



the open-source glide computer

User Manual

Draft state, better you wait printing the whole manual

Manual version 1.6

March 4, 2011

For XCSOAR version 6.0

<http://www.xcsoar.org>

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Preface

This manual applies to XCSoar version 6.0. 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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1 Introduction

This document is a pilot's manual for XCSoar, an open-source glide computer originally developed for Pocket PC 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Updates to the XCSoar software may result in some of this manual being out of date.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.xcsoar.org>

1.1 Organisation of this manual

2: Write about the manual crossref hinting icons and the yellow colour. The Quickstart will be readable also without those links available

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

Chapter 3 describes the moving map part of the display in greater detail and describes how the software can assist in general navigation. Chapter 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. Chapter 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.

Chapter 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. Chapter 7 describes how XCSoar can assist in managing flight in special use airspace and the FLARM collision awareness system. Chapter 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. Chapter 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 Chapter 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 Chapter 12.

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

1.2 Notes

Terminology

A variety of terms may be used to describe embedded devices like the Pocket PC platform, including 'organiser' and Portable Digital Assistant (PDA). XCSoar is also available on triadis Engineering's Altair glide computer, which is formally an Electronic Flight Instrumentation System, and several other platforms. Throughout this document, these terms are used interchangeably to refer to whatever hardware XCSoar is running on.

Screenshots

Throughout this manual are several screenshots of XCSoar. These are taken from the program running on a variety of hardware platforms and possibly even different versions. Each platform and version may have different screen resolutions, layouts and fonts, and so there may be slight differences in the appearance of the display. Most of the screenshots in this manual are taken of XCSoar running in landscape orientation.

1.3 Platforms

Windows PC : It is possible to run XCSoar on an ordinary computer with the Windows operating system. This setup can be used for training yourself in using XCSoar. A simulation mode is included in XCSoar as well as a IGC replay function, that can be used when not connected to a valid GPS source.

Windows Mobile PDA : Devices powered by Microsoft Pocket PC 2000 up to Windows Mobile 6 are supported by XCSoar. Windows Mobile 7 will not be supported as Microsoft decided to skip support for native applications from this version on.

Unix PC : XCSoar can be run on Unix using the Wine emulator. A native Unix port is almost ready, but won't be released yet with the 6.0 version of XCSoar.

Android Devices : XCSoar runs on Android 1.6 or newer.

Altair : The Altair glide computer by triadis Engineering is a glide computer factory installed with XCSoar. The Altair PRO version also contains an internal GPS.

1.4 Downloading XCSoar

The software is available as a free download from the XCSoar website <http://www.xcsoar.org>. Follow the links to the download section.

Pocket PC versions

Download the relevant package for your Pocket PC operating system version and save it to disk:

Pocket PC 2000 : For Pocket PC 2002 and older

Windows Mobile 2003 : For Windows Mobile 2003 (or Pocket PC 2003)

Windows Mobile 5 : For Windows Mobile 5 and 6

Additional files

To be able to use XCSoar's advanced features additional data files, such as terrain, topology, special use airspace, waypoints etc. are needed. The files that can be used with XCSoar are described in Chapter 12.

All data files should be copied into the directory XCSoarData. The location of this directory is determined with the following method:

Windows PC : XCSoarData is always located in your personal folder ("My Documents")

Windows Mobile PDA (PNA) :

- If you start XCSoar from a SD card, it is always in the root of that SD card (e.g. "/SD Card/XCSoarData")
- If XCSoarData already exists on any SD card inserted at XCSoar startup, this one is used
- If none of the above applies, then it is in your personal folder ("/My Documents")

Unix PC : • If .xcsoar exists in you user folder (e.g. "~/ .xcsoar") this one is used.

- Otherwise “/etc/xcsoar” will be used.

Android Devices : XCSoarData is located on the SD card (e.g. “/sdcard/XCSoarData”).

Altair : XCSoarData is located in the internal storage.

For embedded devices it is recommended to create XCSoarData on a SD card, because you can easily update the data files on your PC.

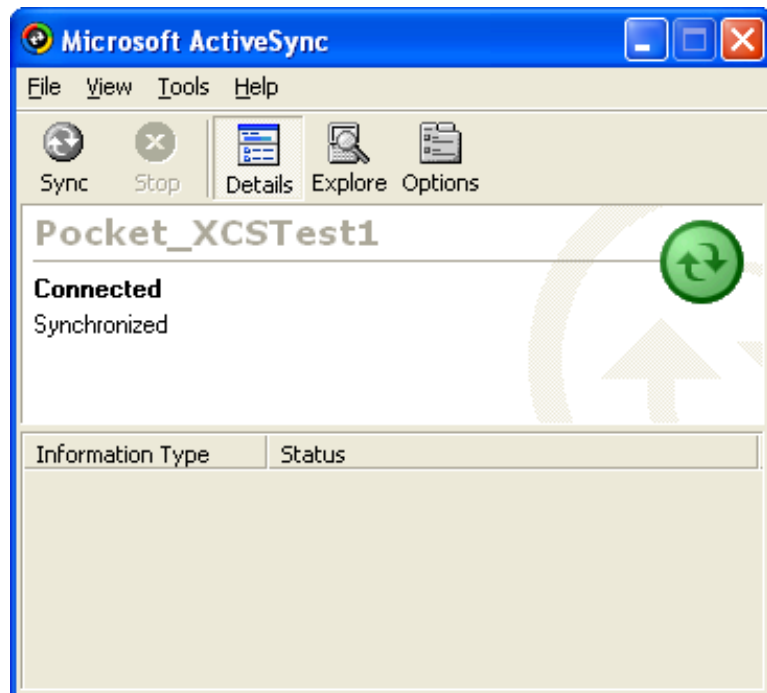
1.5 Installation

Installation of Pocket PC version from Windows PC

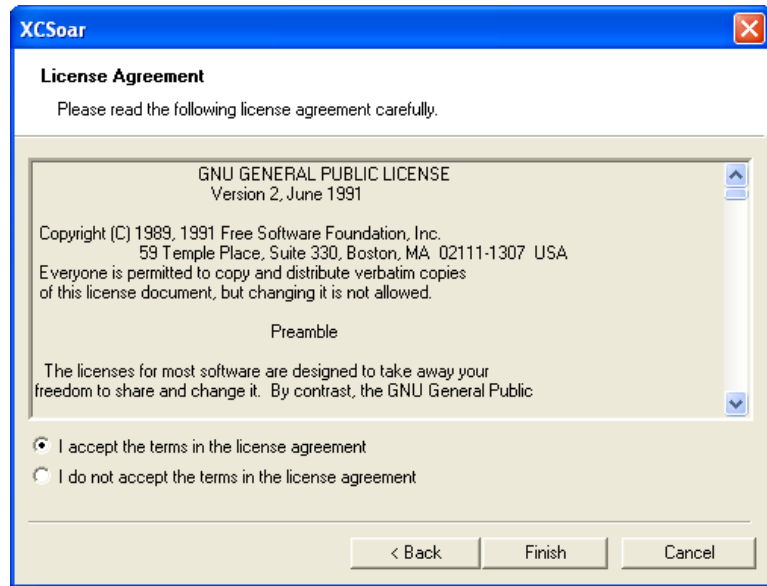
Prior to performing any installation, it is a good idea to backup your organiser for extra safety.

The following sequence describes how to install XCSoar from Windows:

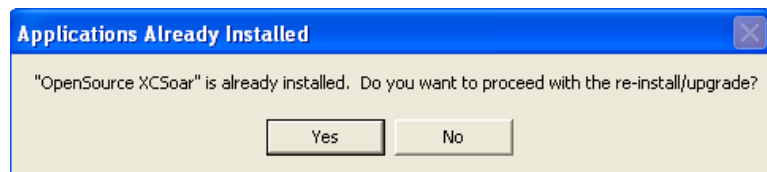
1. Place your PocketPC in its cradle and make sure you have MS ActiveSync running.



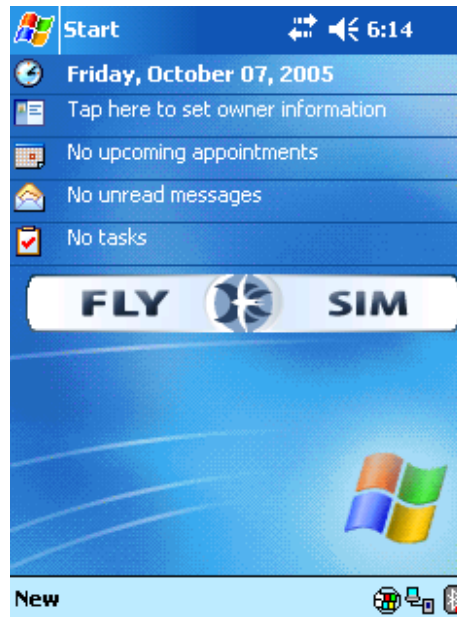
2. Run the program Install-XCSoar-XXX-YYY.exe (where XXX and YYY refer to the version number and operating system version respectively).



3. Read and accept the license
4. Follow the prompts in the installation program and also follow the prompts on the organiser.



5. XCSoar is now installed.
6. Perform a reset of your device. See the operating instructions for your organiser about how to do this.
7. After the reset, the XCSoar 'FLY' and 'SIM' launcher icons will be visible on the Today screen.



It is a good idea to assign one of your PocketPC hardware buttons to run XCSoar. See your PocketPC manual for details of how to do this.

Owners of Compaq Aero PocketPCs may find it useful to enable 'Game Keys'.

Installation of Pocket PC version from a Pocket PC CAB file

You can download the CAB file appropriate for your organiser and install it onto a nonvolatile storage card like a Compact Flash or Secure Digital card. Place it in your organiser. Use the File Manager on your organiser to find the CAB and click on it to execute it. Follow the onscreen instructions, the CAB file will be deleted after installation.

Alternatively you can download the CAB file from sourceforge through your Internet Explorer on your organiser and install it that way.



It is generally a good idea to keep the CAB file on the storage card so that if the organiser's power fails and the memory is lost, XCSoar can be reinstalled.

Installation of PC version

The file XCSoarPC.zip needs to be unzipped using a utility program such as WinZip.

Development of a proper windows installer for the PC version is in progress. For now, any additional data files used by the PC version must be placed in the My Documents\XCSoarData directory.

Installation on Android

Obtain XCSoar from Google's Android market, or install the apk file manually. Copy the data files on the SD card in the directory XCSoarData.

1.6 Running XCSoar

Two modes are available inside the XCSoar application:

FLY : This mode is used when actually flying. The simulator is disabled and serial communications are active.

SIM : This starts XCSoar in simulator mode, no serial communications are attempted.

The simulator contains a simple interface allowing the user to fly the glider about. Dragging the glider symbol (with touchscreen or mouse) causes the glider to move in the direction of the drag, the speed being proportional to the length of the drag. In SIM mode, the aircraft altitude can be adjusted by selecting the GPS altitude InfoBox (marked), and pressing the up or down key.

XCSoar Pocket PC version

The program can be run in either of two modes by pressing the 'FLY' or 'SIM' launcher on the Today screen. If the application is started directly from the explorer a dialog is asking you which mode you want to start.



It is recommended that on Pocket PC devices, no other programs are running while XCSoar is used in flights. This gives the best possible performance and responsiveness of the program.

Altair version

XCSoar starts up automatically when Altair is powered on. The PWR/ESC button (top left) 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 3 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.

The Altair version of XCSoar does not include a simulator mode.

XCSoar PC version

The program can be run by opening the explorer window, finding the directory that has the XCSoar.exe executable, and double clicking on that program file.

The program command line options allows the screen orientation of the display to be defined:

- portrait : The screen is 480 pixels wide, 640 pixels high.
- square : The screen is 480 pixels wide, 480 pixels high.
- landscape : The screen is 640 pixels wide, 480 pixels high. This is the usual setting. If you don't specify this parameter the landscape version will be loaded automatically.
- small : Draws the screen at half size. This is useful for using XCSoar in conjunction with flight simulators e.g. Condor.

To change the screen orientation, it is convenient to create a shortcut to the program, then right click on the shortcut icon and click on "Shortcut". In the field "Target" add one of the desired options listed above.

Start-up and user profiles

When XCSoar starts up, it will check for existing profiles. If multiple profiles are detected it will displays a small window asking you which profile to load. To proceed, choose the desired profile and press Enter. If no profile is chosen the settings from the last session are loaded again. Profiles can be useful for example in the following cases:

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

Splash screen

When XCSoar starts up, shuts down, or loads large files, such as airspace, waypoints, terrain, etc., a progress screen is presented while the data is being loaded. This screen has a progress bar which indicates the data loading activity, and a short line of text describing the action that is being performed.

This screen also displays the software version information.

Exiting the program

For PDA and PC versions, XCSoar is shut down from the menu. The menu can be opened by double-clicking on the map or the infoboxes.

 A rectangular button with the word "QUIT" in capital letters.

For PC versions, XCSoar can also be shut down by clicking the close icon on the XCSoar window.

For Altair, XCSoar is shut down by holding the PWR button for two seconds or more.

1.7 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. If you have a question about XCSoar in particular please email us at:

`xcsoar-user@lists.sourceforge.net`.

Any frequent questions will be added to this document and to the Frequently Asked Questions (FAQ) section of the XCSoar website.

You may also find it useful to subscribe to the XCSoar users mailing list so you will be kept up to date with latest developments. You can find more information about the XCSoar mailing lists on our website:

`http://www.xcsoar.org`

A log file of the startup progress of XCSoar is generated in the file `xcsoar-startup.log`. This can be sent to the XCSoar developers to help determine the cause of any startup related problems.

For Altair users, the startup file is transferred to the 'FromAltair' directory by AltairSync if a USB drive is plugged in when Altair is first switched on.

Updates

You should periodically visit the XCSoar website to check for program updates. The installation procedure described above can typically be repeated in order to upgrade the software. All user configuration settings and data files will be preserved during the re-installation/upgrade.

It is also recommended to periodically check for updates to data files, particularly Special Use Airspace, which may be subject to change by the national civil aviation authority.

Like any complex software program, XCSoar may be subject to software bugs, so if you find any, please report them to the XCSoar developers by using our bug tracker “trac” at

<http://www.xcsoar.org/trac/>

or by sending an email to

xcsoar-devel@lists.sourceforge.net

Updating XCSoar on Altair

Updating XCSoar on Altair involves downloading the latest program file `XCSoarAltair-YYY-CRCXX.exe`, copying it to a USB memory stick, then using the AltairSync utility on the Altair device to complete the installation. Refer to the *Altair Owner's Manual* for details.

Other data and program files can be transferred to Altair in a similar way.

1.8 Training

For the safety of yourself and others, pilots using XCSoar are advised to train themselves in using XCSoar on the ground and become familiar with its interface and features prior to flight.

Using XCSoar on the PC

The PC versions of XCSoar 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 this version are identical to the embedded versions, so it can be helpful to try out customisations on the PC version before using them in flight.

The PC versions can also be connected to external devices and operate just as the embedded versions do. Suggested uses include:

- Connect the PC to a FLARM device to use XCSoar 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.

Using XCSoar with a flight simulator

A good way to learn how to use XCSoar is to connect the Pocket PC device to a PC running a flight simulator that can output NMEA sentences to the serial port. Suitable simulators include Condor and X-Plane.

The benefit of this form of training is that XCSoar can be used in FLY mode, so it behaves exactly as if you were really flying, and you can get a good feel for how the program works while you are flying the simulator.

1.9 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.

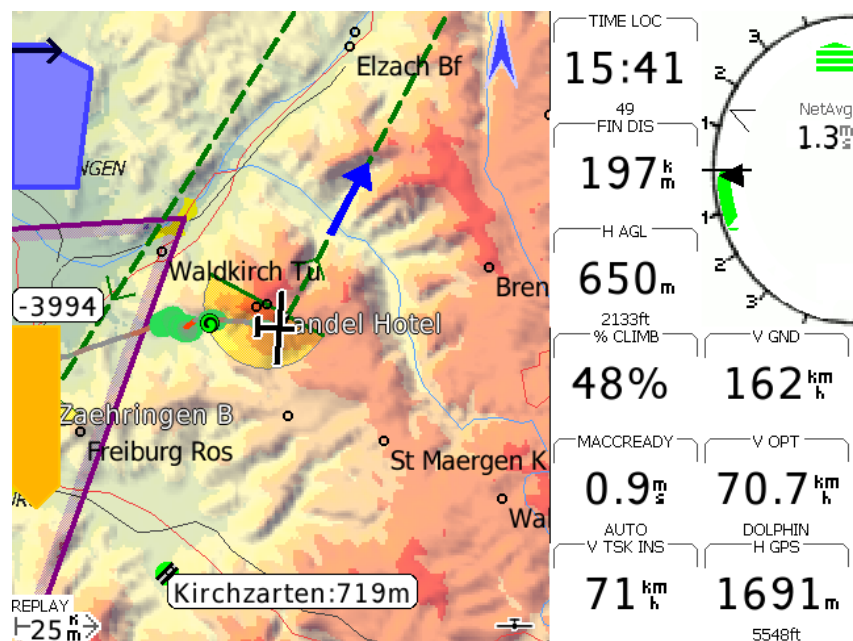
Pilots using XCSoar must take responsibility for using the system safely. Good practice in the use of XCSoar includes:

- 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.

