPS is not connected for more than one minute, XCSoar automatically attempts to restart communication with the device and will then resume waiting. This method has shown to provide the most reliable way of recovering from communication errors.

XCSoar can handle up to two GPS sources and it uses them to provide redundancy. This means that if the primary GPS source drops out, XCSoar will use the GPS data from the second source. If both sources have valid fixes, the second source is ignored. For this reason, it is recommended to have the GPS source with the best antenna or reliability as the primary device.

GPS altitude

Some older GPS units (and some new ones) do not output altitude relative to mean sea level, rather they output elevation with respect to the WGS84 ellipsoid. XCSoar detects when this occurs and applies the ellipsoid to geoid offset according to an internal tabulated data at two degree spacing. This is not required for FLARM units or Altair Pro, which correctly output MSL altitude.

8.2 Switch inputs

XCSoar supports monitoring of switches and sensors connected to the host computer, for the purpose of providing situational awareness feedback, alerts, or as general-purpose user-interface input devices. Several mechanisms are available for interfacing to switches and sensors:

- **Serial device** Certain intelligent variometers such as triadis engineering's Vega have multiple airframe switches and pass this information to Altair/XCSoar as special NMEA sentences.
- **OneWire device** triadis engineering's Altair glide computer and Vega variometer provide a OneWire peripheral bus to which various digital and analog sensors can be attached.

A custom 'input events' file determines how switch and sensor inputs are processed.

A standard set of airframe inputs are defined as:

- Airbrake
- Flap position (positive, neutral, negative)
- Landing gear

Other logical inputs from Vega include computed quantities relating to specific airframe alerts and aircraft operating envelope warnings, for example "airbrake extended and gear retracted".

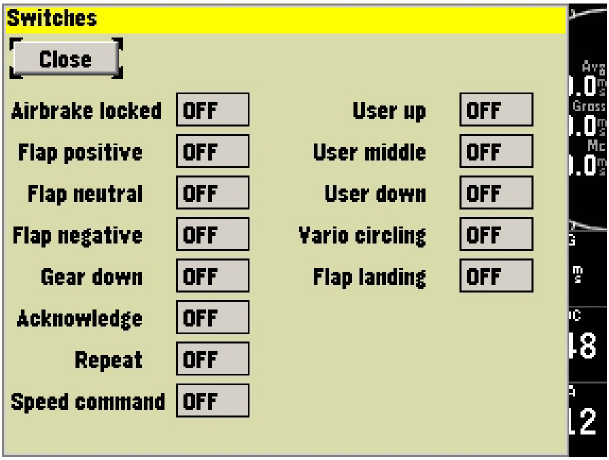
Refer to the Vega documentation for more details on switch inputs and how they may be used.

8.3 Switch Status

When a Vega is connected, the switch status is shown on the last page of Status, which is available from the menu:

CONF ▷ Status Show

This page is updated in real-time, allowing the pilot to check the correct functioning of switches during daily inspection tests or before takeoff.



8.4 Aircraft radio transceiver

Monitoring and setting the active and standby frequencies of aircraft transceivers with serial connections are currently in development. The goal is to provide the functionality whereby the radio frequency can be set with one button press (requiring confirmation by the pilot) when the aircraft flies into controlled airspace or enters an airfield's advisory/mandatory broadcast traffic zone.

8.5 Supported variometers

XCSoar supports inputs from triadis Engineering's Vega variometer and TR-DVS digital voice system, Cambridge Aero Instruments 302 DDV and GPSNav, Borgelt B50/B500, LX Navigation LX1600 variometers, Zander variometers, and Tasman Instruments variometer.

8.6 Other avionics devices

Support for the Honeywell Digital Compass HMR3000 is under development.

8.7 Slave mode

A device type in the configuration settings, “NMEA Out” is defined for use in joining two Altair systems in a master-slave mode.

In the master, the second COM device can be set to NMEA Out, and all data received in the first com device (as well as outgoing data) will be sent to the slave.

In the slave, the first COM device can then be set to “Vega” or “Altair Pro” and this system receives all data as if it came from the Master’s GPS and connected instruments (Vega, FLARM etc).

8.8 Interface to external loggers

XCSoar has support for declaration and handling special sentences used by commercial flight loggers. Devices that are supported but do not include declaration support include Posigraph and Colibri.

Volkslogger

Uploading of the current task to the Volkslogger is supported. The device type in the system settings must be set to ‘Volkslogger’.

When a task is declared in Task Editor, the pilot name, aircraft type and competition ID will be uploaded to the Volkslogger.

> *Note that uploading the task erases the Volkslogger’s database of waypoints!*

EW logger

Uploading of the current task to EW loggers is supported. The device type in the system settings must be set to ‘EW’.

When a task is declared in Task Editor, the pilot name, aircraft type and competition ID will be uploaded to the EW Logger.

CAI 302

Uploading of the current task to the CAI 302 is supported. The device type in the system settings must be set to ‘CAI 302.

When a task is declared in Task Editor, the pilot name, aircraft type and competition ID will be uploaded to the CAI 302.

9 Quickstart

This section provides instructions for using XCSoar in typical cross-country tasks. It is separated into simple scenarios to demonstrate how to use key features. It assumes the configuration options have already been set up to the user's preferences.

These instructions are intended to provide a simple step-by-step guide to flying tasks of varying levels of complexity but are not intended to demonstrate all the features of XCSoar. Furthermore, the system can be used productively in ways other than as described here.

9.1 Local flight

In this scenario, the pilot intends to fly locally or a casual cross-country task where navigation to pre-determined waypoints is not required.

Prior to takeoff

- Turn on the device.
- Open Basic settings and adjust the bugs and ballast as required. Set the maximum forecast temperature. Close the dialog.
- Open Task editor and press New .
- The task now contains the home waypoint as start and finish waypoint.

In-flight

- At the appropriate times, set the MacCready automatically, manually in Setup MacCready , or from the variometer.
- Change the bugs/ballast settings as required.
- In flight, refer to Analysis as required.
- At any time, the glider can reach home when the altitude difference bar is a green arrow pointing upwards.
- Optionally, set MacCready to 'AUTO' when ready to return home. If the MacCready mode was set to 'Final Glide' or 'Both', then the system will command the optimal speed to return home.

After landing

- Status , page 'Task', shows the elapsed flight time.
- Analysis can be used to analyse or review the flight.

These actions may be performed after turning the device off and on again.

9.2 FAI Task

In this scenario, the pilot intends to fly a triangle FAI task with a single start sector and automatic waypoint advance.

Prior to takeoff

- Turn on the device.
- Open Basic settings and adjust the bugs and ballast as required. Set the maximum forecast temperature. Close the dialog.
- Open Task editor and press New .
- The task now contains the home waypoint as start and finish waypoint.
- Add new waypoints with Insert on the 'Waypoints' page.
- Set the start and sector types, and ensure AAT is OFF. In this example, we set alternate start points to 'OFF' and Auto Advance mode to 'Auto'. Once finished, press close.
- The task is now entered. Open Analysis and select the 'Task' page to preview the task on a map.

In-flight

- The current waypoint will advance automatically as the pilot flies through the observation zones.
- After the task is started, Status can be opened to verify a valid start was detected. If the 'start time' is given, the start was detected and legal according to the task start rules specified in the configuration.
- At all times the black track arrow will point at the next waypoint. The blue arrow will point at the direction the glider should track when in cruise.
- If Auto Zoom is activated, the map will automatically zoom in as task waypoints are approached.
- At the appropriate times, set the MacCready automatically, manually in Setup MacCready , or from the variometer.
- Change the bugs/ballast settings as required.
- Refer to Analysis as required.
- Refer to Status as required. This shows the start time, elapsed time on task, estimated arrival time, average task speed etc.
- At any time, the glider can reach home when the altitude difference bar is a green arrow pointing upwards.
- Optionally set MacCready to 'AUTO'. If the MacCready mode was set to 'Final Glide' or 'Both', then the system will command the optimal speed to return home; and the MacCready value will be set to the minimum climb rate at which it is beneficial to continue to climb.

After landing

As described in subsection 9.1.

9.3 FAI Task, Manual Start

In this scenario, the pilot intends to fly a triangle FAI task with a single start sector and manual task start.

Prior to takeoff

As described in subsection 9.2, except where noted below.

- Set 'Auto Advance' to 'Arm start' in Task editor .

In-flight

As described in subsection 9.2, except where noted below.

- Prior to entering the start sector, when you are ready to start the task, press the 'NavTo TaskPt' button.

After landing

As described in subsection 9.1.

9.4 AAT Task, Manual Arm

In this scenario, the pilot intends to fly a triangle AAT task, and will manually arm the waypoint advance system.

Prior to takeoff

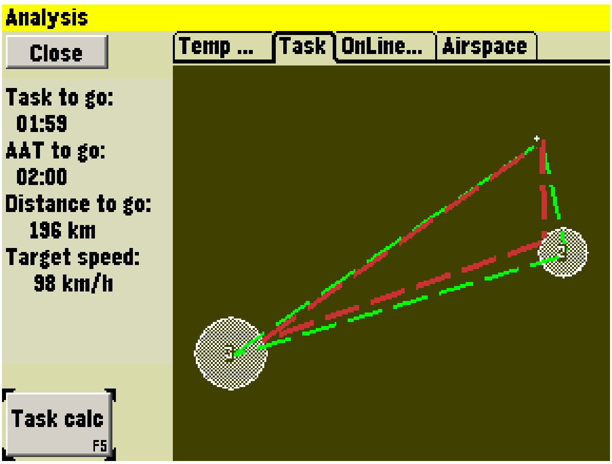
- Turn on the device.
- Open Basic settings and adjust the bugs and ballast as required. Set the maximum forecast temperature. Close the dialog.
- Open Task editor and press New .
- The task now contains the home waypoint as start and finish waypoint.
- Add new waypoints with Insert on the 'Waypoints' page.
- Set the start and sector types, and set AAT to ON, and set the assigned minimum task time. In this example, we assume there are not alternate start points and Auto Advance mode is set to 'Arm'.
- Adjust AAT sector parameters for the waypoints by clicking Enter on the selected waypoint.
- The AAT task is now entered.

- The estimated elapsed time to complete the task with different MacCready settings can be explored by pressing Calc . Adjusting the 'range' setting shifts the targets within the AAT sectors to increase or decrease the task distance.
- Open Analysis and select the 'Task' page to preview the task on a map.

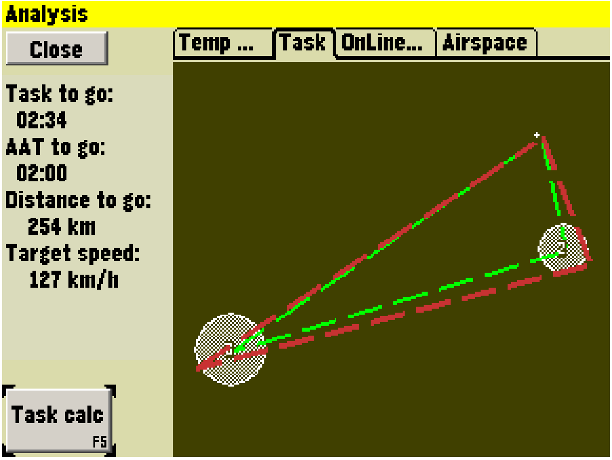
In-flight

- When the pilot is ready to start the task, press Arm Advance . The current waypoint will then advance automatically once, as the pilot flies through the start sector. After this occurs, the advance trigger is disarmed.
- In order to re-start, the pilot needs to press Arm Advance again prior to flying through the start sector again.
- After the task is started, Status can be opened to verify a valid start was detected. If the 'start time' is given, the start was detected and legal according to the task start rules specified in the configuration.
- During flight, the estimated elapsed time to complete the task with different MacCready settings can be explored in Task calculator . Adjusting the 'range' setting shifts the targets within the AAT sectors to increase or decrease the task distance. Typically, the pilot should set the range such that the estimated elapsed time is greater than the assigned task time. If conditions are improving, such that the pilot wishes to fly deeper within an AAT sector, the range can be increased. Likewise, if conditions are deteriorating, the range can be decreased to a value at which the estimated elapsed task time is above the assigned task time. This allows the pilot to effectively increase or decrease the task distance.

  The figure below shows the course around the targets at range set to -100%.



The figure below shows the course around the targets at range set to 100%.



- At all times the black track arrow will point at the next target. The target is the location within the AAT sector at the range specified in Task calculator . The blue arrow will point at the direction the glider should track when in cruise.
- When the pilot is within or approaching an AAT sector and is ready to advance to the next waypoint, press Arm Advance . The current waypoint will then advance automatically once, if the pilot is inside the observation zone. After this occurs, the advance trigger is disarmed.
- If Auto Zoom is activated, the map will automatically zoom in as task waypoints are approached.
- At the appropriate times, set the MacCready automatically, manually in Setup MacCready , or from the variometer.
- Change the bugs/ballast settings as required.
- Refer to Analysis as required.
- Refer to Status as required. This shows the start time, elapsed time on task, estimated arrival time, average task speed etc.
- Optionally set MacCready to 'AUTO'. If the MacCready mode was set to 'Final Glide' or 'Both', then the system will command the optimal speed to return home; and the MacCready value will be set to the minimum climb rate at which it is beneficial to continue to climb.

After landing

As described in subsection 9.1.

9.5 Task with alternate start sectors

In this scenario, the pilot intends to fly a task with alternate start sectors and manually arm the waypoint advance system.

Prior to takeoff

As described in subsection 9.2, except where noted below.

- Open Task editor , and set 'Auto Advance' to 'Arm start'. Set 'Alternate Start Points' to 'ON' on the 'Options' page. Press Enter on the start waypoint in 'Waypoints' and then press Altern. Starts . Press 'Clear list' to clear the list of existing start points if required. Add alternate start points with Insert .

In-flight

As described in subsection 9.2, except where noted below.

- Prior to entering the start sector, when the pilot is ready to start the task, press Arm Advance .
- In order to re-start from any start sector, the pilot needs to press Arm Advance again prior to flying through any of the start sectors again.

10 InfoBox Reference

InfoBox data types are grouped into logical categories.

All InfoBoxes display their data in user-specified units. Where data is invalid, the displayed value will be '–' and the contents are greyed out. This happens, for example, when no terrain data is found or it is not in range for the Terrain Elevation InfoBox type.

In the following description of the InfoBox data types, the first title is as it appears in the InfoBox configuration dialog box, the second title is the label used in the InfoBox title.

10.1 Altitude

Height GPS

This is the height above mean sea level reported by the GPS. Touchscreen/PC only: in simulation mode, this value is adjustable with the up/down arrow keys, and the right/left arrow keys also cause the glider to turn.

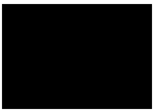
Height AGL

This is the navigation altitude minus the terrain height obtained from the terrain file. The value is coloured red when the glider is below the terrain safety clearance height.

Terrain Elevation

This is the elevation of the terrain above mean sea level obtained from the terrain file, at the current GPS location.

Pressure Altitude



This is the barometric altitude obtained from a GPS equipped with pressure sensor, or a supported external intelligent vario.

10.2 Aircraft state

Bearing

True bearing of the next waypoint. For AAT tasks, this is the true bearing to the target within the AAT sector.

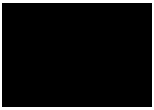
Speed ground

Ground speed measured by the GPS. If this InfoBox is active in simulation mode, pressing the up and down arrows adjusts the speed.

Track

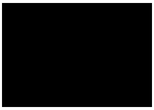
Magnetic track reported by the GPS.

Airspeed IAS



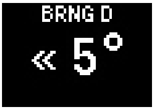
Indicated Airspeed reported by a supported external intelligent vario.

G load



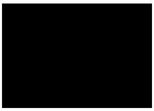
Magnitude of G loading reported by a supported external intelligent vario. This value is negative for pitch-down manoeuvres.

Bearing Difference



The difference between the glider's track bearing, to the bearing of the next waypoint, or for AAT tasks, to the bearing to the target within the AAT sector. GPS navigation is based on the track bearing across the ground, and this track bearing may differ from the glider's heading when there is wind present. Chevrons point to the direction the glider needs to alter course to correct the bearing difference, that is, so that the glider's course made good is pointing directly at the next waypoint. This bearing takes into account the curvature of the Earth.

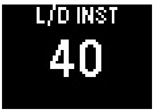
Airspeed TAS



True Airspeed reported by a supported external intelligent vario.

10.3 Glide ratio

L/D instantaneous



Instantaneous glide ratio, given by the ground speed divided by the vertical speed (GPS speed) over the last 20 seconds. Negative values indicate climbing cruise. If the vertical speed is close to zero, the displayed value is '–'.

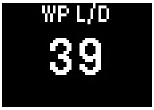
L/D cruise

The distance from the top of the last thermal, divided by the altitude lost since the top of the last thermal. Negative values indicate climbing cruise (height gain since leaving the last thermal). If the vertical speed is close to zero, the displayed value is '–'.

Final L/D

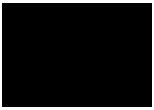
The required glide ratio to finish the task, given by the distance to go divided by the height required to arrive at the safety arrival altitude. Negative values indicate a climb is necessary to finish. If the height required is close to zero, the displayed value is '–'.

Next L/D



The required glide ratio to reach the next waypoint, given by the distance to next waypoint divided by the height required to arrive at the safety arrival altitude. Negative values indicate a climb is necessary to reach the waypoint. If the height required is close to zero, the displayed value is '–'.

L/D vario



Instantaneous glide ratio, given by the indicated airspeed divided by the total energy vertical speed, when connected to an intelligent variometer. Negative values indicate climbing cruise. If the total energy vario speed is close to zero, the displayed value is '–'.

10.4 Variometer

Thermal last 30 sec

A 30 second rolling average climb rate based on the reported GPS altitude, or vario if available.

Last Thermal Average

Total altitude gain/loss in the last thermal divided by the time spent circling.

Last Thermal Gain

Total altitude gain/loss in the last thermal.

Last Thermal Time

Time spent circling in the last thermal.

Thermal Average

Altitude gained/lost in the current thermal, divided by time spent thermaling.

Thermal Gain

The altitude gained/lost in the current thermal.

Vario

Instantaneous vertical speed, as reported by the GPS, or the intelligent vario total energy vario value if connected to one.

Netto Vario

Instantaneous vertical speed of air-mass, equal to vario value less the glider's estimated sink rate. Best used if airspeed, accelerometers and vario are connected, otherwise calculations are based on GPS measurements and wind estimates.

10.5 Atmosphere

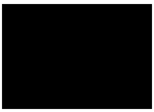
Wind Speed

Wind speed estimated by XCSoar.

Wind Bearing

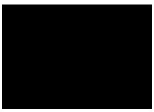
Wind bearing estimated by XCSoar. (Touchscreen/PC only) Manual adjustment is possible by pressing the up/down cursor keys to adjust bearing when the InfoBox is active.

Outside Air Temperature



Outside air temperature measured by a probe if supported by a connected intelligent variometer.

Relative Humidity



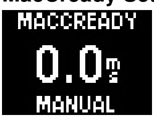
Relative humidity of the air in percent as measured by a probe if supported by a connected intelligent variometer.