2 User Interface

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

3: explain the principle display modes



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 usually either along the top and bottom of the screen (portrait display) or to the right of the screen (landscape display). These so-called InfoBoxes display data from the GPS and other input devices as well as data calculated by XCSoar.
- Gauges :** Gauges 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 : Hardware buttons on the device running XCSoar can be used to bring up and navigate smaller on-screen menus that are typically laid out such that menu items can be selected by pressing the button adjacent to the item. If the device has a touch screen, the menu items can be selected by touching them. These buttons are drawn in black 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.

Down - Up  **Main menu :** The main menu is accessible by double tapping the map area or infoboxes as well as through gesture. If the menu buttons are not pressed after a specified time, they disappear again so as to not obscure the map area.

There are several ways to interact with XCSoar:

- Touching certain map elements
- Touching InfoBoxes and onscreen menu buttons
- ‘Gesturing’, by e.g. drawing a dash from the left to the right on the screen (see Section 2.8 below).
- ‘Dragging’ the screen (touching the screen and moving before releasing).
- Pressing application buttons on the device.
- Pressing the cursor keys on the device.
- Pressing keys or switches on an instrument connected to XCSoar.

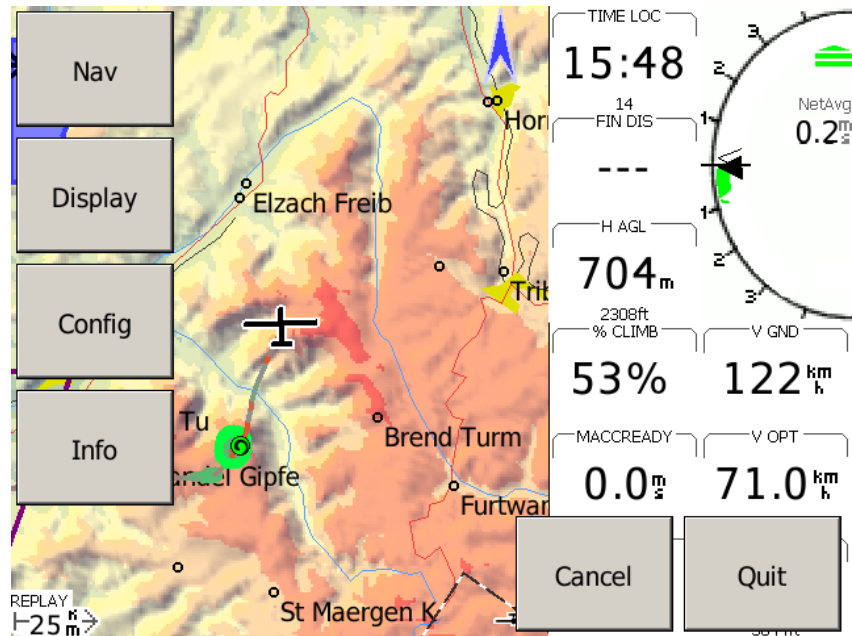
Depending on the particular hardware used with XCSoar, not all of these methods of interaction are possible and there may be different numbers or assignments of buttons.

For the PC version of XCSoar, clicking the mouse over an item is equivalent to touching it.

Since the Altair does not have a touch screen, all user interaction is performed via physical buttons, switches or other external interface devices if connected.

2.1 Button labels and menus

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



Interface basics

The menu is organised into four different groups of functions, usually in the form of a hierarchy. The specific menu layout depends on the hardware button configurations and platform, and may also be customised by the user.

XCSoar can also accept input from external keyboards, gamepads, 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. Pressing the particular menu button again will cycle through several pages of items. Pressing the corresponding horizontal button will activate that item. At the last page, pressing the menu button again will turn that menu off and the horizontal strip of onscreen buttons disappear.

On the PC version, these mode buttons are activated by the 1, 2, 3 and 4 keys. The 6, 7, 8, 9 and 0 keys correspond to the horizontal strip of buttons.

On the PDA version, the mode buttons are activated by the keys to the side of the joystick/rocker button.

If the user doesn't interact with the computer for some 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 buttons appear greyed out if the corresponding function is not available. For example, the "Waypoint lookup" function will appear grey if there are no waypoints loaded.

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 **MC Auto**, then pressing the button will turn on auto MacCready, and the button label will then change to **MC Manual**. In the menu list described below, generic labels are used.

Menu overview

This section describes the default layout of the menu system on all platforms. The functions performed by each button are explained more fully in following chapters.

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

Nav : Actions for navigation control, primarily cross-country gliding tasks.

Display : Actions to control the display

Config : Configuration of XCSoar, connected devices, and in-flight settings

Info : Activates various informational dialog windows.

For the PC version, the keys 1, 2, 3 and 4 activate the corresponding menu.

Navigation menu (Nav)

Task
Calc

Displays the task calculator dialog.

Arm
Start

Arms the automatic task waypoint trigger.

Previous
turnpoint

Selects the previous/start waypoint in the task.

Next turnpoint	Selects the next/finish waypoint in the task.
Waypoint List	Displays the waypoint selector dialog.
Task Edit	Displays the task editor.
GoTo	Displays the waypoint selector dialog and activates the GoTo mode for the selected waypoint.
Task Abort	Aborts/resumes the current task.
Alternates	Shows a list to landable alternates sorted by distance in the near.
Target	Displays the target dialog, which is important for modifying AAT tasks.

Display menu

Zoom In	Zooms in the map display.
Zoom Out	Zooms out the map display.
Mark Drop	Drops a marker at the current glider location.
Full Scrn On	Toggles the full screen map display.
Pan On	Activates pan map mode.
Zoom Auto	Toggles automatic/manual zooming.
Trail Full	Selects a display option out of Full, Long, Short, Off.

Terrain On	Toggles display of terrain.
Topology On	Toggles display of topology.
Labels On	Displays map labels, MID labels, or none.

Configuration menu (Config)

MC +	Increases MacCready value.
MC -	Decreases MacCready value.
MC Auto	Toggles automatic/manual MacCready.
Flight Setup	Displays the flight settings (bugs/ballast/QNH) dialog.
Setup Wind	Displays the wind settings dialog.
Vario	Control of Vega intelligent variometer, this comprises a sub-menu.
Setup System	Displays the XCSoar configuration dialog.
Settings Airspace	Displays the airspace filter dialog.
Logger Start	Turns on/off XCSoar's software IGC flight recorder.
Replay	Displays the IGC/NMEA logger replay dialog.
Raw Logger	Activates the raw NMEA logger (usually only used for debugging).

Information menu (Info)

Waypoint Details	Displays the waypoint details dialog of the active task waypoint.
Nearest Waypoint	Displays the waypoint details dialog of the waypoint nearest to the aircraft.
Nearest Airspace	Displays details of the airspace nearest to the aircraft.
Check List	Displays the check list dialog.
Analysis	Displays the analysis/statistics dialog.
Status	Displays the status dialog.
Weather	Displays the weather forecast dialog.
Team Code	Opens the team code dialog.
Aux Info On	Toggles the infobox display between normal (flight-mode specific) or auxiliary infobox display.
Message Repeat	Repeats the last status message.
FLARM Radar	Opens the full screen FLARM radar dialog.
Thermal Assistant	Opens the full screen thermal assistant dialog.

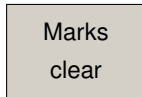
Variometer sub-menu (Vario) of the Configuration menu

The functions in this sub-menu require the Vega intelligent variometer. The menu can only be accessed if “Vega” is selected as the connected device.

Airframe Switches	Displays airframe switch values.
Setup Audio	Adjusts volume of sounds produced by XCSoar as well as certain speech announcements by the Vega intelligent variometer.
Manual Demo	Activates Vega variometer manual tone demo.
Setup Stall	Opens Vega stall monitor setup dialog.
4: what is that for?	
ASI Zero	Zeros the airspeed indicator.
Accel Zero	Levels/zeros the accelerometers.
Store	Stores Vega settings to EEPROM.
Cruise Demo	Activates Vega variometer cruise tone demo.
Climb Demo	Activates Vega variometer climb tone demo.

Pan mode sub-menu of the Display menu

Pan Off	Turns pan mode off.
Zoom in	Zooms in the map display.
Zoom out	Zooms out the map display.
Nearest Waypoint	Displays the waypoint details dialog of the waypoint nearest to the aircraft, or if in pan mode, nearest to the cross-hairs at the center of the screen.



Clear all previously propped marks.

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):

PC:	6	7	8	9	0
Altair:	F5	F6	F7	F8	F9
	Flight Setup	Task Calc	Task Edit	Arm Advance	Drop Mark

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

For all other versions in the default mode, the cursor keys perform the following functions:

- Up key : Zoom in
- Down key : Zoom out
- Left key : Drop marker
- Right key : Toggle through normal/aux. InfoBoxes and Fullscreen
- Enter : Clear status message or suppress FLARM gauge if open and no warning active

For the Altair version in the 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

For Altair, the buttons along the edge of the display can be used as alternate ways of navigating in dialogs. The F4 key (directly above the rotary knob) can be used as an alternate ENTER key

(instead of pressing the rotary knob) in dialogs. The F6 and F7 keys (directly to the right of the rotary knob) can be used to select the next or previous page in multipage dialogs.

Dynamic menu labels

Certain menu items have dynamic labels to make it clearer what happens when the menu item is selected. Furthermore, items that are not available are greyed out to indicate that selecting the menu item will not do anything.

The convention used for dynamic menu labels is for the labels to display the action that will be performed once the menu item is selected. For example “Lights On” will turn the lights on, and the menu will be updated to display “Lights Off”, which would then if pressed turn the lights off. This convention is used throughout XCSoar.

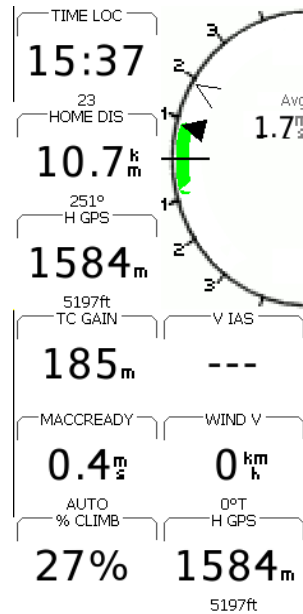
A selection of key dynamic menu items is presented below:

- Next turnpoint** : Greyed out if the task is cleared, or if the active turnpoint is the finish. If on the turnpoint prior to the finish, this displays “Waypoint finish”.
- Previous turnpoint** : Greyed out if the task is cleared, or if the active turnpoint is the start and there are no multiple start points. If there are multiple start points and the active turnpoint is the start, then this displays “Cycle start” to allow selection between the various start points. If on the first turnpoint after the start, this displays “Waypoint Start”.
- Labels** : This now displays “Labels On”, “Labels MID” or “Labels Off”.
- Task calculator** : Greyed out if the task is cleared or in task abort.
- Arm Advance** : Greyed out if Auto or Manual advance mode is active. Displays “Arm start” when the active turnpoint is the start and the trigger is not armed. Displays “Arm Cancel” if the trigger is armed. Displays “Arm turn” if the active turnpoint is past the start.
- Task Edit** : Greyed out if in task abort or no waypoint database.

2.2 InfoBoxes

The information displayed in the InfoBox fields can be selected from a wide variety of options (listed in Chapter 10). These fields can also be used to set user configurable variables, for example the MacCready setting.

The specific number and layout of the InfoBox grid depends on the screen orientation and the device's display size. For a 320x240 display Pocket PC in portrait mode, there are four InfoBoxes above and four InfoBoxes below the map display. For landscape mode, there are 9 InfoBoxes to the right of the map display.



Screen display modes

The main display can be presented with the map area and InfoBoxes, or a full-screen map. The screen mode can be toggled between the following:

- Small map area, with flight-mode specific InfoBoxes
- Small map area, showing auxiliary InfoBoxes.
- Full-screen map area, with InfoBoxes hidden.

This is performed by selecting the menu:

Display > Full Scrn On

At any time the InfoBoxes may be toggled between auxiliary and normal from the menu:

Info > Info > Aux Info On



If a touchscreen is available, you also can switch through the three display modes by gesture R. When auxiliary InfoBoxes are displayed, the word 'AUX' appears at the lower left corner of the map area.

Modifying InfoBox values

(This section applies only when a touchscreen or mouse is present.)

Some InfoBox values can be changed by the user by selecting the InfoBox with the touchscreen or mouse. Examples of InfoBoxes that can be adjusted include the MacCready setting, and the wind speed. The procedure for adjusting InfoBox values is as follows:

1. Highlight the item you wish to modify, by touching the InfoBox. The box title border will change colour indicating it is selected.
2. Press the up/down/left/right or enter button on the device to change the value. Different InfoBoxes allow different buttons to be used.
3. The value is now changed.
4. After about 10 seconds without further button pressing, the InfoBox will be deactivated so there is no risk of accidental adjustment later.

Changing InfoBoxes

InfoBoxes can either be changed by calling the configuration dialog from the menu `Config` ▷ `Config` ▷ `Setup System` or by performing a long press on the InfoBox that should be changed. In the second case a list dialog opens, giving you all available InfoBoxes to choose from.

2.3 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. Additionally, status messages can be made to disappear by acknowledging the message. Acknowledgement is achieved by either pressing the enter key (rotary knob on Altair), touching the status message (on touchscreen devices) or clicking the screen (mouse enabled devices).

Additional user buttons may be assigned to a status message repeat function, which brings up the last message again.

Typical status messages include:

- Airspace queries
- Airspace warnings

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

Note that status messages do not appear while a dialog is on screen, the messages are buffered and displayed as soon as the dialog is exited.

2.4 Dialog windows

XCSoar contains several dialog windows that can be activated to bring up additional information and are also used for more complex interactions with the user, such as editing tasks and configuring settings.




Some dialogs simply display information, and require no user input. Other dialogs contain data fields that can be modified or buttons that can be pressed.

A cursor appears over the active button or data field. Pressing the up/down arrow keys (or rotating the outer knob on Altair), the cursor will cycle through the next or previous items. For list items and scrollable text, the up/down arrow key moves the cursor up or down the list or text, and the left/right arrow keys move the cursor up or down by one page in long lists.

For PDAs and PC versions, list items can be selected by touching the item (or left-clicking with the mouse). Once a list item is selected, another touch (left click) is equivalent to pressing the enter key.

Pressing the right/left arrow keys (or rotating the inner knob on Altair), the data field value under the cursor can be modified. Pressing the enter key (or pressing the rotary knob on Altair) activates the button or makes a selection from a list.

Dialogs are typically started from the button menu.

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  button to make the dialog disappear.

The escape key on a PC or the PWR/ESC button on Altair, 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 menu buttons are disabled until the dialog is closed.

In some dialogs, items that are not relevant or valid (such as AAT details when flying a non-AAT task) are not displayed.

5: This list of dialog explanations (up to 'Text entry') should move somewhere else, because it does not explain the interface.

A summary of the major dialogs is presented below.

- Flight setup : Used to modify the polar of the glider both before and during flight, as well as to set the QNH pressure
- Wind : Used to modify or adjust the estimated wind magnitude and direction
- Waypoint details : Describes a waypoint in detail and has navigation functions such as “GoTo” and “Insert in Task”
- Waypoint selector : Used to select a waypoint from the waypoint database
- Task editor : Used to edit and view cross country tasks
- Task calculator : Allows the pilot to see the effect of various changes to the task on final performance
- Analysis : Shows several pages of analysis and statistics about the flight
- Status : The status dialogs give summaries of the situation of the aircraft, system, task, start and times
- Checklist : A multi-page custom checklist
- Configuration : Allows XCSoar and certain connected devices to be configured
- Airspace colours and patterns : Configuration of colours and patterns of airspace used on the map display
- Airspace filter : Controls enabling and disabling the display and warnings of each airspace class
- Team code : Allows transfer of coordinates between team mates via a code

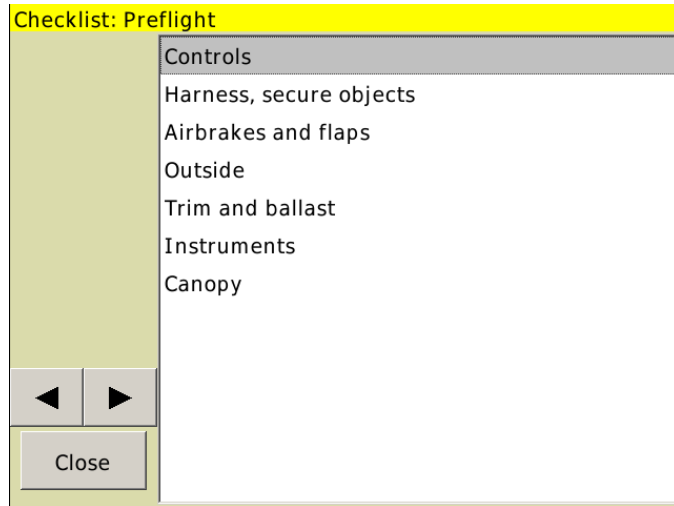
These dialogs are described in later chapters. with the exception of the checklist, status and text entry dialogs, which are described below.

Checklist dialog

The checklist dialog can display several pages of user-defined free text. Typically this is used for checklists. It can be accessed via the menu under

Info > Check list

These checklists may include: daily inspection, preflight, outlanding, pre-landing, radio procedures, and aircraft rigging and de-rigging instructions. Since the checklists may be long, the up/down keys (or rotary knob on Altair) may be used to scroll through the text. Clicking the < and > buttons selects the previous/next checklist.