Forecast Temperature

Forecast temperature of the ground at the home airfield, used in estimating convection height and cloud base in conjunction with outside air temperature and relative humidity probe. (Touchscreen/PC only) Pressing the up/down cursor keys adjusts this forecast temperature.

10.6 MacCready

MacCready Setting

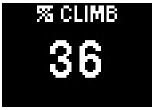


The current MacCready setting. This InfoBox also shows whether MacCready is manual or auto.

Speed MacCready

The MacCready speed-to-fly for optimal flight to the next waypoint. In cruise flight mode, this speed-to-fly is calculated for maintaining altitude. In final glide mode, this speed-to-fly is calculated for descent.

Percentage climb



Percentage of time spent in climb mode. These statistics are reset upon starting the task.

Speed Dolphin

The instantaneous MacCready speed-to-fly, making use of Netto vario calculations to determine dolphin cruise speed in the glider's current bearing. In cruise flight mode, this speed-to-fly is calculated for maintaining altitude. In final glide mode, this speed-to-fly is calculated for descent. In climb mode, this switches to the speed for minimum sink at the current load factor (if an accelerometer is connected). When Block mode speed to fly is selected, this InfoBox displays the MacCready speed.

10.7 Navigation

Next Distance

The distance to the currently selected waypoint. For AAT tasks, this is the distance to the target within the AAT sector.

Next Altitude Difference

Arrival altitude at the next waypoint relative to the safety arrival altitude.

Next Altitude Required

Altitude required to reach the next turn point.

Final Altitude Difference

Arrival altitude at the final task turn point relative to the safety arrival altitude.

Final Altitude Required

Altitude required to finish the task.

Speed Task Average

Average cross country speed while on current task, compensated for altitude.

Speed Task Instantaneous

Instantaneous cross country speed while on current task, compensated for altitude.

Speed Task Achieved

Achieved cross country speed while on current task, compensated for altitude.

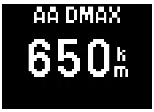
Final Distance

Distance to finish around remaining turn points.

AA Time

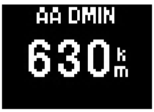
Assigned Area Task time remaining.

AA Distance Max



Assigned Area Task maximum distance possible for remainder of task.

AA Distance Min

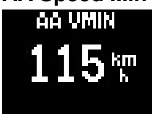


Assigned Area Task minimum distance possible for remainder of task.

AA Speed Max

Assigned Area Task average speed achievable if flying maximum possible distance remaining in minimum AAT time.

AA Speed Min



Assigned Area Task average speed achievable if flying minimum possible distance remaining in minimum AAT time.

AA Distance Tgt

Assigned Area Task distance around target points for remainder of task.

AA Speed Tgt

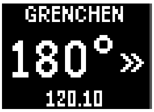
Assigned Area Task average speed achievable around target points remaining in minimum AAT time.

Distance Home

Distance to the home waypoint (if defined).

10.8 Waypoint

Next Waypoint



The name of the currently selected turn point. When this InfoBox is active, using the up/down cursor keys selects the next/previous waypoint in the task. (Touchscreen/PC only) Pressing the enter cursor key brings up the waypoint details.

Time of flight

Time elapsed since takeoff was detected.

Time local

GPS time expressed in local time zone.

Time UTC

GPS time expressed in UTC.

Task Time To Go

Estimated time required to complete task, assuming performance of ideal MacCready cruise/climb cycle.

Next Time To Go

Estimated time required to reach next waypoint, assuming performance of ideal MacCready cruise/climb cycle.

Task Arrival Time

Estimated arrival local time at task completion, assuming performance of ideal MacCready cruise/climb cycle.

Next Arrival Time

Estimated arrival local time at next waypoint, assuming performance of ideal MacCready cruise/climb cycle.

10.9 Team code

Own Team Code

The current Team code for this aircraft. Use this to report to other team members.

Team Bearing

The bearing to the team aircraft location at the last team code report.

Team Bearing Diff

The relative bearing to the team aircraft location at the last reported team code.

Team range

The range to the team aircraft location at the last reported team code.

11 Configuration

XCSoar is a highly configurable glide computer and can be customised to suit a wide variety of preferences and user requirements. This section describes the configuration settings and options.

Scope of configuration

Several features of XCSoar can be customised:

- Modifying configuration settings. This is the sort of configuration most likely to be performed by users; and this is given the greatest attention in this document.
- Changing the language, or even just to change the wording of text in the user interface.
- Changing the button assignments and button menus. This allows the content and structure of the button menu to be changed.
- Changing or adding actions performed when glide computer events take place.
- Defining how long status messages appear and sounds to be played when those messages occur.

Describing all of these is beyond the scope of this document.

Profiles and settings

There are a large set of configuration settings that may be customised from the Settings dialog accessible from the menu under

CONF ▷ Setup system

> ***You are strongly discouraged from changing these settings during flight. All changes to the settings should be performed on the ground so that their desired effect on the programs behaviour can be verified.***

The settings dialog contains several pages. Once changes have been made, click the Close button on the screen or PWR/ESC to close the dialog and return the program back to normal map mode.

Configuration settings are automatically saved to the profile `xcsoar-registry.prf`. To create a new profile, copy this file and rename it. The new profile can be chosen at next system start.

> *It is recommended to create a new profile in order not to loose the configuration settings after a system crash.*

See 12 for a description of the data formats of files referred to in the settings. Where no file is to be used, the field can be left blank. File name fields in forms show files that match a file extension filter. This makes it much easier to find and select the correct file.

Safety lock

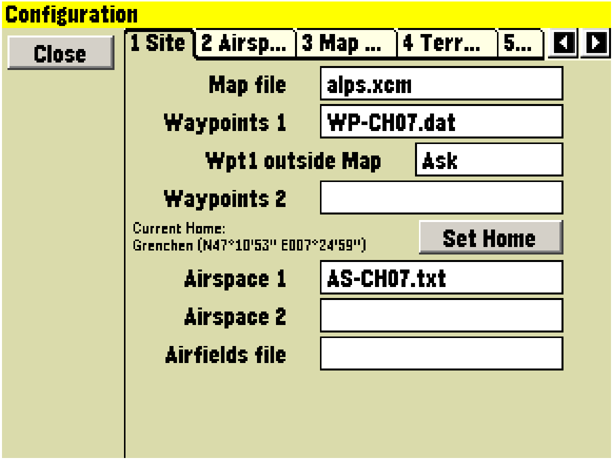
A safety feature is available to prevent settings being modified in flight. This optionally prevents the configuration settings dialog from starting if the aircraft is in flight. This can be set on page 'Interface' in field 'Safety lock'.

Fail-safe

If the XCSoar software crashes due to an unrecoverable error while loading a file, the file will be removed from the configuration settings in order to prevent the crash reoccuring. Therefore, if an error was found in a file, the user must re-enter that file in the configuration settings after remedying the situation.

11.1 Site

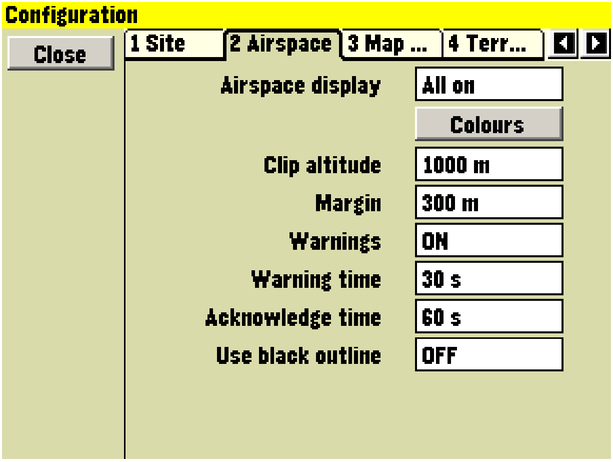
The dialog specifies most of the important files that must be configured when flying at a new site.



- **Map file** The name of the map file (XCM) containing digital elevation terrain data, topology, waypoints etc.
- **Waypoints 1** Primary waypoints file. If left blank, waypoints are loaded from the map file (if available).
- **Wpt1 outside terrain** This option defines how waypoints outside the terrain range are handled: the user can be asked when this occurs, or they can be always included or excluded.
- **Waypoints 2** Secondary waypoints file. This may be used to add waypoints for a competition.
- Set Home You can set your home airfield with this button. The current home is indicated on the left side of the button.
- **Airspace 1** File name of the primary airspace file in which special use airspaces are defined.
- **Airspace 2** File name of the secondary airspace file. Intended especially for NOTAMs.
- **Airfields file** The airfields file may contain extracts from Enroute Supplements or other contributed information about individual airfields.

11.2 Airspace

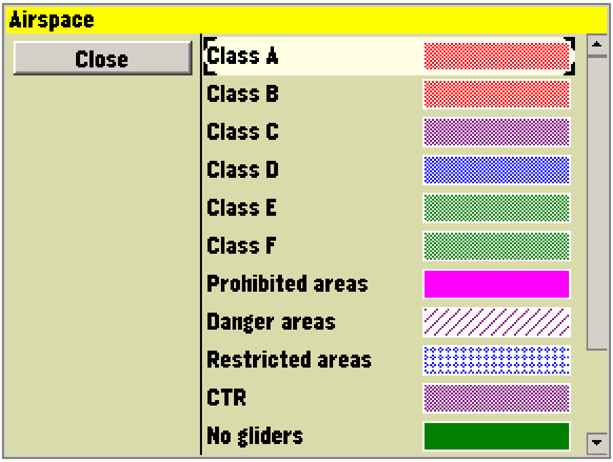
This page is used to determine how the airspace information is displayed and how warnings are issued.