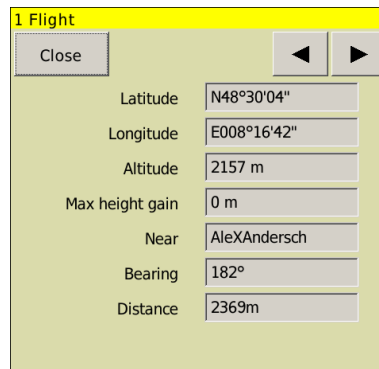
Status dialog

The status dialog is a multipage dialog giving overview information on the aircraft, system, task, rules and times. Pressing the < and > buttons select the previous/next page.

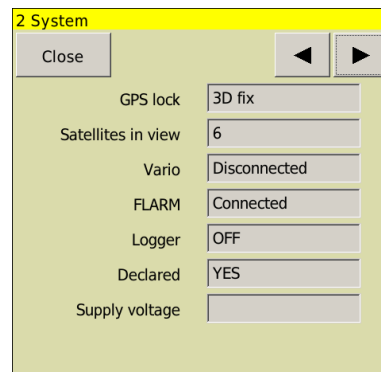
This dialog is accessed via the menu under

Info > Status

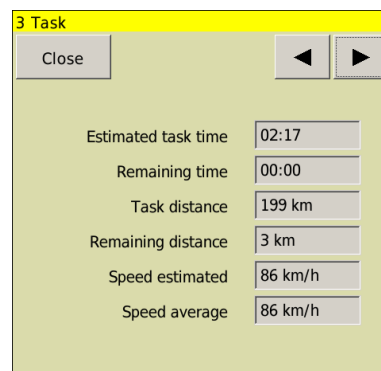
Flight : Shows the location of the aircraft, nearest waypoint and the maximum height gain.



System : Shows the status of connected devices and battery levels.



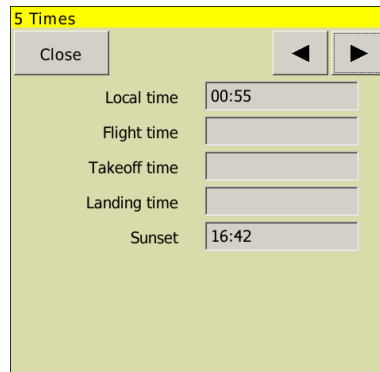
Task : Shows the AAT times, distances achieved and remaining and the task speeds.



Rules : Shows validity of start/finish according to the task rules.



Times : Shows the local time, flight time, takeoff and landing time and the local sunset time.

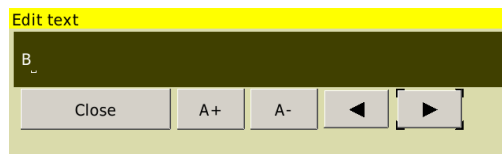


Text entry

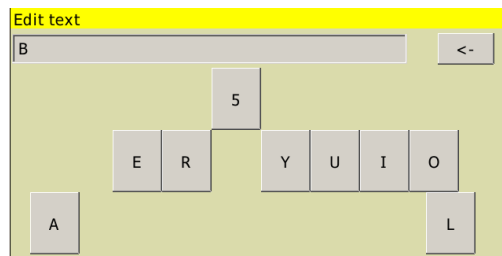
A text entry dialog is used for entering text. This is used for team code entry, setting file names, waypoint editing, as well as entering other configuration options, such as pilot name for the logger.

Two ways of entering text are provided. See Section 12.16 for details on customisation.

To enter text in HighScore Style, use the A+/A- buttons to adjust the character under the cursor (underlined character). Clicking the < and > buttons move the cursor left/right.



To enter text with the touch screen keyboard, press the letters of choice one after the other. In some dialogs (e.g. waypoint editing) only the next letters matching to an entry in the database will be shown. For deleting the last letter use the <- button. The **Clear** button deletes all input.



Press **Ok** to take over, or **Cancel** to exit.

2.5 Sounds

XCSoar generates sounds for different events, and can be configured to have custom sounds for any event. See Section 12.16 for details on customisation.

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

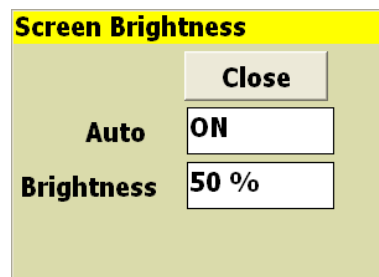
2.6 Screen

Certain aspects of the look of items on the screen can be adjusted. The most noticeable of these is whether to display InfoBoxes and gauges in black on white (called inverse colours) or white on black.

For some hardware platforms, the control of the screen hardware brightness can be controlled from the brightness dialog accessible from the menu:

Display > Display > Bright

Refer to the *Altair User's Manual* for details of the brightness dialog.



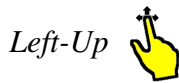
2.7 Help system

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.

2.8 Gestures

As of version 6.0, XCSoar supports so-called mouse gestures. To activate this feature go to the configuration dialog (Setup System / Interface) and enable it.

To use this feature hold down the mouse button or put the finger on the touchscreen, draw a certain figure and release the mouse button/touchscreen. Depending on the figure that was drawn a certain function is activated. A list of available gestures is shown below. A figure is defined by movements of the cursor in the four directions Up, Down, Left and Right. This means if you hold down the mouse button, drag the mouse to the left and afterwards to the top, the gesture "LU" is detected, which stands for "Left-Up". The manual indicates an available gesture as shown here on the left side of the text body.



Gestures available on the map screen:

- U: Zoom in
- D: Zoom out
- L: Toggle map mode (Normal, Aux. InfoBoxes, Fullscreen)
- R: Drop marker
- DU: Show the menu
- DR: Show the GoTo dialog

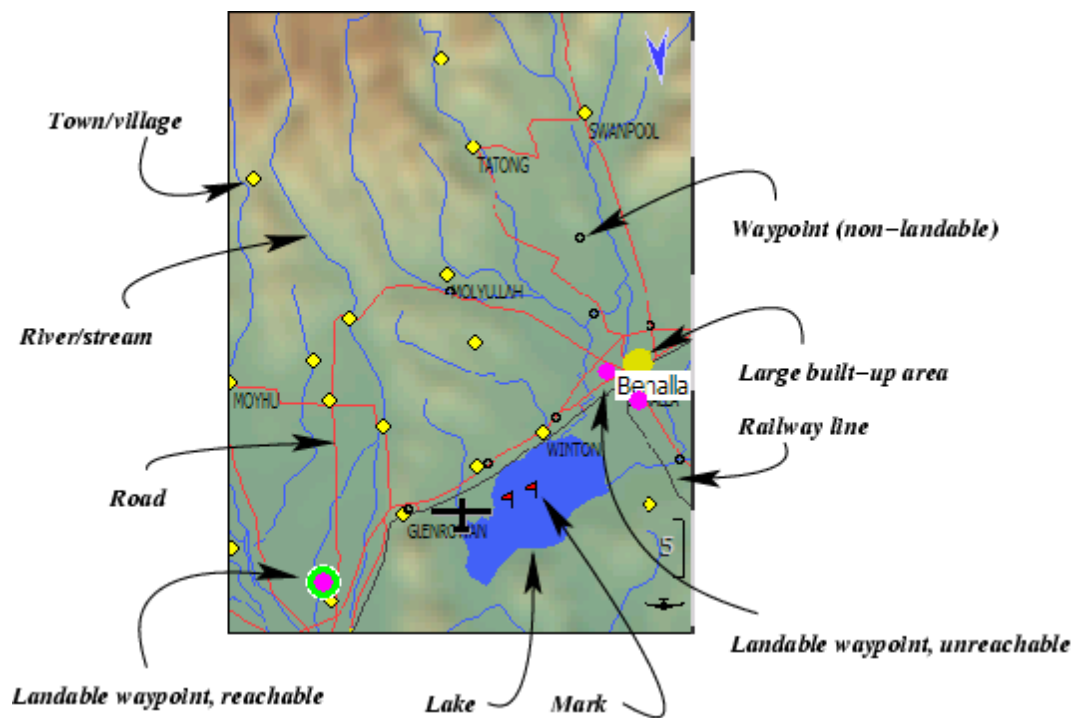
Gestures available on the FLARM radar dialog:

- U: Zoom in
- D: Zoom out
- L: Previous target
- R: Next target
- UD: Activate autozoom
- DR: Open details of selected target
- RL: Switch additional data show on the side (avg. climb/rel. altitude)

3 Navigation

This chapter describes the moving map display as an aid to navigation, and also describes some of the task and glide related overlays on the map display.

3.1 Map display elements



The moving map shows:

1. Glider symbol
2. Waypoints
3. The active task
4. The bearing to the next waypoint
5. Special Use Airspace
6. Terrain and topology
7. Markers

8. Trail
9. Glide range

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.

3.2 Glider symbol, map orientation

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

11.5 

The map is oriented in one of three ways: North up, Track up, or Target up. Configuration settings can be used to specify a different map orientation when in circling mode. This is 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 Track or Target-up is used in circling mode, the glider symbol is centred on the screen, even if the symbol position is configured differently. In cruise mode the Track and the Target-up orientation allows the glider symbol to be positioned (e.g.) 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.

11.6 

3.3 Zoom and map scale

To change the scale of the map, for PC, PNA, or Pocket PC:

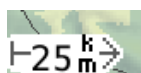
1. Tap/click on a blank part of the map to highlight the map if it is not already selected. Then use mouse wheel, or the Pocket PC up/down key to either zoom in or out.
2. You can also gesture to change the zoom level. Gesture “Up” zooms in, “Down” zooms out.
3. A PNA with a button wheel let you also change the zoom.
4. Or select the function from the menus:

Up/Down 

`Display` ▷ `Zoom In` and `Display` ▷ `Zoom Out`

On Altair, the rotary knob can be used to zoom in and out.

The map scale is displayed in the lower left corner of the moving map display. The indicated distance is measured from the left to the right boarder of the map display.



Compaq Aero Users. If you enable the Compaq Aero Game Keys (On the Q-menu) the centre two front buttons become the up/down keys.

11.5

There is a facility to have two zoom settings; one when the glider is in circling mode, and one in the cruise or final mode. This is the “Circling zoom” option in the configuration settings. By default, the circling zoom is set to about 2.5 km - 5.0 km, depending on the display size. 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. When auto-zoom is active, 'AUTO' appears next to the map scale. The user can still zoom in and out if desired, zoom will be switch to manual control automatically.



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

> >

When a waypoint changes (automatically, via the task selector, or by manually switching waypoints), auto-zoom adjusts the zoom level automatically so that the next waypoint is visible on the map.

3.4 Panning the map

A pan mode allows the user to explore areas beyond the glider. This is particularly useful when task planning.

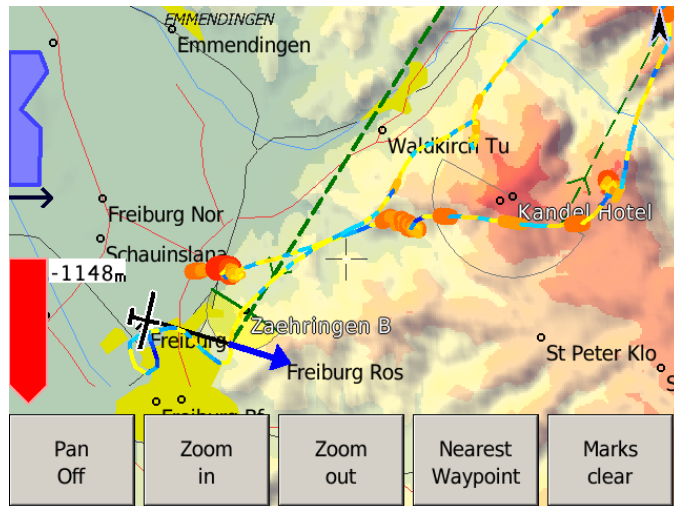
1. Enable pan mode by pressing

>

2. The map can then be panned by dragging the screen or using the cursor keys. For Altair, panning is performed with the inner/outer rotary knob.
3. When done, pan mode has to be disabled manually, by pressing:

When pan is active, the text 'PAN' appears next to the map scale. While panning the location of the focus stays in the middle of the display under the cross hairs.

A special menu of buttons in pan mode is also displayed when in pan mode.


















3.5 Waypoints

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

11.6

The waypoint symbols are drawn as shown below. There are three icon sets for landable waypoints.

Icon set	Simple waypoint	Landable field	reachable	Aerfield	reachable
Purple Circle					
B/W Icon					
Orange Icon					

11.5

6: explain somewhere else in detail: the MC value scaled according to your altitude compared with the cloud base altitude

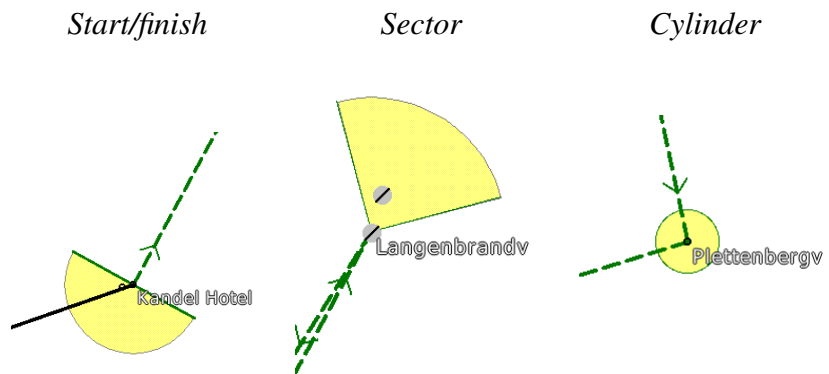
Waypoints are optionally labelled according to one of several abbreviation schemes.

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 displayed next to the waypoint. This arrival altitude is calculated on a minimum MacCready setting.

3.6 Active task

The active task course is drawn on the map as a green dashed line. Assigned area tasks also show the task sectors or areas as a yellow shaded region. Circles are always drawn around start and finish points, lines are only drawn if the start/finish points are of line type. Task observation sectors are drawn as segments.

At all times a thick black line is drawn from the glider to the next waypoint in the task.



3.7 Terrain and Topology

The following topological features are drawn on the map:

- Major roads, shown as red lines
- Rivers, shown as blue lines
- Large water bodies (lakes), shown as blue areas
- Large cities, shown as yellow areas
- Small population areas, shown as yellow diamonds

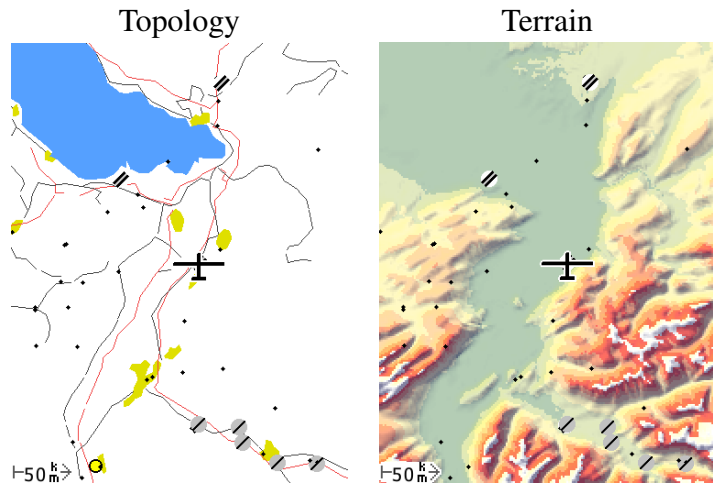
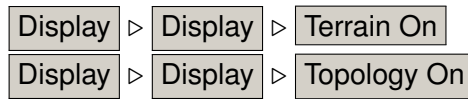
Cities and small population areas are labeled in italics.

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 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 shading and overall terrain brightness is configurable. Support for a sun ephemeris is underway. Terrain shading and brightness can be configured .

11.7 

Both terrain and topology display can be switched on or off from the menu:



If the terrain data is not available (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 be white.

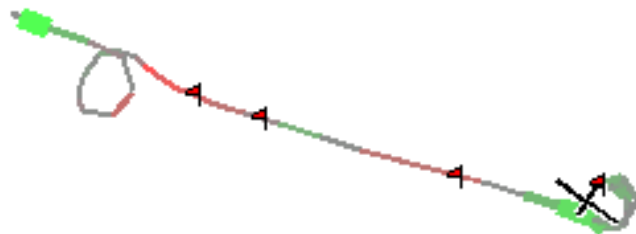
The screen can be de-cluttered, turning off the display of topology labels and non-task waypoint labels by toggling:



3.8 Trail

11.5 

An optional 'snail trail' is drawn on the map showing the glider's path history. The colour and thickness of the trail depends on the height or on the variometer value.



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 .

11.5 

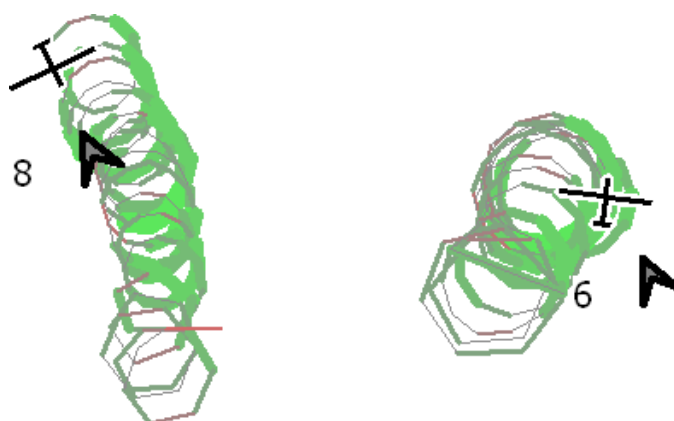
The snail trail display can be toggled between off, a short trail (about ten minutes), a long trail (about one hour) or a full trail which displays the entire flight. This can be performed permanently through the configuration settings or temporarily by the menu:

Display > Display > Snail trail

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

In order to assist centering thermals in the presence of wind, the snail trail can be artificially drifted with the wind as it is displayed (this is drift compensation). In this way, the snail 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).

11.5 

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:

Config > Setup Wind

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

11.5 

The trail width can be adjusted in the configuration settings .

3.9 Markers

Markers are shown as small flags on the map. The markers can be dropped manually, by pressing a button, or automatically. An ex-

ample use of automatic markers is to drop markers when entering circling mode, as a simple way of showing all thermals encountered.

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

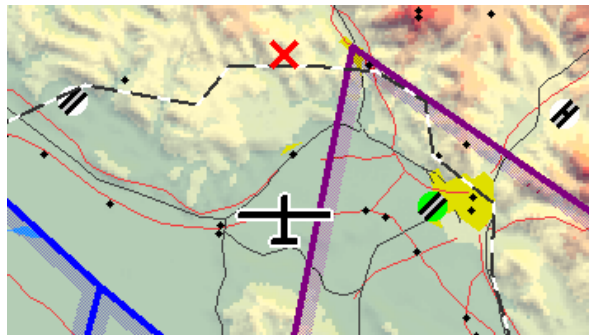


Markers are dropped by the menu, or by gesture :



3.10 Glide range line

A reachable glide ‘footprint’ is displayed on the map display as a black and white 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 display can be configured to additionally blur the not reachable area outside the glide range. The final glide path is checked for whether the glider clears terrain ahead by the terrain clearance height. If clearance is not attained, a red cross appears on the map at the point where the violation occurs. If a target is defined the calculation is done along the path to the target.

3.11 Status dialog

The nearest landmark function, typically available via the button menu, brings up a status message describing the name, distance and bearing to the nearest landmark. The nearest landmark is also reported on the status dialog.

You may find this function useful when you need to report your location to others.

Currently the landmarks scanned are the list of waypoints. In the future, XCSoar may also search for nearby towns and cities in the topology database.

The aircraft status dialog (see Section 2.4) shows the status of the aircraft's locality, and can be useful when giving position reports.

This is accessed via the menu under:

`Info` ▷ `Info` ▷ `Status` .

and then selecting the page 'Aircraft'.

4 Cross Country Tasks

XCSOar provides a full task management system, in which tasks can be edited prior to flight and, when undertaking casual cross-country flying, modified during flight. Waypoints are advanced automatically or may be cycled through manually. This chapter also describes the use of IGC loggers with XCSOar.

4.1 Editing tasks

You can edit tasks in several ways. Some methods are more useful for editing prior to flight, and others allow tasks to be modified whilst in flight for casual cross-country touring. Tasks can be saved to files and loaded later, and can be transferred between any XCSOar platform (Pocket PC, Altair, PC).



It is also possible to save a ‘default’ task and have this task loaded automatically upon start-up of XCSOar. One application of this is to set up a default task with one waypoint being the home — this means that XCSOar is then programmed for final glide back to home, which is useful for casual cross-country touring.

The main ways of setting tasks are the following:

- Using the task editor dialog
- Selecting waypoints from the map and adding them to the task from the waypoint details dialog
- Loading the task from a file



Loading a task from file may be useful in competition or casual cross-country flying in groups, as one person can distribute the task file to others, thereby saving the group the job of editing the task themselves.

XCSOar saves the current task when shutting down and loads it at startup, thereby allowing the task to be entered early in the day, then turning off the glide computer until ready for flight.

Task waypoints are preserved even if the waypoint file is changed. This means, if you save a task, then change the waypoint file, then load the task again, new waypoints are generated for any waypoints that are missing in the new waypoint file.

4.2 Waypoint details dialog

The waypoint details dialog describes a waypoint in detail and has navigation functions such as GoTo, Insert.

This may be accessed several ways:

- From the task editor, menu **Nav** > **Nav** > **Task Edit** and select a waypoint, then press the button with waypoints name on it.
- From the menu **Info** > **Waypoint details** to show the details for the active waypoint.
- From the menu **Info** > **Nearest waypoint** to show the details of the waypoint nearest the aircraft, or if in pan mode, nearest the pan cursor.
- From the waypoint selector, menu **Nav** > **Waypoint List** and select a waypoint to show the details of that waypoint.

The waypoint details dialog contains two major pages (accessed via the **>** and **<** buttons). Depending on the availability of further details to the waypoint they will be shown on extra pages.

Waypoint details

This page contains text describing the waypoint's location, elevation and local sunset. Last not least a button **GoTo** to directly initiate navigating to this waypoint. The button cancels the current task.

Waypoint Info: 'Emmendingen'	
Goto	Comment: Railwayst
	Latitude: N48°07'10"
	Longitude: E007°50'51"
	Elevation: 201m
	Sunset: 16:59
	Distance: 11.0km
	Bearing: 5°
	Alt diff Mc 0: 315 m
	Alt diff Mc safety: 314 m
	Alt diff Mc current: 248 m
< >	
Close	

This page also shows three forms of altitude difference (additional altitude required to reach the waypoint at the safety altitude) for the corresponding waypoint:

Alt diff MC 0 : Altitude difference at MC setting of 0

Alt diff MC safety : Altitude difference at the abort/safety MacCready setting

Alt diff MC current : Altitude difference at the current MacCready setting

Task menu

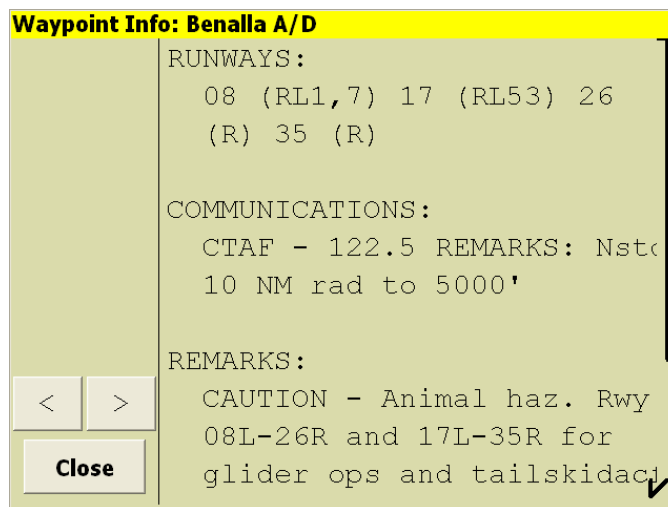
This page contains a column of buttons allowing various actions to be performed:

- : replaces the active waypoint in the task.
- : inserts the waypoint before the active waypoint in the task.
- : adds the waypoint to the end of the task.
- : removes the waypoint from the task.
- : sets the waypoint as the home airfield.
- : sets the waypoint as reference waypoint for team code coordinates.

It is a good idea to set your home waypoint from the waypoint details dialog. This causes XCSoar to start up at the home location regardless of whether a GPS fix is received. If no home is set, then XCSoar starts in the center of the terrain map.

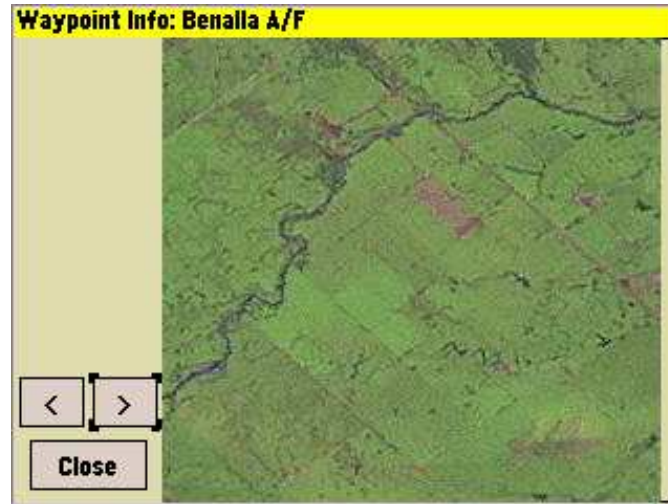
Airfield information

This page may contain relevant text from the enroute supplement about the airfield, including runways, radio frequencies, traffic patterns, contacts.



Satellite image

This page shows a satellite image of the waypoint.




4.3 Waypoint selector dialog

The waypoint selector is a dialog that allows waypoints to be easily selected from a potentially large database.

This may be accessed several ways:

- From the menu `Nav` > `Waypoint List`
- From the task editor, menu `Nav` > `Nav` > `Task Edit` and selecting a waypoint and open the details.
- Or just by gesture.

Down - Right 

The waypoint selector comprises a set of optional filters on the left side of the page, and a list of matching waypoints on the right. There are several filters available, which may be used together, individually or not at all.

Name : Filtering based on the matching the first letter in the waypoint name.

Distance : Filters out waypoints further that a specified distance to the aircraft.

Direction : Filters out waypoints that are not in a specified direction from the aircraft. An additional special direction “HDG(0)” filters waypoints within 30 degrees to either side of the heading of the glider. This allows the pilot to point the glider at a group of waypoints and quickly find them.

Type : Filters out waypoints that are not of the specified type (Landable point, Airport or Turnpoint) or that appear in the specified File 1 or File 2 (primary or secondary waypoint file respectively).

When filtering by name and type, the list of matching waypoints is sorted by name. When (in addition) filtering by distance or direction, the list of matching waypoints is sorted by distance.

Select Waypoint				
Filter...	Freiburg	HT	0m	0°
Name	Kirchzarten	AT	12.0km	130°
*	Bremgarten	AT	20.7km	231°
Distance	Muellheim	AT	26.0km	214°
75km	Altdorf Wall	AT	27.7km	1°
Direction	Lahr	AT	38.8km	359°
*	Huetten Hotz	AT	43.8km	169°
Type	Reiselfingen	AT	44.2km	115°
Airport	Offenburg Bad	AT	48.2km	8°
Select	Donauesching	AT	51.5km	96°
	Herten Rhei	AT	51.6km	187°
Close	Winzeln Schra	AT	52.7km	57°

The list can be scrolled if there is more than one screen full of matching waypoints. To scroll through the list, simply drag with the finger, or move to the bottom (or top) of the list with the cursor.

Selecting an item will result in different behaviour depending on what function opened the waypoint selector. In typical use it brings up the waypoint details dialog for the selected waypoint.

4.4 Task manager

The task manager is target of major rework and thus the description possibly comes short compared to its functionality. Version 6.1 of XCSoar will hopefully leverage the rate of change at the task editor and the manual will be more complete at this point.

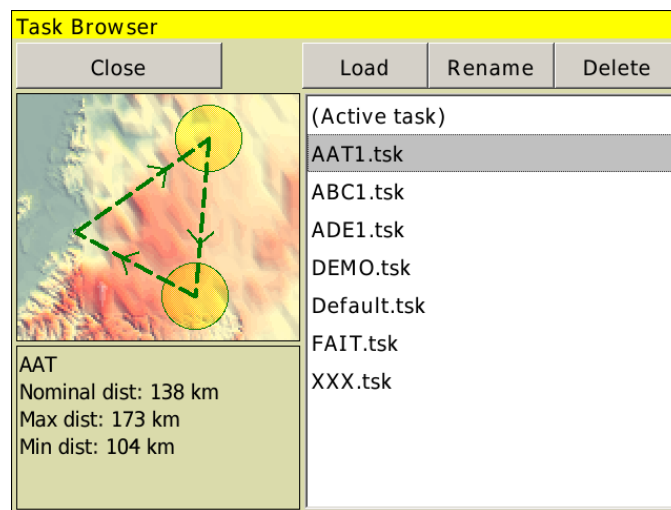
The task manager is used to edit, view, load, save to file, and declare cross country tasks. It is accessed via the menu

Nav > Nav > Task Edit

The task manager's primary page is an overview. It gives a graphical view of the active task, lets you enter into the task editor, or task browser. Further you can backup the current task with the **Save as** button, and send the task to a connected intelligent logger device with the **Declare** button.

Task browser

The **Browse** button enters the task browser. On the left side it displays a thumbnail of the selected task, its type and task distance. The right side lists all tasks XCSoar found on your system, including an item for the current active task. This could be handy to save the active task to a different file and thus make a backup before modifying it. Not to mention, the active task can not be renamed or deleted. To remove any active task from XCSoar you have to enter the editor and “clear” it there.



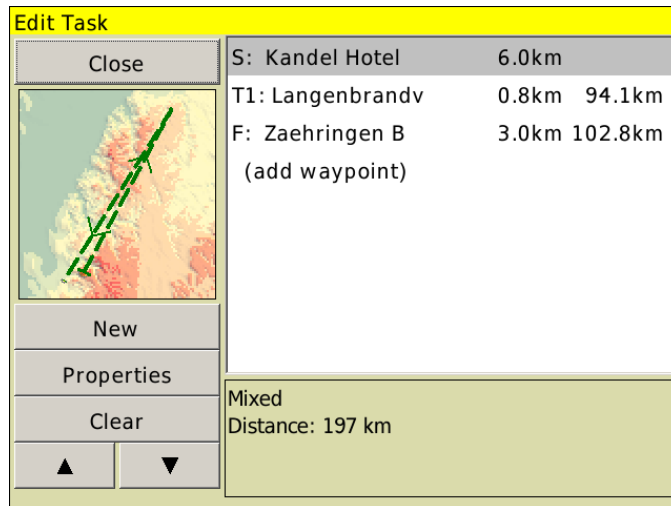
The task browser dialog has the following buttons on the top of the form:

- Load** : Loads the selected task file and closes the dialog and returns to the task overview page.
- Rename** : Opens the text editor, allowing the file name to be changed. If the Chancel button or ESC button in the text editor is pressed, the task will be unchanged.
- Delete** : Removes the task entirely from the system.

Task editor

The **Edit** button enters the task editor. It comprises a list of waypoints on the right side of the form. All means to add, change, or delete waypoints to the list composing the task are accessible through this side of the form. By pressing the “(add waypoint)” a proper selection of waypoint types according to the task type is presented. Selecting a waypoint type leads directly to the already described waypoint selector dialog (see Section 4.3).

The type of task and the total distance of the task is shown below the waypoint list.

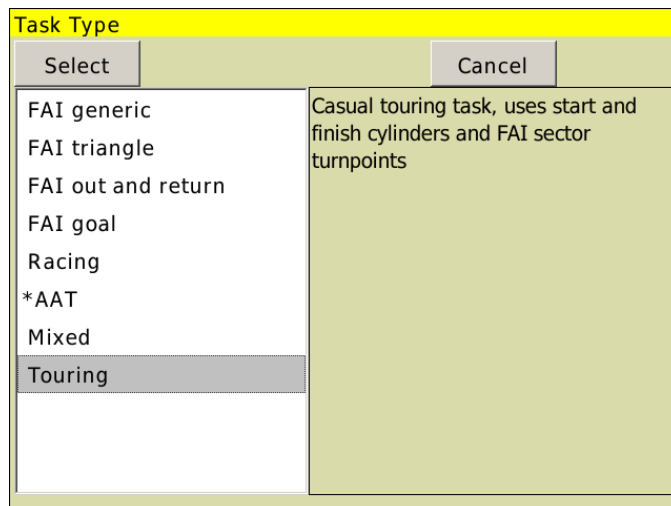


The left side of the form gives all means to manipulate the task entirely. You can create a new one, review the task properties, and clear the task entirely. A graphical fullscreen overview is shown by taping on the task thumbnail view.

The up and down button below allow to reorder the waypoint list. This is handy to e.g. flip the round trip direction of a triangle course by changing the turning point sequence.

Task types

By pressing the **New** button a selection of task types is presented to choose from.




On the list of task types the type of the active task is marked with a "*" in front of it. The set of task types largely covers the typically used international FAI task set and also a "Mixed" type to describe virtually any intended flight. The "Touring" type is a simple way to enter as less as possible into the system and have a maximal

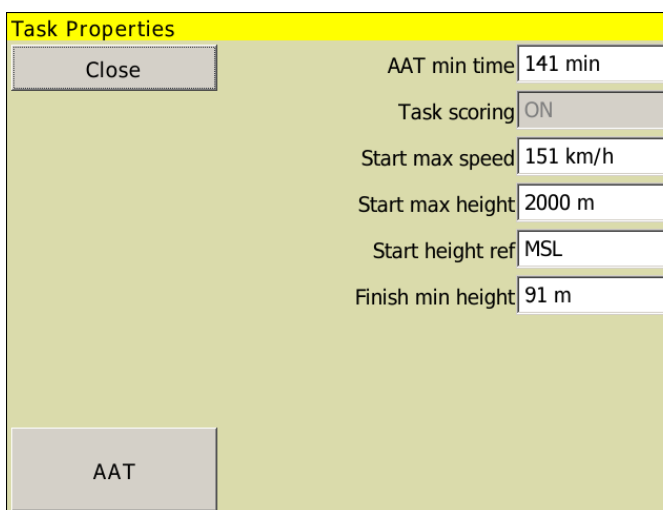
casual cross country support by XCSoar. On the left side of the form a short description is given to the selected task type.