- **Airspace display** Controls how airspace display and warnings are filtered based on altitude. Filtering options for single airspaces or airspace classes are available in Airspace Browser (see 7.7 for more details).
  - **All off** No airspaces are shown on the map.
  - **All on** All the airspace information is displayed at the same time.
  - **Clip** Only airspace below a user determined altitude is shown.
  - **Auto** Only airspace at the current altitude plus or minus a user definable margin is shown.
  - **All Below** Only airspace below the glider is shown.

- **Clip altitude** For clip mode, this is the altitude below which airspace is displayed.
- **Margin** For auto mode, this is the safety margin for warnings and display.
- **Warnings** Determines whether all warnings are enabled or disabled.
- **Warning time** This is the time before an incursion is estimated at which the system will warn the pilot.
- **Acknowledge time** This is the time period in which an acknowledged airspace warning will not be repeated.
- **Use black outline** Draws a black outline around each airspace.

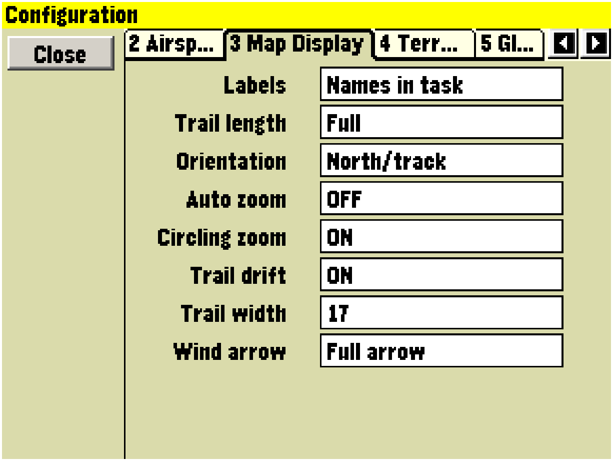
This page also has Colours which can be used to review or change the colours/patterns used by each airspace class. When pressed, the following dialog is opened:



First select the airspace type you wish to change. Then press Enter and select the colour and pattern you wish it to be drawn in.

11.3 Map Display

This page has options relating to the map display.



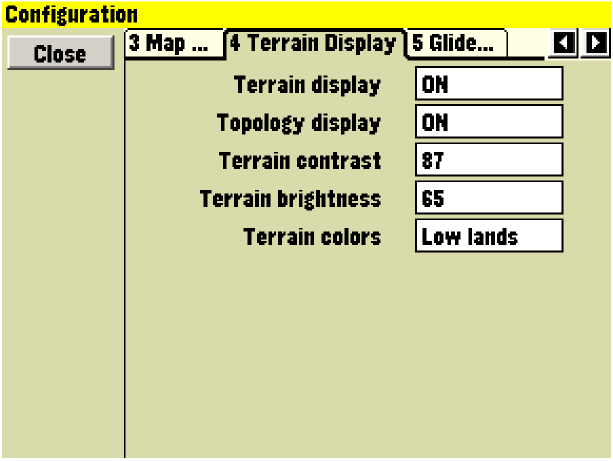
- **Labels** This setting determines the label displayed with each waypoint. There are 6 options:
  - **Names** The full name of each waypoint is displayed.
  - **Numbers** The waypoint number of each waypoint is displayed.
  - **None** No names are displayed with the waypoints.
  - **Names in task** Names are only displayed for waypoints that are in the active task as well as the home airfield.
  - **First Three** The first 3 letters of the waypoint name are displayed.
  - **First Five** The first 5 letters of the waypoint name are displayed.
- **Trail length** Determines whether and how long a trail is drawn behind the glider.
  - **Off** No trail is drawn
  - **Long** A long trail is drawn (approx 60 minutes)
  - **Short** A short trail is drawn (approx 10 minutes)
  - **Full** Displays the entire flight
- **Orientation** This determines how the screen is rotated with the glider.
  - **North up** The moving map display will always be orientated north to south and the glider icon will be rotated to show its course.
  - **Track up** The moving map display will be rotated so the glider's track is oriented up.
  - **North up when circling** This is equivalent to track-up in cruise and north-up when circling.

  - **Target up when circling** This is equivalent to track-up in cruise and the bearing to next waypoint up when circling.
  - **North/track** North-up in cruise, glider track-track up in circling

- **Auto zoom** Determines whether auto-zoom is enabled. Auto-zoom changes the zoom level during flight so that the map zooms in as the active waypoint is approached. After passing a waypoint, the map zooms out to the next waypoint.
- **Circling zoom** This determines whether separate zoom levels will be maintained for circling and cruise modes. If unchecked, there is only one zoom. If enabled, then the map will zoom in automatically when entering circling mode and zoom out automatically when leaving circling mode.
- **Trail drift** Determines whether the trail is drifted with the wind when displayed in circling mode. When OFF, the trail is uncompensated for wind draft.
- **Trail width** Sets the width of the trail display.
- **Wind arrow** Determines the way the wind arrow is drawn on the map.
  - **Arrow head** Draws an arrow head only
  - **Full arrow** Draws an arrow head with a dashed arrow line

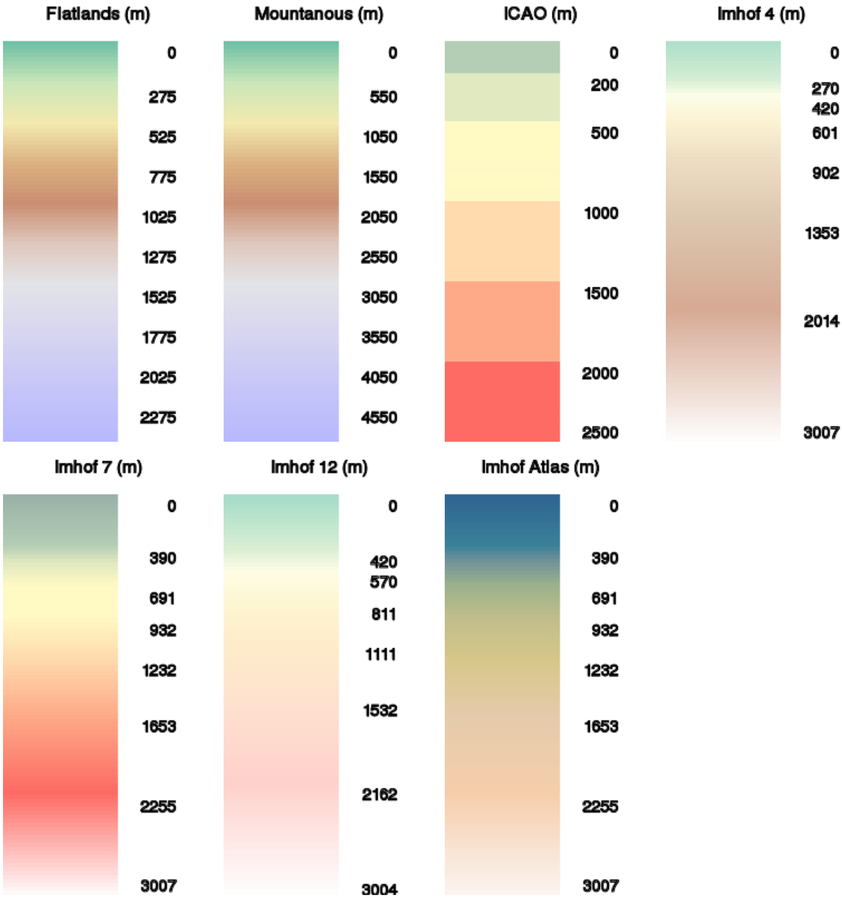
11.4 Terrain display

This page sets how terrain and topology is drawn on the map window.



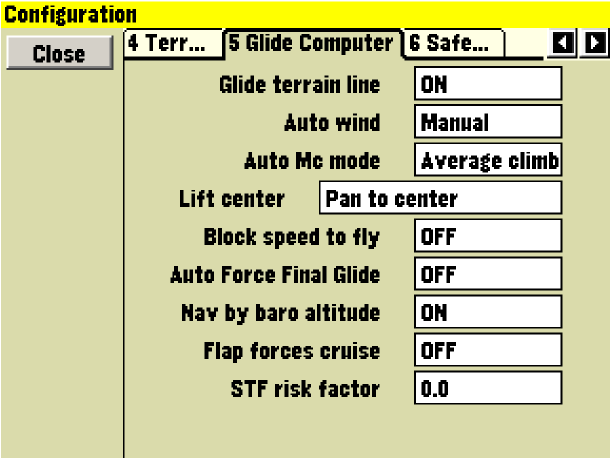
- **Terrain display** Draws digital elevation terrain on the map
- **Topology display** Draws topological features (roads, rivers, lakes) on the map
- **Terrain contrast** Defines the amount of phong shading in the terrain rendering. Use large values to emphasise terrain slope, smaller values if flying in steep mountains.
- **Terrain brightness** Defines the brightness (whiteness) of the terrain rendering. This controls the average illumination of the terrain.
- **Terrain colors** Defines the color ramp used in terrain rendering. Various schemes are available, which works best for you will depend on how mountainous your region is. The available terrain color schemes are illustrated in the table below.

Colour schemes



11.5 Glide computer

This page allows glide computer algorithms to be configured.



- **Glide terrain line** This determines whether the glide terrain range is calculated and drawn as a line on the map area.
- **Auto wind** This allows switching on or off the automatic wind algorithm. When the algorithm is switched off, the pilot is responsible for setting the wind estimate. Circling mode requires only a GPS source, ZigZag requires an intelligent vario with airspeed output.
- **Auto Mc mode** This option defines which auto MacCready algorithm is used.