Since the manual does not intend to rephrase FAI rules or tasks you better refer to the online source <http://www.fai.org>.

Task properties

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By pressing the **Properties** button a summary with the important parameters of the task is reached. If applicable values are taken from the default rules configuration page. For FAI tasks only the finish height option applies. For the AAT the most important setting is the minimum task time, which can be set here.



Task Properties	
Close	AAT min time 141 min
	Task scoring ON
	Start max speed 151 km/h
	Start max height 2000 m
	Start height ref MSL
	Finish min height 91 m
AAT	

The task properties dialogs contain several fields:

- AAT min time : (Only for AAT) Minimum AAT task time in minutes.
- Task scoring : Internal flag, which determines whether accurate scoring measurements of the task is required or not. It can not be modified.
- Start max speed : Maximum speed allowed in start observation zone. Set to 0 for no limit.
- Start max height : Maximum height while starting the task. Set to 0 for no limit.
- Start height ref : Reference used for start max height rule. “MSL” reference is altitude above mean sea level, “AGL” reference is the height above ground at the start point.
- Finish min height : Minimum height above ground while finishing the task. Set to 0 for no limit.

FAI finish height : (Only for FAI tasks) If enabled, this option requires the minimum height above ground for finish to be greater than 1000m below the start height.

4.5 Advancing and restarting tasks

At all times one waypoint in the task is designated as the active waypoint. The active waypoint is used for calculation and display of navigation information, that is, the pilot is directed to fly towards the active waypoint (also referred to as the “next waypoint” in the description of InfoBoxes as in Chapter 10).

During flight a continuous display of the bearing of the next turn point is shown.

The altitude required to complete the task is calculated from the glider’s position to the active waypoint through to the final waypoint.

Changing the active waypoint is performed automatically by default in the following ways.

Auto advance mode : Once the aircraft enters the turn point observation zone (OZ) and satisfies the turn point rules, the software will automatically select the next task turn point. This is the default behavior for almost every task waypoint. An exceptions is the AAT task.

The active waypoint is advanced through the list of waypoints in the task automatically: the start waypoint is advanced when the starting conditions are met (such as flying through a start line or leaving a start cylinder); intermediate waypoints are advanced when the glider enters the observation zone.

Manually arm mode : This is quite similar to the Auto method, but it requires the pilot to manually interact and arm a trigger. Therefore, if the advancement conditions are met but the trigger is not armed, the waypoint is not advanced. The ‘Arm’ button can be used to arm the trigger. It is accessed via the menu

Nav ▷ Arm Start/Turn

This is used for all waypoints with an variable target like the AAT observation zone with an obtimised target point, so that the minimum task time conditaion will be meet.

Status messages are given in manually arm mode when inside the observation sector, as reminders to press arm when the pilot is ready to advance to the next waypoint. For starting, a warning is

given that the glider is in the start cylinder or behind the start line, as a reminder to “arm” if necessary.

In any times, the pilot can override the current waypoint with the buttons:

Nav ▷ **Previous turnpoint** and **Nav** ▷ **Next turnpoint**

For PC and Pocket PC with touchscreen versions only, the user may manually cycle through the waypoints by highlighting the waypoint InfoBox and by pressing the up or down cursor key.

See Section 4.6 for details on observation rules.

If a user has cycled through the waypoint manually, this does not mean that the glider has successfully passed the waypoint! However, this facility is useful to force a task restart or to skip a waypoint when flying a casual cross-country task.



Tasks can be restarted simply by manually cycling back through the waypoints to the start.

In all modes, if the glider re-enters the start zone or crosses the start of the previous start, the task will be automatically restarted.

When selecting **Previous turnpoint**, the trigger that detects auto-advance for that waypoint is cleared; meaning that the task manager expects the aircraft wants to fly to that observation zone (OZ) again before continuing the task. The pilot may still select **Next turnpoint** to advance to the next task waypoint.

A system beep and message is given on task/waypoint advance. The messages are given when the system advances the task waypoint automatically or, in manually arm mode, when the system is armed and the aircraft is in sector:

Task start appears when the aircraft has crossed the start line or exited the start sector. This can be repeated any time.

Next turnpoint appears when the aircraft has entered the observation sector for turnpoints. Turns with variable target advance as soon as **Arm Turn** is pressed. For the manually arm mode, if the aircraft has already entered the observation sector and left, pressing arm will cause the task manager to expect, that the turn is intended to approach another time.

Task finish appears when the aircraft has crossed the finish line or entered the finish cylinder. This occurs in both advance modes.

4.6 Task rules

A variety of task rules may be used when specifying tasks, including the common FAI triangles and Assigned Area Tasks (AAT). Many aspects of the rules can also be customised.

Starting and finishing lines are centered on their associated waypoint and aligned perpendicular to the next and previous waypoints respectively.

Sector turn-points are 90 degree segments aligned to the bisection of the previous and next waypoints, as commonly used in FAI tasks. There is also support for British BGA, and German DAeC sectors.

The conditions to meet for a valid start depending on the type of start:

Start Cylinder : When the glider leaves the cylinder area.

Start Line : When the glider crosses the start line.

The conditions to meet for a valid intermediate waypoints depending on their type:

FAI Sector : When the glider has entered the observation zone (OZ), defined by a segment and radial distance from the waypoint. The segment is defined by a 90 degree arc centered about the bisector of inbound and outbound legs, with a distance of 20 km.

Keyhole Sector (DAeC 0.5/10 sector) : When the glider has entered the observation zone, defined by a segment and radial distance from the waypoint. The segment is defined by a 90 degree arc centered about the bisector of inbound and outbound legs, with a distance of 10 km. The observation zone also includes a cylinder of 500 m.

Turnpoint Cylinder : When the glider has entered the observation zone defined by a radial distance from the waypoint.

BGA Fixed Course Sector : When the glider has entered the observation zone defined by a segment and radial distance from the waypoint. The segment is defined by a 90 degree arc centered about the bisector of inbound and outbound legs, with a distance of 20 km. The observation zone also includes a cylinder of 500 m (British rules).

BGA Enhanced Option Fixed Course Sector : When the glider has entered the observation zone defined by a segment and radial distance from the waypoint. The segment is defined by a 180 degree arc centered

about the bisector of inbound and outbound legs, with a distance of 10 km. The observation zone also includes a cylinder of 500 m (British rules).

Area Zylinder (AAT) : and

Area Sector (AAT) : When the glider has entered the observation zone defined by the radial distance from the waypoint, and segment for sector areas.

Task completion depends on the finish type:

Finish Cylinder : When the glider enters the cylinder area.

Finish Line : When the glider crosses the finish line.

Automatic advancement is triggered whenever a condition is met. To start an AAT, mixed task, or Racing task the start has to be armed before.



Competition rules may be defined in a profile file for distribution to a group of pilots or task-setters, so all competitors are playing by the same rules!

Additional task rules for valid starts and finishes may also be specified. Starts may have a defined maximum altitude above ground, and a maximum speed. Finishes may have a minimum altitude above ground. These parameters are defined in the page “Default Task Rules” in the configuration settings.

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For non-AAT tasks, an option is available to set the minimum finish altitude according to the FAI rule, whereby the minimum finish altitude is above 1000 meters below the start altitude.

4.7 Alternate starts

Alternate start points are skipped for XCsoar 6.0, but will potentially be brought back in a next release.

4.8 Task calculator dialog

The task calculator dialog allows the pilot to see the effect of various changes to the task on final performance.

This may be accessed several ways:

- From the menu

Nav > Task calc

- From the analysis dialog, menu **Info** > **Analysis** and select the button **Task Calc**

Field	Value
Assigned task time	102 min
Estimated task time	107 min
Task distance	121 km
Set MacCready	1.1 m/s
AAT Range	-51%
Set speed remaining	68 km/h
Achieved MacCready	1.1 m/s
Achieved Speed	0 km/h
Cruise efficiency	100%

Assigned task time : This field displays the assigned task time.

Estimated task time : This field displays the estimated total time on task to complete the task at the provided MacCready setting.

Task distance : This field displays the task distance remaining.

Set MacCready : Allows the user to adjust the MacCready value and see the effect it has on the estimated task time.

Set range : Allows the user to adjust the targets within the remaining AAT areas, to see the effect it has on estimated task time and task distance.

Set speed remaining : This field displays the estimated speed for the remainder of the task at the provided MacCready setting.

Achieved MacCready : This field displays the achieved MacCready value.

Cruise efficiency : 100 indicates perfect MacCready performance, greater than 100 indicates better than MacCready performance is achieved through flying in streets. Less than 100 is appropriate if you fly considerably off-track. This value estimates your cruise efficiency according to the current flight history with the set MC value. Calculation begins after task is started.

See Section 5.11 for more details on task speed and achieved MacCready calculations.

On closing the dialog the entered MacCready value is used as the MacCready setting. If the **Cancel** button is pressed, the MacCready setting is unaffected.

The **Target** button, for AAT tasks, adjusts the range (increases or decreases) so that the estimated task time exceeds the assigned task time by less than five minutes. The range is adjusted target-wise. In typical use, all targets are set to “auto” that means the pilot does not have to manually adjust the range to find the course for arrival at the assigned task time, thereby reducing pilot workload.

4.9 Task status dialog

The status dialog (see Section 2.4) gives a summary of important task information. It can be useful to give a good overview of the task status while freeing up InfoBoxes for other purposes. The status dialog can be referred to in order to confirm that a valid start was detected, as well as the progress against the task.

This is accessed via the menu:

Info ▷ **Info** ▷ **Status**

the pages ‘Task’ and the following are of interest.

4.10 Assigned Area Tasks

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 does not trigger when entering an AAT area solely. The pilot has to arm the turn manually to advance to the next turn. When arming the AAT turn while flying through the OZ also the task optimiser is triggered to capture the realised AAT target and bring the target optimisation for the rest of the task up to date. See Section 4.5 for details.

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 task calculator dialog (see Section 4.8), shows the average percentage over all turns in the AAT Range field. The targets can be individually modified from the target dialog of the task calculator.

AAT targets and the Task Calculator

The typical use of targets in flying AAT is as follows:

- Set the expected MacCready, bugs/ballast and wind settings for the flight using the flight settings and wind settings dialogs.
- Define the task as normal from the task editor.
- Based on the pilot's judgement of how good the weather is, and whether some areas are likely to be more or less difficult than others, targets may be set individually for each turn-point in the task editor. The ETE field in the task editor can be compared to the assigned minimum time to check the planned task is efficient and long enough.
- During flight, if situations change, such as changed MacCready setting or wind, the task calculator can be brought up to show the estimated task time, again allowing comparison to the assigned minimum time.
- If the pilot decides to extend or shorten the flight, all the remaining targets can be modified from the task calculator.

The task calculator therefore allows the pilot to make (and help to answer) 'what if?' questions, for example:

- What will happen if the conditions improve? The MacCready setting can be increased and the pilot can see if there is sufficient adjustment to targets in order to be able to extend the planned task.
- What will happen if the conditions deteriorate? The MacCready setting can be decreased and the pilot can see how much the task can be shortened and still finish the task later than the assigned minimum time.
- What will happen if I leave the AAT area now? By pressing **Arm turn** the take over of the current position into the

optimisation can be forced. The repositioning of subsequent turns can be reviewed in the task calculation dialog.

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.

A worked example is provided in the following figures to illustrate how targets move during a flight and to show how XCSoar determines the maximum scored path.

Outside sector
Target (-20%) is on bisector

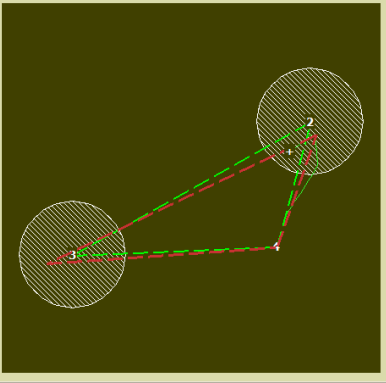
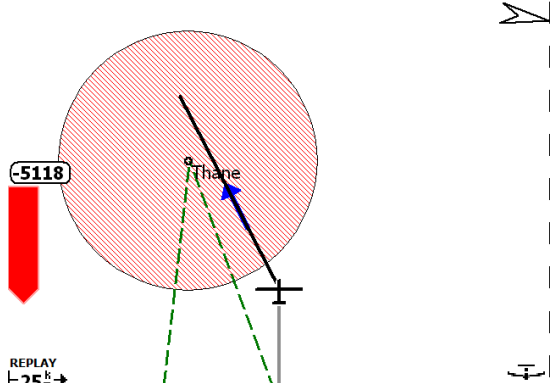
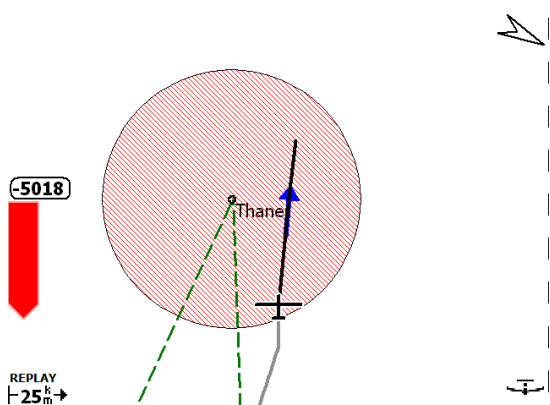
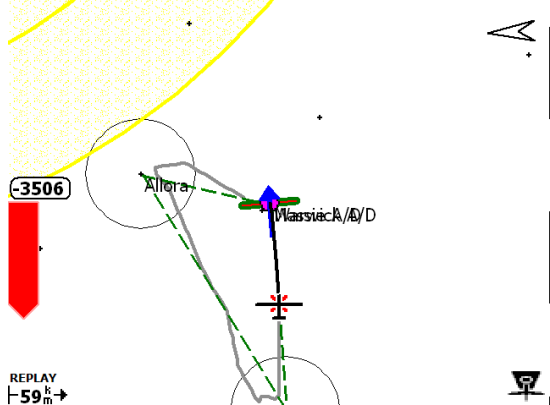
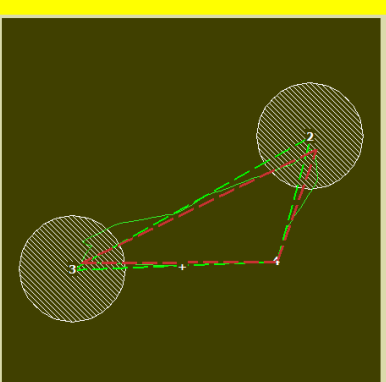
Inside sector
Target moved along track line

User decreased range
Target (-80%) moved along track line


User increased range
Target (80%) moved along track

Analysis (task page)
Path around active target

Next waypoint
"Arm Turn" pressed

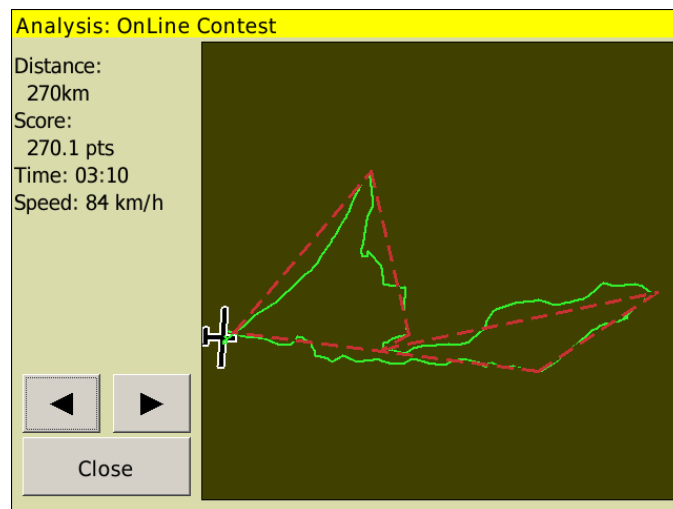
<p>Analysis: Task</p> <p>Task to go: 06:20 AAT to go: 00:55 Distance to go: 56 km Target speed: 60 km/h</p> <p>Task calc</p> <p>< ></p> <p>Close</p>  <p><i>Analysis (task page)</i> Best scored target found</p>	 <p>REPLAY -25^k_m→</p> <p><i>Approaching next area</i> Target (60%) is on bisector</p>
 <p>REPLAY -25^k_m→</p> <p><i>Inside sector</i> Target (60%) moved along track line</p>	 <p>REPLAY -59^k_m→</p> <p><i>Next waypoint</i> "Arm Turn" pressed</p>
<p>Analysis: Task</p> <p>Task to go: 01:33 AAT to go: 00:42 Distance to go: 10 km Target speed: 15 km/h</p> <p>Task calc</p> <p>< ></p> <p>Close</p>  <p><i>Analysis (task page)</i> Best scored targets found</p>	

4.11 OnLine Contest

11.17 

The analysis dialog contains a page ‘OnLine Contest’ which can be used to show the optimal path and estimated score. The configuration settings (task rules page) allows the selection of which set of rules to be used for the OLC optimisation.

The optimisation is done continuously in the background and can be retrieved at any time. The analysis page shows a graphical overview of the optimisation result besides distance and score. A InfoBox is available which gives the instant OLC distance and score as well.



When flying OLC, either AAT or non-AAT tasks may still be used to manage the flight navigation. During flight, 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, 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.

7: still true?

The score and computed optimal distance is approximate.

When the aircraft has landed, the displayed result gets not updated anymore.