  Final glide Adjusts MC for fastest arrival.

  Average Sets MC to the average climb rate across all climbs.

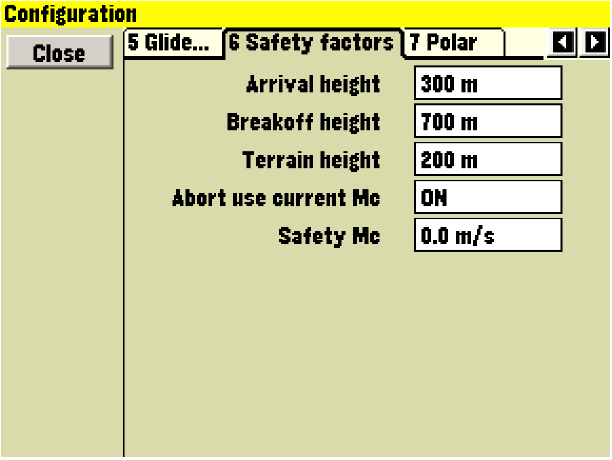
  Both Both algorithms are used.
- **Lift center** Controls display of the thermal locator.
  - **OFF** Lift center locator disabled.
  - **Circle at center** A thermal marker is displayed at the center of lift.
  - **Pan to center** A marker is displayed at the center of lift, and when circling, the display is panned to this lift center.
- **Block speed to fly** If enabled, the command speed in cruise is set to the MacCready speed to fly in no vertical air-mass movement. If disabled, the command speed in cruise is set to the dolphin speed to fly, equivalent to the MacCready speed with vertical air-mass movement.
- **Auto Force Final Glide** This option enables automatic forcing of final glide mode if the aircraft is above final glide prior to reaching the penultimate waypoint. Forcing final glide early can also be performed manually from the task menu.

- **NAV by baro altitude** When enabled and if connected to a barometric altimeter, barometric altitude is used for all navigation functions. Otherwise GPS altitude is used.
- **Flap forces cruise** When this option is enabled, causes the flap switches in Vega to force cruise mode when the flap is not positive. This means that when departing a thermal, switching to neutral or negative flap will immediately switch XCSoar's mode to cruise mode.

  Similarly, for Borgelt B50 systems, the speed command switch forces XCSoar's climb or cruise mode.
- **STF risk factor** The STF risk factor reduces the MacCready setting used to calculate speed to fly as the glider gets low, in order to compensate for risk. Set to 0.0 for no compensation, 1.0 scales Mc linearly with height. See 5.5 for more details.

11.6 Safety factors

This page allows the safety heights and behaviour in abort mode to be defined.

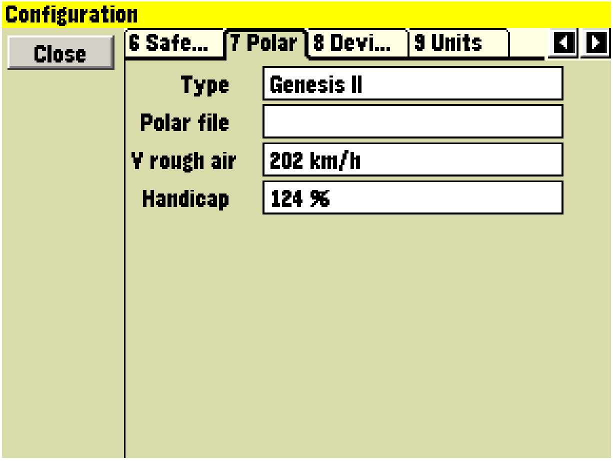


- **Arrival height** The height above terrain that the glider should arrive at for a safe landing.
- **Breakoff height** This is the height above terrain, below which the pilot should abort the task and prepare for an outlanding.
- **Terrain height** The height above terrain that the glider must clear during final glide.
- **Abort use current Mc** When enabled, the current MacCready setting is used for determining arrival altitude during task abort mode.
- **Safety Mc** The MacCready setting used in task abort mode and for determining arrival altitude at airfields.

See 5.6 for more details on safety heights.

11.7 Polar

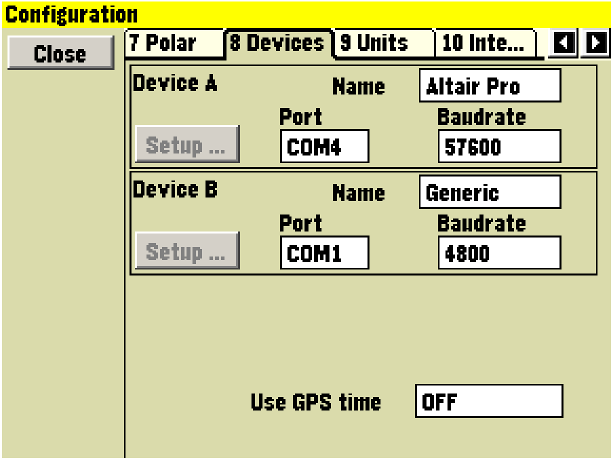
This page allows the glide polar to be defined.



- **Type** This contains a selection of gliders of different performance classes, as well as a special entry for 'WinPilot File'.
- **Polar file** When 'WinPilot File' is the polar type, this is the name of the file containing the glide polar data.
- **V rough air** The maximum manoeuvring speed can be entered on this page to prevent the glide computer from commanding unrealistic cruise speeds.
- **Handicap** The handicap factor used for OnLine Contest scoring.

11.8 Devices

The Devices page is used to specify the ports used to communicate with the GPS and other serial devices. The default settings are COM1 and 4800 bits per second. When connected to the Vega intelligent variometer, the settings should be COM1 and 38400.



Two COM devices are available (device A and device B), to allow, for example, one to be connected to a GPS and another to be connected to a second device such as a variometer. If there is no second device, set the device B port settings to the same as those of device A – this instructs the program to ignore device B.

COM ports 0 to 10 may be used. Which COM port is appropriate for you depends on what make of PDA you use, and the communications medium (serial cable, BlueTooth, virtual COM port, SD card or CF based GPS, internal GPS). Detailing the various options for different devices is beyond the scope of this document. If you have trouble identifying which COM port to set, please refer to the XCSoar website and mailing lists.

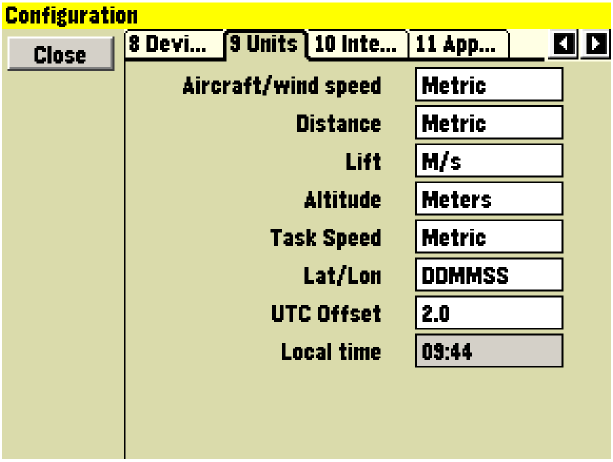
The specific type of device can be selected from the list in order to enable support for devices with proprietary protocols or special functions. If your device is not in the list, choose 'Generic'.

This page also has a Setup ... button to display a configuration dialog specific to the Vega intelligent variometer.

The 'Use GPS time' option, if enabled sets the clock of the computer to the GPS time once a fix is set. This is only necessary if your computer does not have a real-time clock with battery backup or your computer frequently runs out of battery power or otherwise loses time.

11.9 Units

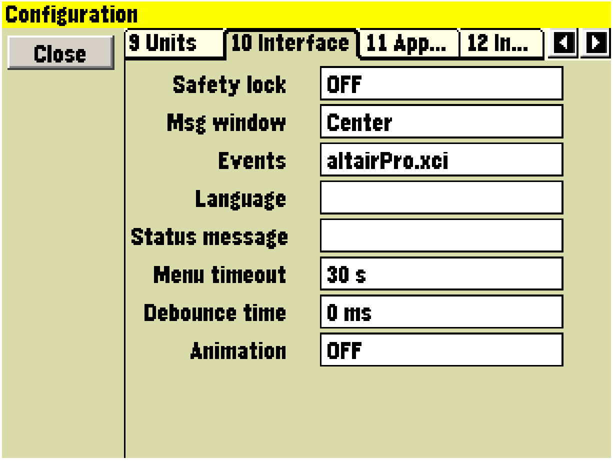
This page allows you to set the units preferences used in all displays, InfoBoxes, dialogs and input fields. Separate selections are available for speed, distance, lift rate, altitude, task speed and latitude/longitude.



The ‘UTC offset’ field allows the UTC local time offset to be specified. The local time is displayed below in order to make it easier to verify the correct offset has been entered. Offsets to the half-hour may be set.

11.10 Interface

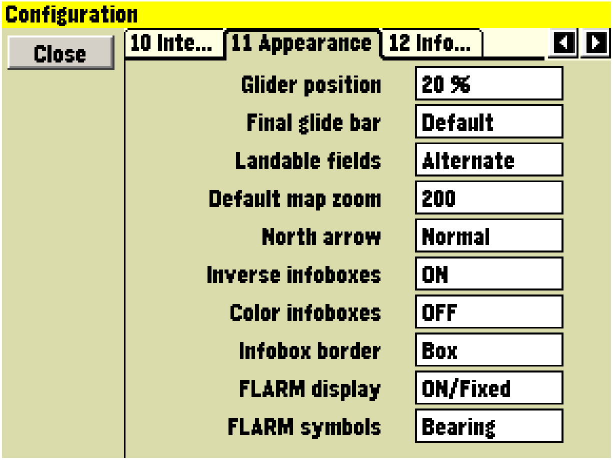
This page defines some general display features of XCSoar.



- **Safety lock** This determines whether the configuration settings dialog is accessible during flight.
- **Msg window** Defines the alignment of the status message box, either centered or in the top left corner.
- **Events** The Input Events file defines the menu system and how XCSoar responds to button presses and events from external devices.
- **Language** The language file defines translations for XCSoar text in English to other languages. If this field is left blank, then XCSoar uses English.
- **Status message** The status message file can be used to define sounds to be played when certain events occur, and how long various status messages will appear on screen.
- **Menu timeout** This determines how long menus will appear on screen if the user does not make any button presses or interacts with the computer.
- **Debounce time** This is the minimum interval between the system recognising key presses. Set this to a low value for a more responsive user interface; if it is too low, then accidental multiple key presses can occur.
- **Animation** Determines whether to draw window animations when dialogs open and close.

11.11 Appearance

This page defines various display styles used by symbols and InfoBoxes.



- **Glider position** Defines the location of the glider drawn on the screen in percent from the bottom.
- **Final glide bar** Two styles are available: Default and Alternate. The differences between these styles is cosmetic. Alternate displays the height difference to the right of the final glide bar; default displays the height difference above/below the final glide bar and inside a rounded box.
- **Landable fields** Two styles are available: WinPilot style (green and purple circles) or a high visibility style.
- **Default map zoom**
- **North arrow** Two styles are available. Normal, or with a white outline.
- **Inverse InfoBoxes** If true, the InfoBoxes are white on black, otherwise black on white.
- **Colour InfoBoxes** If true, certain InfoBoxes will have coloured text. For example, the active waypoint InfoBox will be blue when the glider is above final glide.
- **InfoBox border** Two styles for InfoBox borders are available: ‘Box’ draws boxes around each InfoBox. ‘Tab’ draws a tab at the top of the InfoBox across the title.
- **FLARM display** This enables the display of FLARM traffic on the map window as well as the pop-up radar-like display.
  - **OFF** FLARM radar and map display disabled
  - **ON/Fixed** FLARM radar enabled, map display enabled with fixed scale.

- **ON/Scaled** FLARM radar enabled, map display enabled and auto scaled.

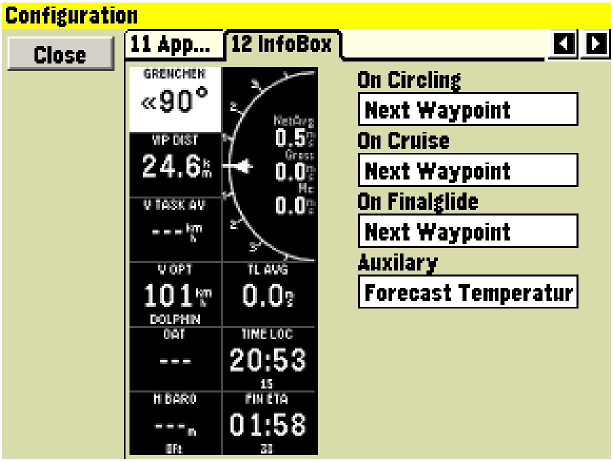
  When auto scaling is enabled, the FLARM targets on the map display are scaled so that when the map is at large zoom levels, targets are still visible.

- **FLARM symbols** This controls the symbols used to display FLARM targets on the radar display.
  - **Relative altitude** The relative altitude of the target is represented as a shape that becomes triangular for extreme above/below heights, square at the same altitude. An arrow pointing up indicates the target is above the aircraft.
  - **Bearing** The track bearing of the target relative to the track bearing of the aircraft is displayed as an arrow head.

  In all modes, the color of the target indicates the threat level.

11.12 InfoBox

This page allows the configuration of InfoBoxes to be defined in each InfoBox display mode (circling, cruise, final glide and auxiliary). See 2.2 for a description of the InfoBox types and their meanings.



Click on the InfoBox to set the different display modes.

Vario Gauge

By clicking on the Vario gauge, you can configure the following options:

- **Speed arrows** Whether to show speed command arrows on the Vario gauge. When shown, in cruise mode, arrows point up to command slow down; arrows point down to command speed up.
- **Show average** Whether to show the average climb rate. In cruise mode, this switches to showing the average netto airmass rate.
- **Show MacCready** Whether to show the MacCready setting.
- **Show bugs** Whether to show the bugs percentage.
- **Show ballast** Whether to show the ballast percentage.
- **Show gross** Whether to show the gross vario value
- **Averager needle** If true, the vario gauge will display a hollow averager needle. During cruise, this needle displays the average netto value. During circling, this needle displays the average gross value.

12 Data Files

Data files used by XCSoar fall into two categories:

- **Flight data files** These files contain data relating to the aircraft type, airspace and maps, waypoints etc.
- **Program data files** These files contain data relating to the 'look and feel' of the program, including language translations, button assignments, input events, dialog layouts.

This section focuses on flight data files; see the *XCSoar Advanced Configuration Guide* for details on program data files.

12.1 File management

File names must correspond to the name extensions specified below. It is good practice to make sure that the file names are recognisable so that when making configuration changes there is less risk of confusion between different files and different file types.

All data files should be copied into the directory:

```
My Documents/XCSoarData
```

12.2 Terrain

The terrain file (extension `.dat`) is a raster digital elevation model represented as an array of elevations in meters on a latitude/longitude grid. The format used is unique to XCSoar as it contains a header containing the grid geometry followed by the raster array.

Terrain files for various regions can be obtained from the XCSoar website. Additional terrain files can be produced upon request.

12.3 Topology

The topology file (extension `.tpl`) is a text file containing a series of entries each of which define a layer of topology. Typical layers include roads, railway lines, large built-up areas (cities), miscellaneous populated areas (towns and villages), lakes and rivers.

The topology file defines which features are to be displayed, their colour, maximum zoom visibility, icons, and labelling. This file can be customised, for example to add or remove specific layers. The topology data itself uses ESRI Shape files which are generated from the freely available VMAP0 database.

Topology files for various regions can be obtained from the XCSoar website. Additional topology files can be produced upon request.

12.4 Waypoints

XCSoar uses waypoint files written in the format designed by Cambridge Aero Instruments for their C302 instrument. The file extension should be `.dat`.

Files are available from the Soaring Turn-points section of the Soaring Server `http://soaringweb.org/TP`.

Several commercial and freely distributable programs exist for converting between different waypoint formats.

If the elevation of any waypoints is set to zero in the waypoint file, then XCSoar estimates the waypoint elevation from the terrain database if available.

Furthermore, if the terrain database is available, then waypoints outside the terrain coverage area cause a dialog to open asking the user if these waypoints are individually or all to be ignored (excluded) or loaded (included). The configuration setting 'Wpt outside terrain' can be used to ask, exclude or include all waypoints outside terrain on subsequent loads.

12.5 Airspace

XCSoar supports airspace files (extension `.txt`) using a subset of the widely distributed OpenAir format. Files are available from the Special Use Airspace section of the Soaring Server at `http://soaringweb.org/SUA`.

The following are the list of supported airspace types: Class A, Class B, Class C, Class D, Class E, Class F, Prohibited areas, Danger areas, Restricted Areas, CTR, No Gliders, Wave, Other. All other airspace types will be drawn as type "Other".

12.6 Map

The map file (extension `.xcm`) contains terrain, topology and optionally waypoints and airspace information. The use of map files reduces the number of files the user needs to manage and to specify in the configuration settings. For backward compatibility, though, the previous methods of using individual terrain, topology, and waypoint files has been retained.

Map files can be generated from the online terrain/map file generator available from the xcsoar website. This allows users to generate their own map files for their region, incorporating their own waypoint files or by specifying the bounds of the region of interest.

Map files are superior to individual terrain/topology files because they incorporate compression of the data, thereby allowing much larger areas and higher resolution terrain to be used.

12.7 Airfield details

The airfield details file (extension `.txt`) is a simple text format file containing entries for each airfield, marked in square brackets in uppercase, followed by the text to be displayed on the Waypoint Details Dialog for that particular waypoint. The text should have a narrow margin because the waypoint details dialog cannot currently handle word wrapping.

The names of airfields used in the file must correspond exactly to the names in the waypoints file, with the exception of being converted to uppercase.

The XCSoar website provides airfield details files for several countries and includes tools to convert from various Enroute Supplement sources to this file format.

Users are free to edit these files to add their own notes for airfields that may not otherwise be included in the Enroute Supplement sources.

An example (extract from the Australian airfields file):

```
[BENALLA]
RUNWAYS:
```

```
 08 (RL1,7) 17 (RL53) 26
 (R) 35 (R)

COMMUNICATIONS:
 CTAF - 122.5 REMARKS: Nstd
 10 NM rad to 5000'

REMARKS:
 CAUTION - Animal haz. Rwy
 08L-26R and 17L-35R for
 glider ops and tailskidacft
 only, SR-SS. TFC PAT - Rgt
 circuits Rwy 08R-26L. NS
 ABTMT - Rwy 17R-35L fly wide

ICAO: YBLA

[GROOTE EYLANDT]
...
```

12.8 Glide polar

The WinPilot format is used for glide polar files (extension `.plr`).

The WinPilot and XCSoar websites provide several glide polar files. Files for other gliders may be created upon request to the XCSoar team.