4.12 Abort/resume task

If atmospheric conditions change for the worse, you may make the judgement that it will be impossible to complete the task. In this situation, XCSoar can be instructed to 'abort' the task, and it will then help you reach a safe landing site.

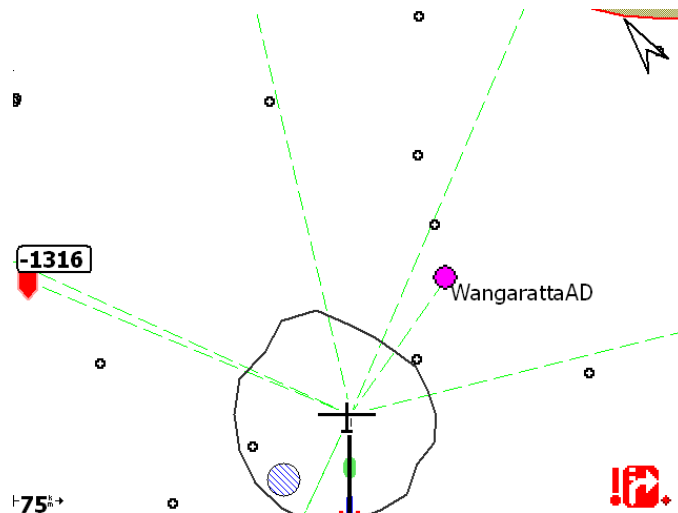
To abort/resume the task, press

Nav > Nav > Task Abort

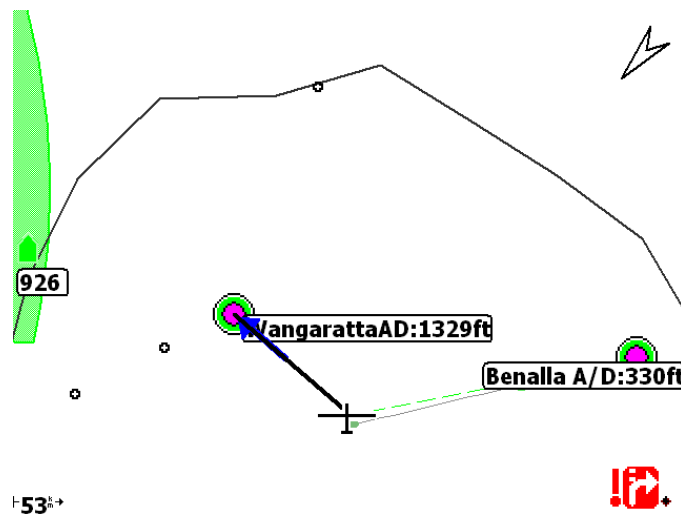
Once aborted, whatever cross-country task was being flown is discarded. The task waypoint list is then filled with nearby landing points, ordered by the estimated arrival altitude at best glide angle with the safety MacCready ring setting, adjusted for wind. The first waypoint in the list is therefore the most reachable waypoint.

The configuration option 'Abort use current MC' determines whether waypoint arrival heights in abort mode uses the MacCready value prior to aborting the task, or if the safety MacCready value is used. If this is false, the MC value used to calculate arrival heights in abort mode is the safety MacCready value. Default is to use the safety MacCready value. When switching to abort mode, the MacCready setting is set to the safety value if it is lower than the current setting.

When no land-point is reachable, then the nearest 10 landable points are shown.



When at least one land-point is reachable, then only the reachable land-points are shown.



If the task waypoint that was active, prior to aborting the task, is landable and estimated to be reachable, then it remains the active waypoint in abort mode. Otherwise, the most reachable landable waypoint is selected as the active waypoint, even if there are no reachable waypoints.

The active waypoint, and in fact the list of nearby landable points in the task, is changed dynamically when in abort mode, so that at any time the pilot is presented with several landing options and any of these may be selected as the active waypoint.

If conditions improve, the task can be resumed (by selecting the same menu button that aborted the task). The active waypoint, prior to aborting the task, is then restored along with all the other task details.


When the task is aborted, the flight mode changes to final glide mode.

4.13 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.

11.11 

- XCSoar can also send declarations to some external logger devices. For this to work, the device must be specified in the “Devices” section of the configuration settings.

The logger can be turned on and off automatically or manually. To turn the logger on (or off) manually, select from the menu

Config > Config > Logger Start

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 does it 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.

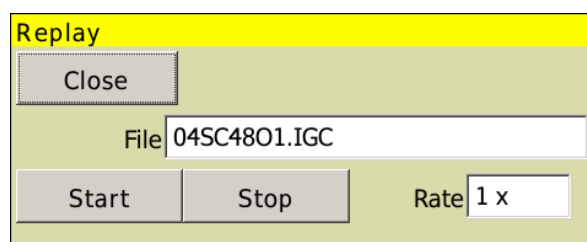
The XCSoar software logger, when started, checks for 500kB of free space on the file storage. If there is insufficient space, it will automatically delete IGC files, oldest first, in order to free up 500kB. It does not ask the user for confirmation before performing this operation.

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.

4.14 Logger replay dialog

Flight logs in the IGC format generated by XCSoar or other loggers can be replayed. The logger replay dialog can be accessed via the menu:

Config > Config > Replay



During replay, the word “REPLAY” appears at the lower left corner of the screen. During replay, the program behaves as if real GPS updates are being received by a GPS. The logger replay dialog does not need to be open during replay.

To start a log, first select the file to load, and then select the **Start** button. The replay can be performed in accelerated time by changing the time scale from 1x to a higher number, and paused by setting the time scale to zero. High time scales can result in degraded performance of the wind estimation and other statistics/analysis routines.

Stop the log using the **Stop** . Once a log is started, further presses of the **Start** has the effect of restarting the replay.

Note: it is recommended to reset the device before flight, after a log file has been replayed, in order to ensure that XCSoar’s internal statistics are properly reset.

When operating XCSoar in FLY mode, the replay is disabled (stopped) if the real GPS receiver detects that the aircraft is moving.

The logger replay works best with high sampling rate log files; 6 second interval or less works fine.

4.15 Analysis dialog

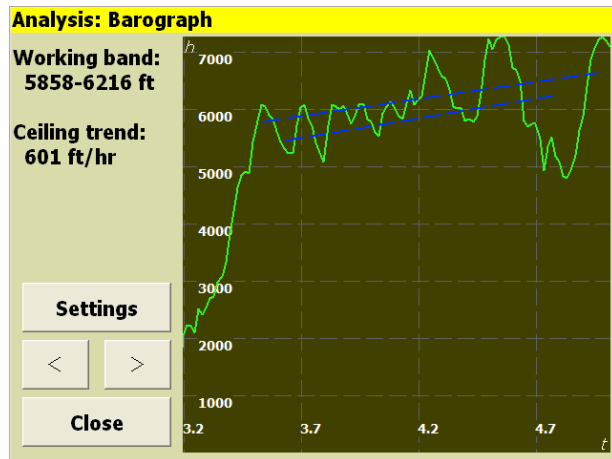
The analysis dialog is very useful in planning and conducting cross-country flights. This is accessed via the menu under

Info ▷ **Analysis**

Several pages are of interest:

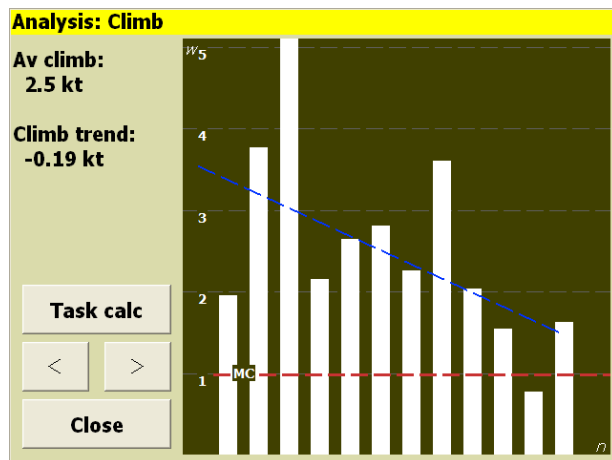
Barograph : Shows a graph of the history of the altitude of the glider. Statistics are used to estimate the thermal working band (average base and ceiling of climbs) and to estimate how the ceiling is changing over time. The base and ceiling lines are drawn on the barograph.

The ‘Settings’ button opens the flight settings dialog (e.g. to adjust the QNH)



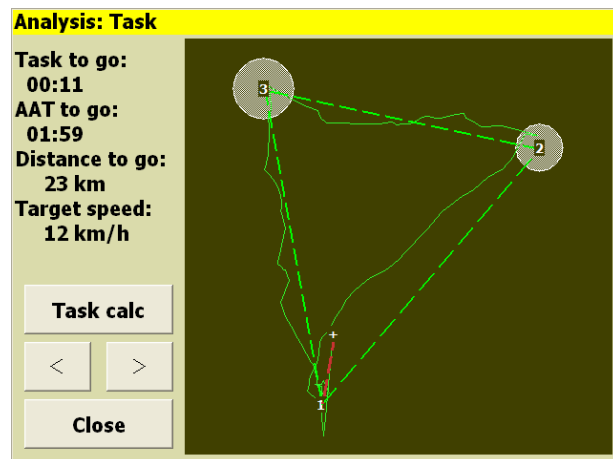
Climb history : Shows a bar chart of the average climb rate achieved during each climb. Statistics are used to estimate the overall average climb rate, and to estimate how this average is changing over time. The current MacCready setting is drawn on the bar chart as a thick red dashed line, and the climb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

The “Task Calc” button opens the task calculator, (e.g. to adjust the MC value)



Task : This page shows an overview of the entire task. The main task line is drawn in thick dashed green, AAT areas are shaded. For AAT tasks, the path from the aircraft around the remaining targets within AAT areas is shown in red. The aircraft track is shown as a thin green line.

The ‘Task Calc’ button opens the task calculator, (e.g. to adjust the AAT task range or MC value)



4.16 Sunlight and time

A sun ephemeris computes the time of sunset, which is displayed in the Aircraft Status dialog (see Section 12.16). Note that local terrain and atmospheric conditions may result in poor visibility before the displayed sunset time.

For PDA systems, the clock is adjusted for daylight saving time according to the settings in the operating system. For Altair, the clock UTC offset must be adjusted manually for daylight saving time in the configuration settings dialog.

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

5 Glide Computer

This chapter 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 aborted.

Cruise : The glider is not circling and there is either no task active, or the task 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, or the gliders height is above the final glide path.

The specific computations performed by XCSoar are of course dependent on this flight mode. The display changes according to each mode, principally, the InfoBoxes may be set up differently for each mode; 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.

-  No gps connection
-  GPS waiting for fix
-  Cruise
-  Climb
-  Final glide
-  Abort task
-  FLARM traffic

In addition to these 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. This is accessed from the menu

Info ▷ Info ▷ Aux Info On

which toggles between the normal mode-specific InfoBoxes and the auxiliary set of InfoBoxes.

Final glide mode replaces the Cruise mode as soon as the glider is above the final glide path. The required height depends most important on the adjusted MC value, but also the ground clearance is respected. On entering a thermal while in Final mode XCSoar will switch to the Circling display and back to the Final display once the thermal is left again and the final glide condition is still met. The potential of having the Final glide mode is obvious when flying short tasks in which the aircraft may well be above final glide turning the penultimate waypoint.

5.2 MacCready setting

The MacCready setting may be adjusted several ways:

- From the menu items

Config ▷ MC +

Config ▷ MC -

- For touchscreen/mouse devices, select the MacCready InfoBox field, then use the up and down arrow keys.
- When connected to a supported intelligent variometer, adjusting the MacCready setting on the variometer will change the setting in XCSoar.

In addition, an automatic MacCready mode is available as described in Section 5.13.

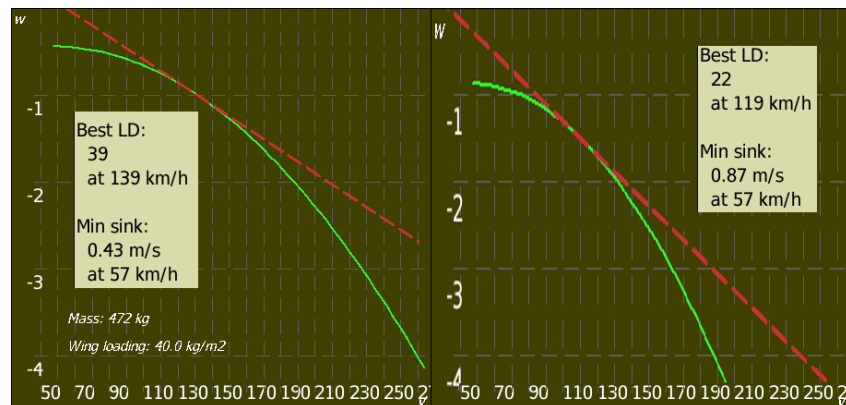
5.3 Glide polar

11.10

The glide polar specifications of a wide selection of glider types, representing major classes of gliders, are built into XCSoar. If your glider type is not listed, these may be used as an approximation for 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 (left side), the glider performs as a clean glider, and at 50% bugs value (right side), the glider's sink rate is doubled when compared to a clean glider.



Knowing all this, a meaningful setting for a worst-case bug polluted wing could scale down the polar by 30% to 70%. Last not least this setting is a bit of trial and error, because gliders performance suffer not the same way from type to type.

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 the analysis dialog as described later in this chapter.

5.4 Flight setup dialog

Use the flight settings dialog to modify the all up weight of the glider both before and during flight, as well as to set the QNH pressure.

This is accessed via the menu under

Config ▸ Flight Setup

Flight Setup	
Close	Dump
Ballast	0%
Volume	0 l
Wing loading	43.7 kg/m ²
Clean	100%
QNH	1013.2hPa
Altitude	0 m
Max Temp	14 °C

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.

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.

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.

The maximum forecast ground temperature is used by the convection forecast algorithm (see Section 6.9) in its determination of estimated convection height and cloud base.



It is possible to configure XCSoar to display the basic settings dialog when it starts up.

On system startup, after the GPS has acquired lock, and if a barometric altitude source is connected (e.g. Vega, AltairPro, 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.

5.5 Speed command display

When used in conjunction with an intelligent variometer that produces indicated airspeed measurements, a speed command chevron is drawn on the right side of the map display. If the glider is flying slower than the optimal speed, the chevrons are red and point downwards. If the glider is flying faster than the optimal speed, the chevrons are green and point upwards. If the speed is approximately optimal, no chevrons are drawn.

Depending on the configuration, speed command chevrons can be displayed on the right side of the map area, or on the variometer gauge.

5.6 Speed to fly

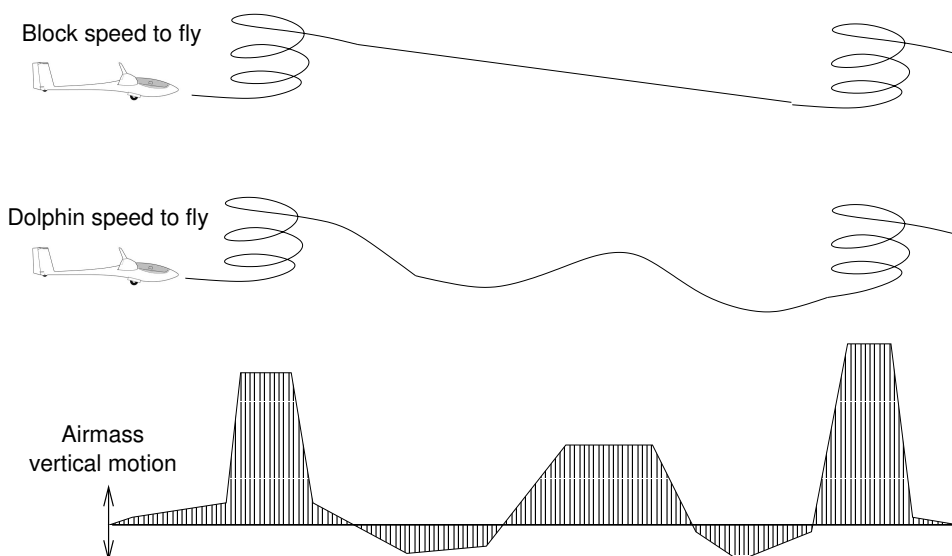
XCSoar continuously calculates two types of speed to fly:

MacCready speed : This is the best speed to fly during cruise in still air, adjusted for wind if in final glide mode.

Dolphin speed : This is the instantaneous, best speed to fly in rising or descending 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 Section 11.8) 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.

5.7 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.

Many pilots typically wind down the MC as they get low — this feature performs this automatically. 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.

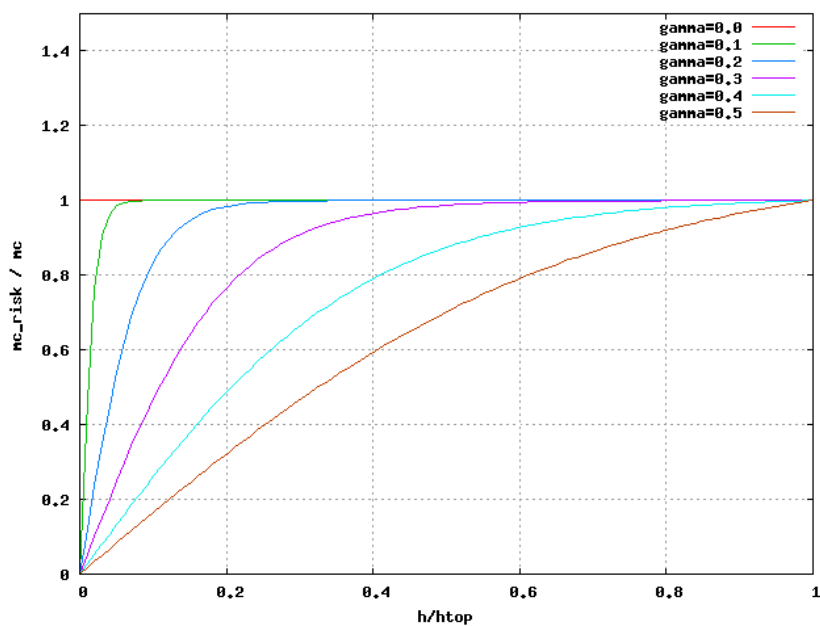
<http://faculty.chicagogsb.edu/john.cochrane/research/Papers/newmcred.pdf>

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.



5.8 Safety heights

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

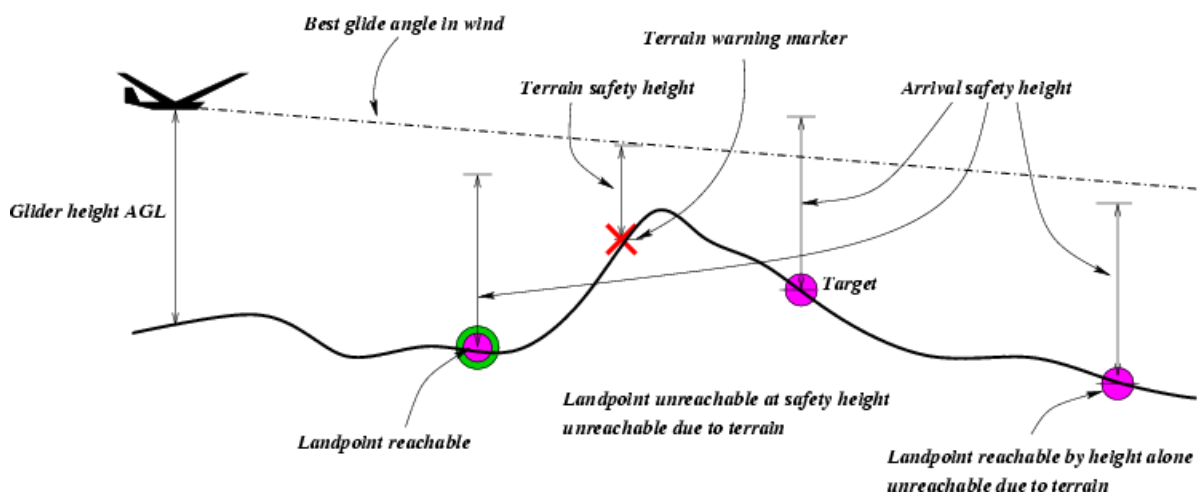
The safety heights are:

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 referenced in the manual.



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, or if no height is specified in the waypoint file, from the terrain file.

The estimated arrival altitude displayed next to landable waypoints is calculated for best glide angle at zero MacCready ring setting ($MC=0$), adjusted for wind.

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.

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.

5.9 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.

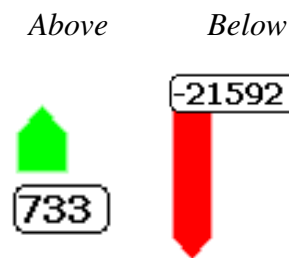
The height required is adjusted for energy height, compensating for the fact that the kinetic energy of the glider can be converted to height (potential energy). The kinetic energy that is convertible to height is calculated from the difference in the true airspeed to

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.

5.10 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. If, however, there are landable waypoints within glide range, but the glider is below the minimum height required to complete the task, the bar is coloured amber.



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.

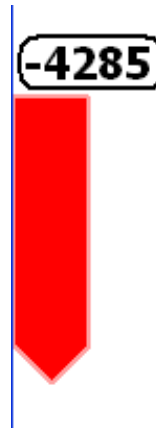
In this situation, if the glider is climbing, the pilot can assess whether to leave the thermal early and commence a final glide descent at a reduced MacCready setting; or continue to climb. It is useful to switch on the auto MacCready setting as this will automatically adjust the MacCready value to 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.



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



For assigned area tasks at the same time a new task time estimation is calculated the target position is optimised. For each variable target set to “auto” can XCSoar tweak the position so that the AAT will be completed not more than five minutes after the given task time.

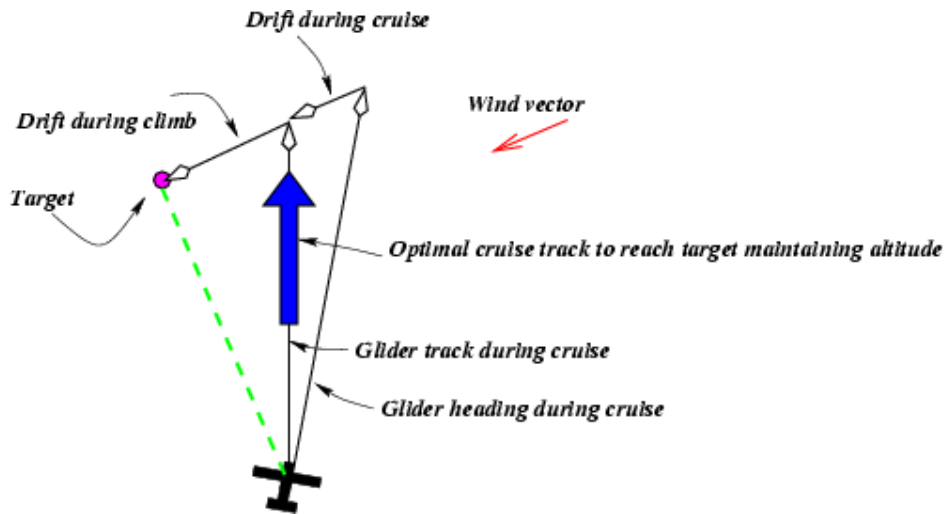
In addition, a measure called *achieved MacCready* is calculated. This is computed by finding the MacCready setting that under classical MacCready flight would produce the same task speed as has been achieved. This value is higher than the actual MacCready setting when the glider has climbed faster than 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.

5.12 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. For example, if the display is oriented 'Track-Up', then steer so the blue arrow points directly up.

The glide computer accounts for wind drift during circling to provide an 'optimal cruise track' vector, which indicates the track the glider should follow during cruise such that it will arrive at the waypoint in minimum time. This vector is displayed on the map as a blue arrow. 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.

5.13 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.

Trending Average climb : When not in final glide, MacCready is adjusted to the trending average climb rate based on 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 dialog as the field “Auto MC Mode”. The default setting is “Both”.

To enable/disable Auto MacCready, use the menu

Config > **MC Auto**

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.

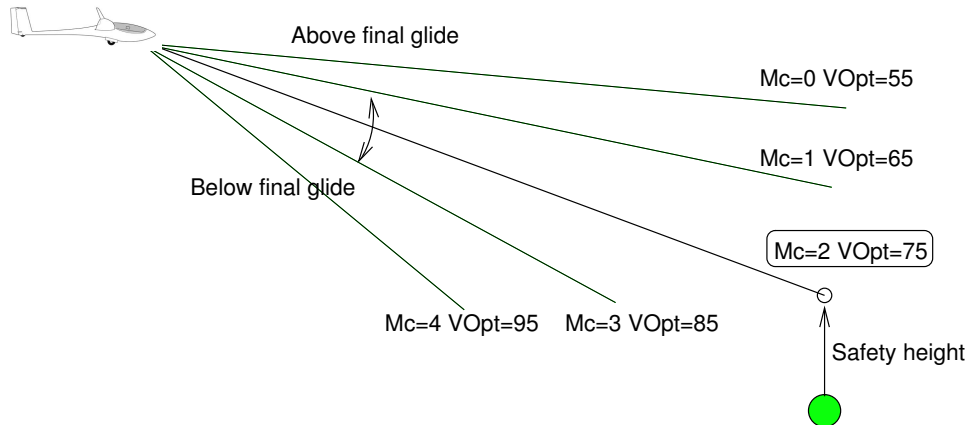
Final glide

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 may 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.

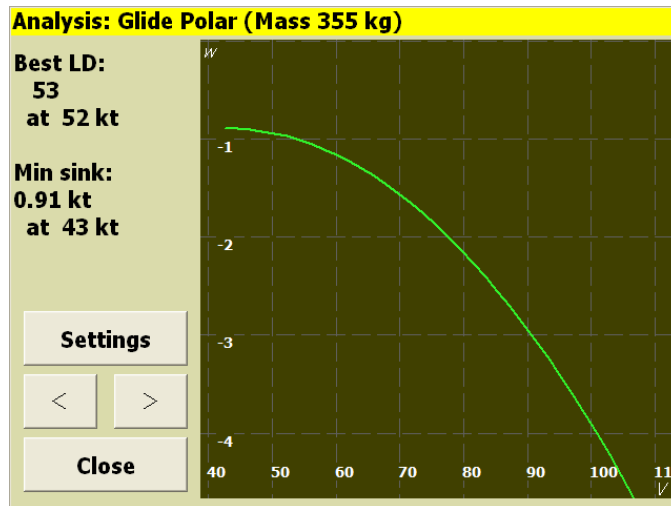
As a result of these limitations, the pilot should be aware of how the system operates and adjust his decision-making accordingly.

5.14 Analysis dialog

The analysis dialog can be used to check the glide polar. This is accessed via the menu

Info ▷ Analysis

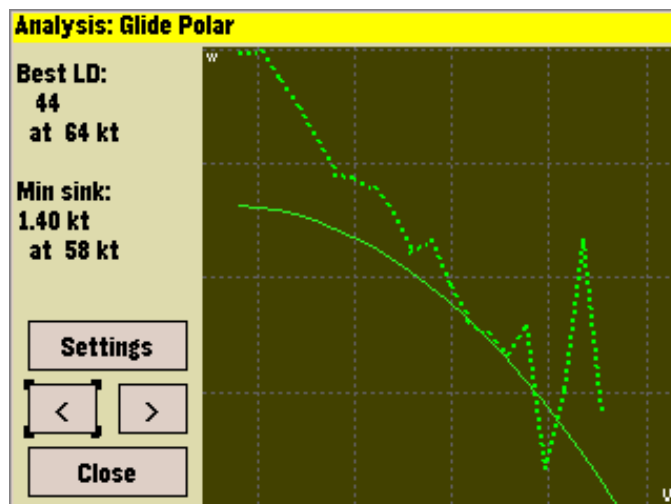
The polar page shows a graph of the glide polar at the current bugs and ballast setting. It also shows the calculated best LD and the speed at which it occurs, and the minimum sink and the speed at which it occurs. The current aircraft all up weight is displayed in the title.



In this dialog page, the ‘Settings’ button opens the flight settings dialog (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.



5.15 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
- Transition to above/below final glide

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 Pocket PC 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

(Landscape display mode only)

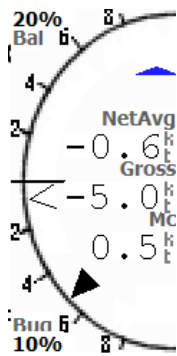
A needle-dial style display shows the variometer measurements. The gross variometer reading drives the main arrow on the dial, and in the center of the dial the instantaneous measurement is shown as text. Additionally, speed command arrows (chevrons) appear above or below the gross variometer measurement. 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 (caret). The vario gauge is customisable as to what is displayed along with the gross value etc.

When an intelligent variometer is connected to XCSoar, the needle displays data from the instrument; otherwise it 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.



11.16 

A list of supported variometers is maintained in Section 8.7.

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

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 for display, and to colour the snail 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.

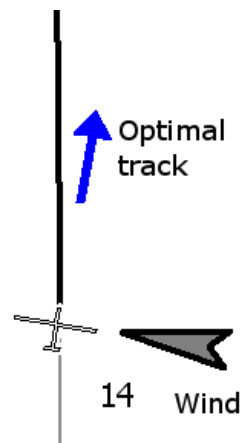
Air density : Used for calculating true airspeed from indicated airspeed.

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.



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 the wind settings dialog (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.

For PC and Pocket PC with touchscreens, you can also do this by highlighting the wind InfoBox and using the cursor keys (up and down increase and decrease the magnitude, left and right rotate the wind direction).

11.8

The configuration settings dialog allows control of which estimation method is used for wind updates, via the field 'Auto Wind':

- 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 manoeuvre. No specific manoeuvre 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 manoeuvring.

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

The wind dialog allows the initial estimate of the wind speed and direction to be entered, usually prior to flight.

This is accessed via the menu under:

Config > Wind

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

The automatic wind algorithm may also be switched on or off (or between modes) in this dialog. See Section 6.4 for details on these algorithms.

The compensation of wind drift of the snail trail can also be switched on or off in this dialog. See Section 3.8 for details on how this affects the display of the snail trail.

6.6 Thermal profile



Statistics on climb rates in thermals are collected and displayed in a thermal band meter. This is shown above the final glide difference bar on the left side of the map display. It is not shown when the glider is above final glide.

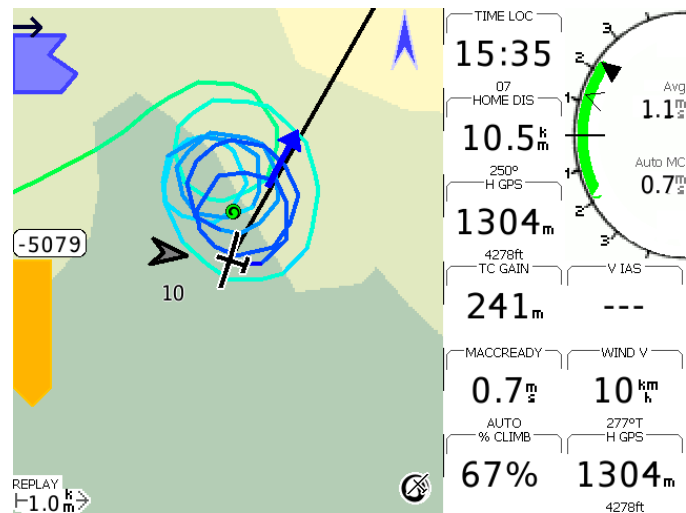
The thermal band meter shows a graph, where the vertical axis is height above the break-off height (Section 5.8), and is scaled according to the maximum height achieved. The horizontal axis is the average climb rate achieved at a particular height band. The horizontal axis is scaled according to the 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.

6.7 Thermal locator

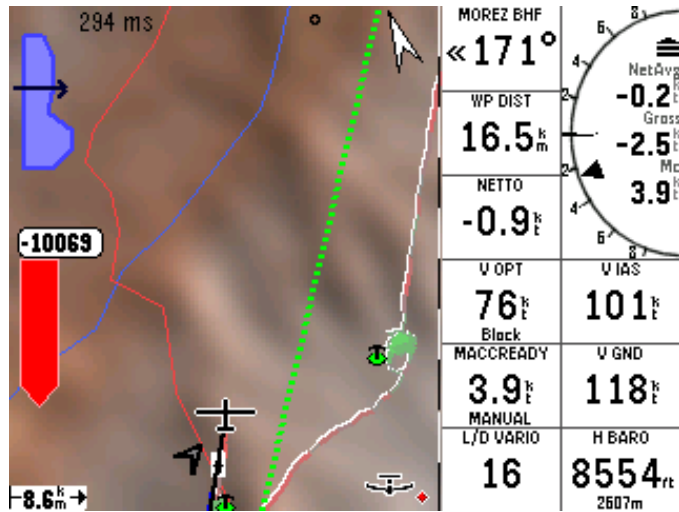
An algorithm estimates the center of the lift when circling. The thermal marker symbol is a green circle with a spiral.




The thermal locator marks the location of the last 20 thermals on the map with the thermal symbol 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.

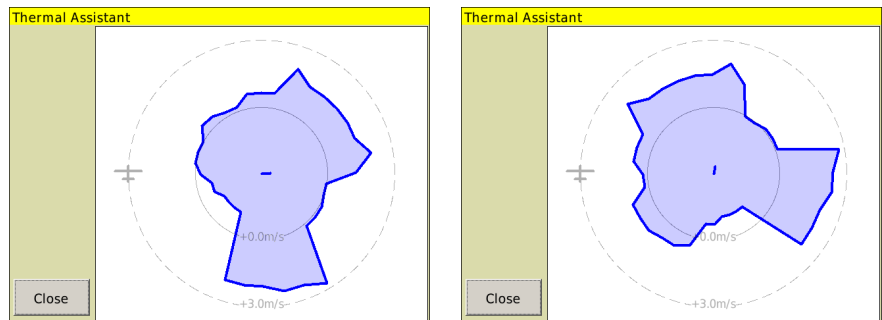


6.8 Thermal assistant

11.16 

The thermal assistant is a graphical aid to maximise the exploitation of the given thermal updraft. If it is configured “On” the small polar digram is mapped to the lower left corner of the screen. A single tap on the small digram enlarges it to a full-screen view.

The polar diagram shows the climb rate over the circular course of the glider. The screen-shots show a right circle, where the glider position is fixed to the left side, and the polar distribution of the climb rate is shown relatively to the current glider position.