The format of the file is simple. Lines beginning with `*` are ignored and so may be used to document how the polar was calculated or if there are restrictions on its use. Other than comments, the file must contain a single row of numbers separated with commas:

- Mass dry gross weight in kg: this is the weight of the glider plus a 'standard' pilot without ballast.
- Max water ballast in liters (kg)
- Speed in km/h for first measurement point, (usually minimum sink speed)
- Sink rate in m/s for first measurement point
- Speed in km/h for second measurement point, (usually best glide speed)
- Sink rate in m/s for second measurement point
- Speed in km/h for third measurement point, (usually max manoeuvring speed)
- Sink rate in m/s for third measurement point

An example, for the LS-3 glider, is given below:

```
*LS-3 WinPilot POLAR file: MassDryGross[kg],
*MaxWaterBallast[liters], Speed1[km/h], Sink1[m/s],
*Speed2, Sink2, Speed3, Sink3
373,121,74.1,-0.65,102.0,-0.67,167.0,-1.85
```

> *Don’t be too optimistic when entering your polar data. It is all too easy to set your LD too high and you will rapidly see yourself undershooting on final glide.*

The polars built in to XCSoar are documented in the table below.

Name	Empty mass (kg)	Ballast mass (kg)	V1 (kph)	W1 (m/s)	V2 (kph)	W2 (m/s)	V3 (kph)	W3 (m/s)
1-26E	315	0	82.3	-1.04	117.73	-1.88	156.86	-3.8
1-34	354	0	89.82	-0.8	143.71	-2.1	179.64	-3.8
1-35A	381	179	98.68	-0.74	151.82	-1.8	202.87	-3.9
1-36 Sprite	322	0	75.98	-0.68	132.96	-2	170.95	-4.1
604	570	100	112.97	0.72	150.64	-1.42	207.13	-4.1
ASH-25M 2	750	121	130.01	-0.78	169.96	-1.4	219.94	-2.6
ASH-25M 1	660	121	121.3	-0.73	159.35	-1.31	206.22	-2.4
ASH-25 (25m, PAS)	693	120	105.67	-0.56	163.25	-1.34	211.26	-2.5
ASH-25 (25m, PIL)	602	120	98.5	-0.52	152.18	-1.25	196.93	-2.3
ASH-26E	435	90	90	-0.51	96	-0.53	185	-2.0
ASG29-18	355	225	85	-0.47	90	-0.48	185	-2.0
AstirCS	330	90	75.0	-0.7	93.0	-0.74	185.00	-3.1
ASW-12	948	189	95	-0.57	148	-1.48	183.09	-2.6
ASW-15	349	91	97.56	-0.77	156.12	-1.9	195.15	-3.4
ASW-17	522	151	114.5	-0.7	169.05	-1.68	206.5	-2.9
ASW-19	363	125	97.47	-0.74	155.96	-1.64	194.96	-3.1
ASW-20	377	159	116.2	-0.77	174.3	-1.89	213.04	-3.3
ASW-24	350	159	108.82	-0.73	142.25	-1.21	167.41	-1.8
ASW-27 Wnglts	357	165	108.8	-0.64	156.4	-1.18	211.13	-2.5
ASW28-18	345	190	65	-0.47	107	-0.67	165	-2.0
Std Cirrus	337	80	93.23	-0.74	149.17	-1.71	205.1	-4.2
Cobra	350	30	70.8	-0.60	94.5	-0.69	148.1	-1.83
DG-400 (15m)	440	90	115	-0.76	160.53	-1.22	210.22	-2.3
DG-400 (17m)	444	90	118.28	-0.68	163.77	-1.15	198.35	-1.8
DG-500M PAS	750	100	121.6	-0.75	162.12	-1.37	202.66	-2.5
DG-500M PIL	659	100	115.4	-0.71	152.01	-1.28	190.02	-2.3
DG-500 PAS	660	160	115.5	-0.72	152.16	-1.28	190.22	-2.3

DG-500 PIL	570	160	107.5	-0.66	141.33	-1.19	176.66	-2.1
DG-800 15m	468	120	133.9	-0.88	178.87	-1.53	223.59	-2.5
DG-800 18m Wnglts	472	120	106	-0.62	171.75	-1.47	214.83	-2.4
Discus A	350	182	103.77	-0.72	155.65	-1.55	190.24	-3.1
Duo Discus (PAS)	628	201	106.5	-0.79	168.11	-1.54	201.31	-2.9
Duo Discus (PIL)	537	201	94.06	-0.72	155.49	-1.43	188.21	-2.7
Genesis II	374	151	94	-0.61	141.05	-1.18	172.4	-2.0
Grob G-103 Twin II (PAS)	580	0	99	-0.8	175.01	-1.95	225.02	-3.8
Grob G-103 Twin II (PIL)	494	0	90.75	-0.74	161.42	-1.8	207.54	-3.5
H-201 Std Libelle	304	50	97	-0.79	152.43	-1.91	190.54	-3.3
H-301 Libelle	300	50	94	-0.68	147.71	-2.03	184.64	-4.1
IS-29D2 Lark	360	0	100	-0.82	135.67	-1.55	184.12	-3.3
Jantar 2 (SZD-42A)	482	191	109.5	-0.66	157.14	-1.47	196.42	-2.7
Janus B (18.2m PAS)	603	170	115.5	-0.76	171.79	-1.98	209.96	-4.0
Janus B (18.2m PIL)	508	170	105.7	-0.7	157.65	-1.82	192.68	-3.6
Ka-6CR	310	0	87.35	-0.81	141.92	-2.03	174.68	-3.5
L-33 SOLO	330	0	87.2	-0.8	135.64	-1.73	174.4	-3.4
LS-1C	350	91	115.87	-1.02	154.49	-1.84	193.12	-3.3
LS-3	383	121	115.03	-0.86	174.04	-1.76	212.72	-3.4
LS-4a	361	121	114.87	-0.8	172.3	-2.33	210.59	-4.5
LS-6-18W	330	140	90	-0.51	100	-0.57	183	-2.0
LS-8-15	325	185	70	-0.51	115	-0.85	173	-2.0
LS-8-18	325	185	80	-0.51	94	-0.56	173	-2.0
LS7wl	350	150	103.77	-0.73	155.65	-1.47	180.00	-2.66
Nimbus 2 (20.3m)	493	159	119.83	-0.75	179.75	-2.14	219.69	-3.8
Nimbus 3DM (24.6m PAS)	820	168	114.97	-0.57	157.42	-0.98	222.24	-2.3
Nimbus 3D (24.6m PAS)	712	168	93.64	-0.46	175.42	-1.48	218.69	-2.5
Nimbus 3D (24.6m PIL)	621	168	87.47	-0.43	163.86	-1.38	204.27	-2.3
Nimbus 3 (24.6m)	527	159	116.18	-0.67	174.28	-1.81	232.37	-3.8
Nimbus 3T	577	310	141.7	-0.99	182.35	-1.89	243.13	-4.0
Nimbus 4DM (26m PAS)	820	168	100.01	-0.48	150.01	-0.87	190.76	-1.6

Nimbus 4DM (26m PIL)	729	168	94.31	-0.46	141.47	-0.82	179.9	-1.5
Nimbus 4D PAS	743	303	107.5	-0.5	142.74	-0.83	181.51	-1.6
Nimbus 4D PIL	652	303	99	-0.46	133.73	-0.78	170.07	-1.5
Nimbus 4 (26.4m)	597	303	85.1	-0.41	127.98	-0.75	162.74	-1.4
PIK-20B	354	144	102.5	-0.69	157.76	-1.59	216.91	-3.6
PIK-20D	348	144	100	-0.69	156.54	-1.78	215.24	-4.2
PIK-20E	437	80	109.61	-0.83	166.68	-2	241.15	-4.7
PIK-30M	460	0	123.6	-0.78	152.04	-1.12	200.22	-2.2
PW-5 Smyk	300	0	99.5	-0.95	158.48	-2.85	198.1	-5.1
Russia AC-4 (12.6m)	250	0	99.3	-0.92	140.01	-1.8	170.01	-2.9
Speed Astir	351	90	90	-0.63	105	-0.72	157	-2.0
Stemme S-10 PAS	850	0	133.47	-0.83	167.75	-1.41	205.03	-2.3
Stemme S-10 PIL	759	0	125.8	-0.82	158.51	-1.33	193.74	-2.2
SZD-55-1	336	201	98.3	-0.67	176.76	-2.27	216.04	-4.3
Ventus A/B (16.6m)	358	151	100.17	-0.64	159.69	-1.47	239.54	-4.3
Ventus B (15m)	341	151	97.69	-0.68	156.3	-1.46	234.45	-3.9
Ventus 2C (18m)	385	180	80.0	-0.5	120.0	-0.73	180.0	-2.0
Ventus 2Cx (18m)	385	215	80.0	-0.5	120.0	-0.73	180.0	-2.0
Zuni II	358	182	110	-0.88	167	-2.21	203.72	-3.6

12.9 Profiles

Profile files (extension .prf) can be used to store configuration settings used by XCSoar. The format is a simple text file containing <label>=<value> pairs. Certain values are text strings delimited by double quotes, for example:

```
PilotName="Baron Richtoffen"
```

All other values are numeric, including ones that represent boolean values (true$=1$, false$=0$).

All values that have physical dimensions are expressed in SI units (meters, meters/second, seconds etc).

When a profile file is saved, it contains all configuration settings. Profile files may be edited with a text editor to produce a smaller set of configuration settings that can be given to other pilots to load.

When a profile file is loaded, only the settings present in that file overwrite the configuration settings in XCSoar; all other settings are unaffected.

The default profile file is generated automatically when configuration settings are changed or when the program exits; this has the file name xcsoar-registry.prf.

The easiest way to create a new profile is to copy a previous one, such as the default profile. Copy the file, give it a logical name, and then when XCSoar starts next time the new profile can be selected and customised through the configuration settings dialogs.

12.10 Checklist

The checklist file (xcsoar-checklist.txt) uses a similar format to the airfield details file. Each page in the checklist is preceded by the name of the list in square brackets. Multiple pages can be defined (up to 20).

An example (extract):

```
[Preflight]
Controls
Harness, secure objects
Airbrakes and flaps
Outside
Trim and ballast
Instruments
Canopy
[Derigging]
Remove tape from wings and tail
...
```

12.11 Tasks

Task files (extension .tsk) are currently in a special binary format and cannot be easily edited other than in XCSoar or XCSoarPC. However they are transferable between devices.

Work is under way to produce a text format that will make it easier for users to edit the files or to export/import them for use with other programs.

12.12 Flight logs

The software flight logger generates IGC files (extension `.igc`) according to the long naming convention described in the FAI document *Technical Specification for IGC-Approved GNSS Flight Recorders*. These files can be imported into other programs for analysis after flight.

The flight logs replay facility allows the files to include embedded commands to control XCSoar as if the user was interacting with the program. It does this by defining a special use for the general-purpose 'pilot event' IGC sentence:

> LPLT event=StatusMessage Hello everybody

This command will bring up a status message with the text "Hello everybody" when the line is reached during replay.

The internal software logger has adjustable time steps, separate for cruise and circling modes, via parameters in the configuration settings. Typically the circling time step is set to a smaller value than cruise in order to give good quality flight logs for replay purposes.

12.13 Input events

The input event file (extension `.xci`) is a plain text file designed to control the input and events in your glide computer.

You do not require access to the source code or understanding of programming to write your own input event files but you do require some advanced understanding of XCSoar and of gliding.

Some reasons why you might like to use xci:

- Modify the layout of button labels
- Customise any button/key event
- Do multiple events from one key or glide computer triggered process

12.14 Language

The language file (extension `.xcl`) is a plain text file designed to provide translations between English and other languages, for messages and text displayed by XCSoar.

The format is quite simple, it is a list of text lines that XCSoar uses, followed by an equals sign and the translation, thus:

```
[English text]=[Translated text]
```

An example is provided below:

```
Hello=Hallo
```

Several language files are available from the XCSoar website.

Upon startup, if the language file "default.xcl" is present and no language file is specified in the configuration settings, then this file will be loaded.

12.15 Status

Status files are text of the form *label=value*, arranged in blocks of text where each block corresponds to an individual status message. These are delimited by double spaces. Each block can contain the following fields:

- **key** This is the text of the status message.
- **sound** Location of a WAV audio file to play when the status message appears. This is optional.
- **delay** Duration in milliseconds the status message is to be displayed. This is optional.
- **hide** A boolean (yes/no) that dictates whether the message is to be hidden (that is, not displayed).

Example:

```
key=Simulation\r\nNothing is real!
sound=\My Documents\XCSoarData\Start_Real.wav
delay=1500

key=Task started
delay=1500
hide=yes
```

12.16 FLARM Identification file

The FLARM identification file `xcsoar-flarm.txt` defines a table of aircraft registrations or pilot names against the ICAO IDs that are optionally broadcast by FLARM equipped aircraft. These names are displayed on the map next to FLARM traffic symbols, for matching ICAO IDs.

The format of this file is a list of entries, one for each aircraft, of the form *icao id=name*, where *icao id* is the six-digit hex value of the ICAO aircraft ID, and *name* is free text (limited to 20 characters), describing the aircraft and/or pilot name. Short names are preferred in order to reduce clutter on the map display.

Example:

```
DD8F12=WUS
DA8B06=Chuck Yeager
```

Currently this file is limited to a maximum of 200 entries.

12.17 Dialog files

These files describe the layout of dialogs, including font size, button size, and other aspects of the layout of the widgets within the dialogs. The files are written in an XML data format.

Users may want to edit these files, or use replacements prepared by others, in order to change the layout of dialogs to suit their preferences. In particular, it is possible to hide configuration settings or other data fields that the user is not interested in.

13 About XCSoar

13.1 Product history

XCSoar started as a commercial product developed by Mike Roberts (UK), where it enjoyed a successful share of the market for several years and going though several releases, the last being **Version 2**. Personal reasons prevented him from being able to continue supporting the product and so in late 2004 he announced the licensing of the source code to the GNU public license, as XCSoar **Version 3**. A support website on Yahoo Groups was set up and the open source project started to gain interest and input by developers.

In March 2005 the program was substantially enhanced and this resulted in **Version 4.0** being released. By this time, coordination of the various development efforts on the source code became difficult and time-consuming, so it was decided to move the project to SourceForge, whereby all the software work could be managed by a concurrent version management system.

In July 2005, **Version 4.2** was released which addressed some compatibility issues that were experienced with certain PDA and GPS hardware configurations.

In September 2005, **Version 4.5** was released. This contained major enhancements to the user interface including the introduction of the ‘input event’ system and language translation files.

In April 2006, **Version 4.7** was released to Altair customers. This contained stability and performance enhancements as well as many bug fixes; and a new method for handling dialogs based on XML files.

In September 2006, **Version 5.0** was released on all platforms, Altair, PC, PDA. This version contains many improvements and new features and is based on extensive testing in flight and in simulation.

In September 2007, **Version 5.1.2** was released on all platforms, Altair, PC, PDA. This version contains many improvements and new features and is based on extensive testing in flight and in simulation. Major improvements include a new map file format incorporating JPG2000 compression, online contest support, additional supported devices, FLARM radar screen, and overall improved stability, reliability and accuracy of task calculations. Many feature requests from users have been incorporated into this release.

In May 2008, **Version 5.2** was released on Altair. This version contains many improvements and has been completely reorganised to make the computer-pilot interaction easier.

13.2 Get involved

The success of the project is the result of many kinds of contributions. You do not have to be a software developer to help; in general, there are perhaps five major ways of contributing, other than working on the software itself:

- **Give feedback** Ideas, suggestions, bug reports, encouragement and constructive criticism are all very welcome and helpful.
- **Setup suggestions** Because XCSoar is so configurable, we rely to some extent on users to think about how they would like the program to be set up. Selection of InfoBox layouts, button menus and button assignments require some design thought, and making these available to the developers and other users will help us provide good default settings.

- **Data integrity** Airspace and waypoint files need to be kept up to date, and it often takes people with local knowledge to do this.
- **Promotion** The more users the software has, the better the product will be. As more people use the software and give feedback, bugs are found more easily and improvements can occur at a greater pace. You can help here, for example, by showing the software to others and by conducting demonstration and training sessions in your club.
- **Documentation** You are encouraged to add and edit text on the XCSoar homepage, which is set up as a 'Wiki'. All you need to do is to register for edit access.

13.3 Open source philosophy

There are several benefits to having software like XCSoar open source:

- Firstly, it is free so pilots can try out the software at no cost and decide if it is suitable for their needs; and pilots are free to copy the program onto whatever Pocket PC device, PC or EFIS they like without charge.
- You have access to the source code so you are free to change the software or use pieces of it in new free programs.
- Having the source code available on the Internet means that it is subject to wide scrutiny and therefore bugs are easily and quickly fixed.
- A large group of developers are available to help in troubleshooting and quickly implement new features upon request.
- Open source software under the GNU public license cannot at a later date be made closed-source; so by using this software you will not be locked in to unspecified software costs in the future.

The full terms of the licensing agreement for XCSoar is given in Appendix A.

The development of XCSoar since its open source release has been entirely a volunteer effort. This does not preclude individual developers or organisations from offering commercial support services. The spirit of the project however suggests that in such cases the commercial services are encouraged to produce some flow-on benefit back to the wider community of users.

13.4 Development process

We try to incorporate new features as quickly as possible. This has to be balanced by the needs to not change substantially the interface without appropriate warnings so users that upgrade do not get a shock. This means that when we introduced the new button menu system in version 4.5, it was necessary to also distribute a file that allowed users to have the buttons assigned to their 'legacy' function.

XCSoar, being used in flight, is a special kind of software because it can be regarded as 'mission-critical', and is a real-time system. This has placed a very high emphasis on developers to perform a great deal of testing before releasing changes to the public.

The software developers all keep in contact with each other through the SourceForge developer's mailing list xcsoar-devel@lists.sourceforge.net

We try to coordinate our activities to avoid conflict and duplicated effort, and to work together as a team. If you would like to get involved in the software development, send the developers an email.

13.5 User base

Who is using XCSoar? Good question, and hard to answer. Since no-one pays for the product – most people download the program anonymously – it is hard for anyone to keep track of how many users are out there.

Statistics from the main website indicate there has been an average of approximately twenty downloads per day between June 2005 and June 2006, and eighty downloads per day between June 2006 and September 2007. Looking at how many people download the terrain and topology data packs from the website indicates that it is used in many countries and in nearly every continent.

XCSoar is used by a wide cross section of pilots, including early post-solo through to experienced competition pilots. There are many 'armchair' pilots who use XCSoar with gliding simulators, such as Condor.

13.6 Credits

Software developers:

- Mike Roberts
- John Wharington jwharington@bigfoot.com
- Samuel Gisiger samuel.gisiger@triadis.ch
- Scott Penrose scottp@dd.com.au
- Jeff Goodenough jeff@enborne.f2s.com
- Robin Birch robinb@ruffnready.co.uk
- Alastair Harrison aharrison@magic.force9.co.uk

Other code and algorithms contributions come from:

- **Ephemeris** Jarmo Lammi
- **Shapelib** Frank Warmerdam
- **Least squares** Curtis Olson http://www.flightgear.org/~curt
- **Aviation Formulary** Ed Williams
- **JasPer**
- **KFlog** Volkslogger code by Heiner Lamprecht
- **Volkslogger support** Garrecht Ingenieurgesellschaft

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Version 2, June 1991

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