The two screen-shots are taken in a few seconds sequence to demonstrate the practical usage of the rotating climb diagram. A simple recipe to optimise the climb rate according to the assistant would be to follow these two steps repeatedly:

1. : At the moment the maximum peak on the polar diagram passes the top of the display; that is a quarter of the circle before you reach that part again: Open the circle a bit to displace the circle center in the direction of the strongest climb rate.

2. : At the moment the maximum peak on the polar diagram passes the gliders position; the vario should show the maximal climb rate: Narrow the circle as much as possible to center the thermal updraft at its maximum.

It must be said, that the interpretation of the thermal assistant always relays on the specific lag of the connected sensor and PDA itself. A successful updraft optimisation will thus depend on a bit training to take the lag into account.

6.9 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 the “Forecast Temperature” InfoBox.

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 maximum forecast temperature on the ground is entered using the flight settings dialog described in Section 5.4.

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.

6.10 Analysis dialog

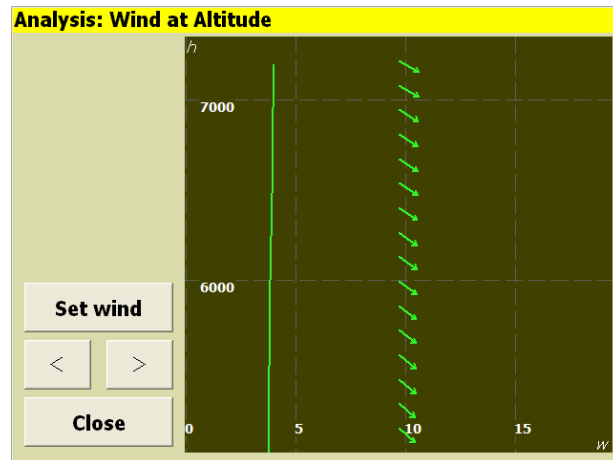
The analysis dialog is used to see several aspects of the atmosphere. This is accessed via the menu under:

Info ▷ Analysis

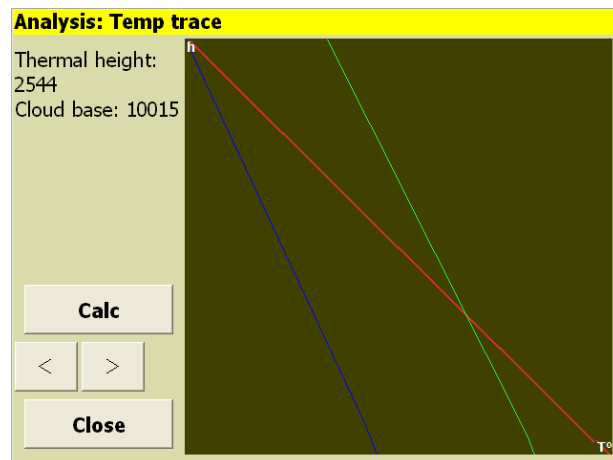
Several pages of interest:

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

The 'Set wind' button opens the wind settings dialog (e.g. to manually set the wind).



Temperature 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.



The climb history and barograph pages, described in Section 4.15, are also useful to determine trends in the soaring conditions.

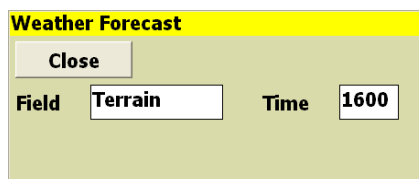
6.11 Weather forecast

Weather forecasts, typically generated from RASP (Regional Atmospheric Soaring Prediction) forecasts, may be overlaid on the map. The user must install a 'xcsoar-rasp.dat' file, prepared by a RASP provider, into the XCSoarData directory for this function to be available.

This section of the documentation is intended to describe the basic functionality; the reader is referred to the RASP website www.drjack.info for more details on how RASP forecasts work, from where they are available, and their use and limitations.

The forecast overlays are accessed by the weather dialog. This is performed by selecting the menu:

Info > Info > Weather



The Field setting determines which data field is displayed on the map. The Time setting determines at which forecast time the data field will be displayed. Upon entering the weather dialog, the Time setting is advanced to the next nearest forecast time available in the RASP file.

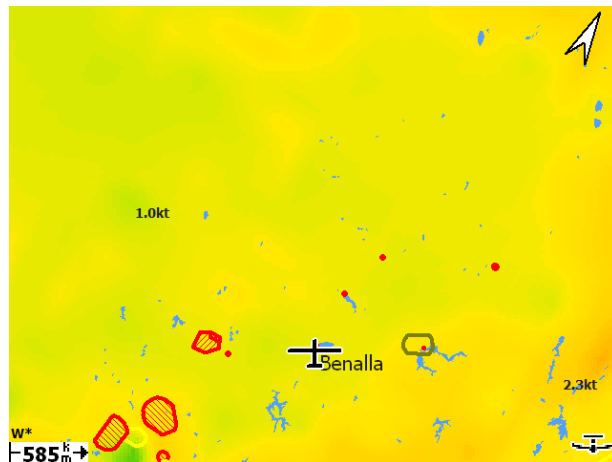
When a field is not available in the RASP file, the background is left blank.

The maximum and minimum values of the field in the map area are drawn at their respective locations on the map. The field name is displayed on the lower left of the screen.

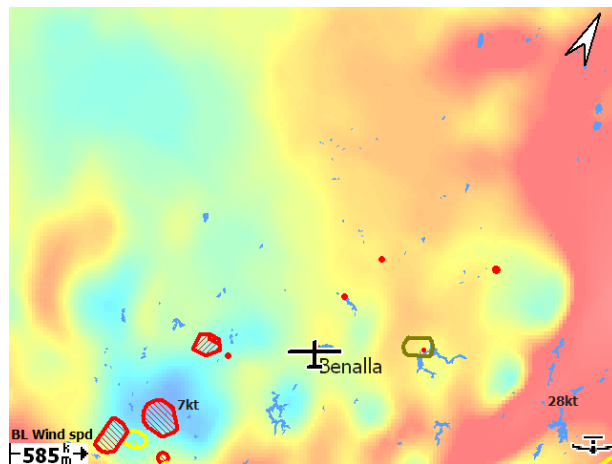
The fields available to display are as follows:

Terrain : Display terrain on map, no weather data displayed.

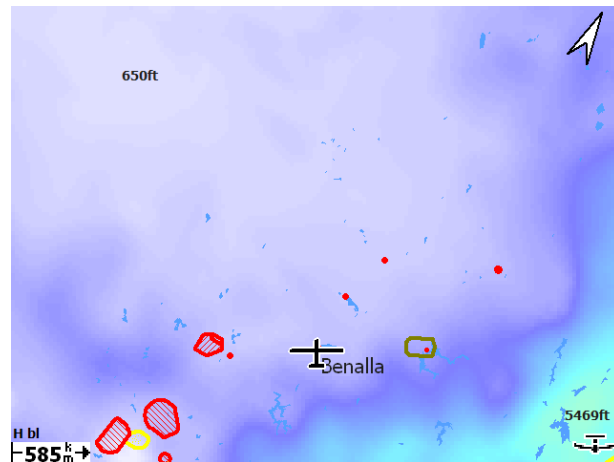
W* : Average dry thermal updraft strength near mid-BL height. Subtract glider descent rate to get average vario reading for cloudless thermals. Updraft strengths will be stronger than this forecast if convective clouds are present, since cloud condensation adds buoyancy aloft (i.e. this neglects “cloud-suck”). This value depends upon both the surface heating and the BL depth.



BL wind spd : The speed and direction of the vector-averaged wind in the BL. This prediction can be misleading if there is a large change in wind direction through the BL.

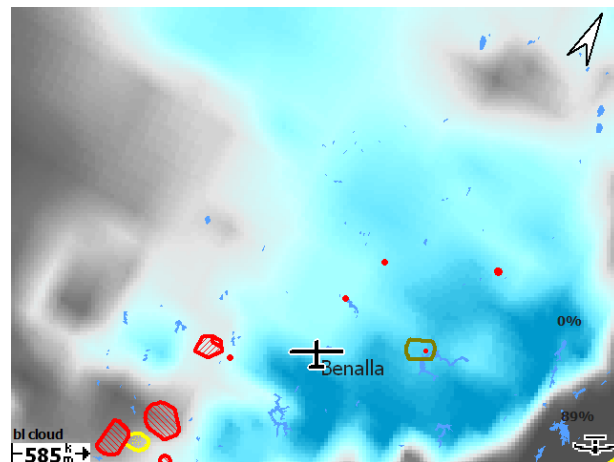


H bl : Height of the top of the mixing layer, which for thermal convection is the average top of a dry thermal. Over flat terrain, maximum thermalling heights will be lower due to the glider descent rate and other factors. In the presence of clouds (which release additional buoyancy aloft, creating “cloudsuck”) the updraft top will be above this forecast, but the maximum thermalling height will then be limited by the cloud base. Further, when the mixing results from shear turbulence rather than thermal mixing this parameter is not useful for glider flying.



dwcrit : This parameter estimates the height above ground at which the average dry updraft strength drops below 225 fpm and is expected to give better quantitative numbers for the maximum cloudless thermalling height than the BL Top height, especially when mixing results from vertical wind shear rather than thermals. (Note: the present assumptions tend to underpredict the max. thermalling height for dry conditions.) In the presence of clouds the maximum thermalling height may instead be limited by the cloud base. Being for “dry” thermals, this parameter omits the effect of “cloudsuck”.

bl cloud : This parameter provides an additional means of evaluating the formation of clouds within the BL and might be used either in conjunction with or instead of the other cloud prediction parameters. It assumes a very simple relationship between cloud cover percentage and the maximum relative humidity within the BL. The cloud base height is not predicted, but is expected to be below the BL Top height.



Sfc temp : The temperature at a height of 2m above ground level. This can be compared to observed surface temperatures as an

indication of model simulation accuracy; e.g. if observed surface temperatures are significantly below those forecast, then soaring conditions will be poorer than forecast.

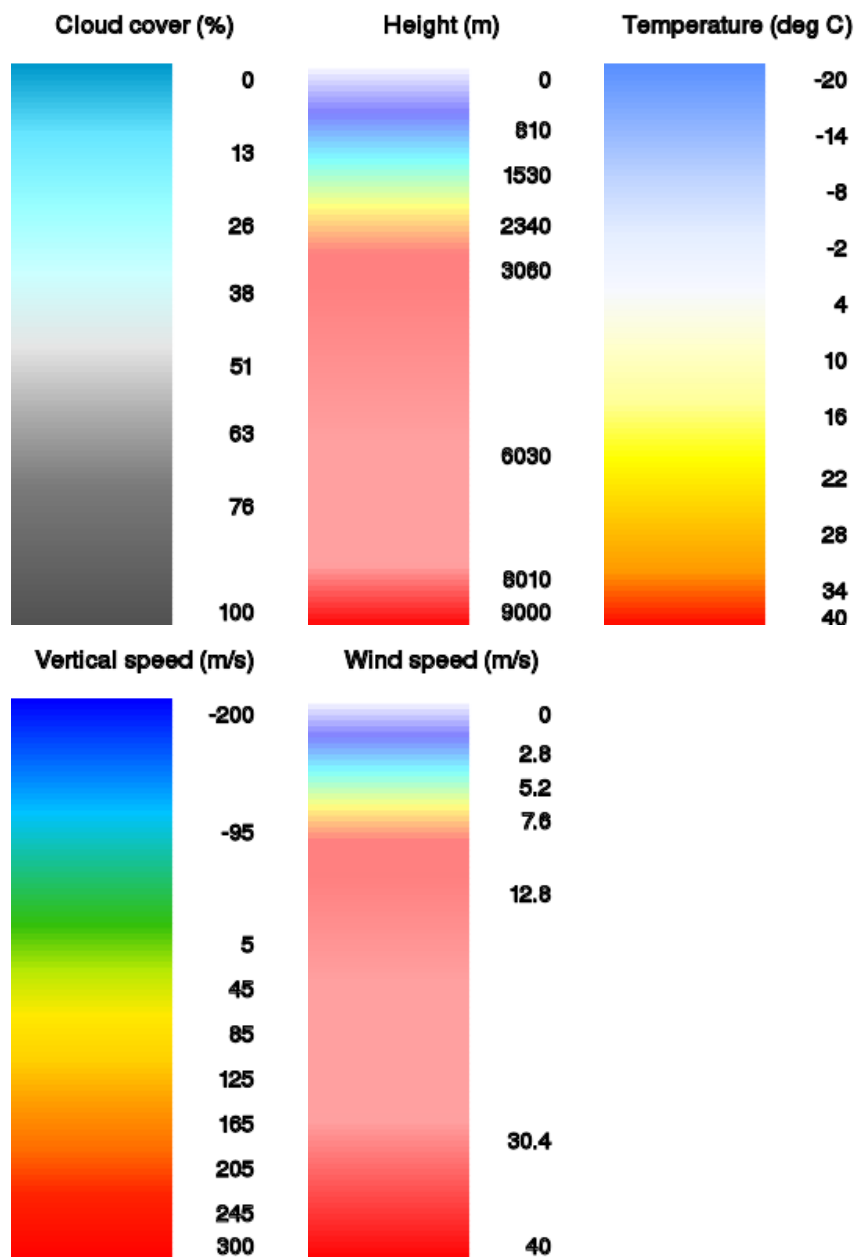
hwcrit : This parameter estimates the height at which the average dry updraft strength drops below 225 fpm and is expected to give better quantitative numbers for the maximum cloudless thermalling height than the BL Top height, especially when mixing results from vertical wind shear rather than thermals. (Note: the present assumptions tend to underpredict the max. thermalling height for dry conditions.) In the presence of clouds the maximum thermalling height may instead be limited by the cloud base. Being for “dry” thermals, this parameter omits the effect of “cloudsuck”.

wblmaxmin : Maximum grid-area-averaged extensive upward or downward motion within the BL as created by horizontal wind convergence. Positive convergence is associated with local small-scale convergence lines. Negative convergence (divergence) produces subsiding vertical motion, creating low-level inversions which limit thermalling heights.

8: describe

base :

The colour schemes used in rendering the RASP contours are illustrated in the table below.



7 Airspace, Traffic and Team Flying

A database of Special Use Airspace (SUA) can be loaded into XC-Soar 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. 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.

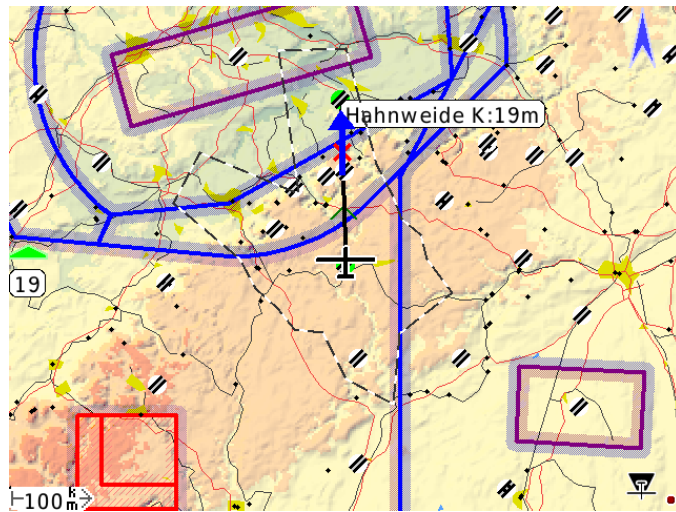
It is the user's responsibility to ensure that the SUA database (airspace file) is up-to-date.

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 all airspaces, only airspaces below a certain altitude, only airspace within a particular height separation, or only airspace below the glider.



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 Section 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

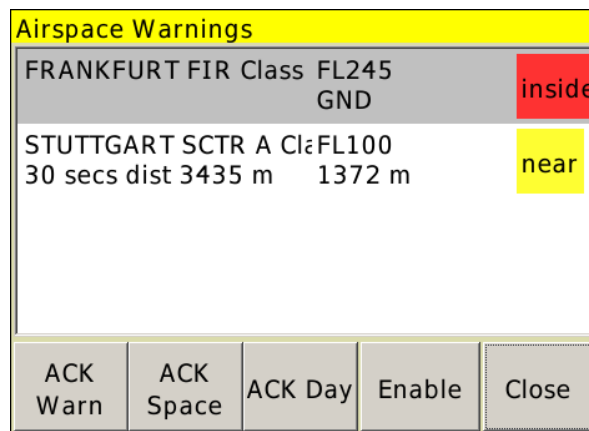
The concept of airspace warning levels is introduced:

- 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 from Altair or the PDA. When there are no more airspace regions at warning levels above 0, the dialog disappears automatically.



7.4 Airspace warning dialog

The airspace warning dialog contains a list of up to 4 individual warnings. The list item backgrounds are coloured RED if the glider is inside, and YELLOW if near. If the warning is acknowledged, the text is greyed out.

Each list item occupies two rows, and includes the following details:

```
<NAME>                <TOP>   <Inside>
<distance if outside> <BASE>
```

The values in the list are continuously updated.

An example follows:

```
Bern TMA Class D      FL100      near
dist 1300              1750m
```

This means that the aircraft is 1300m horizontally separated from the Class D airspace 'Bern TMA', with a base of 1750m and ceiling at FL100.

Another example:

```
Bern CTRgld Class C 1350m      inside
                        SFC
```

This means that the aircraft is inside the Class C airspace 'Bern CTRgld', with base of terrain surface and ceiling at 1350m.

At any time, the airspace warning dialog can be opened by selecting the menu:

```
Info ▸ Nearest Airspace
```

If there were airspace warnings and you are not well outside all airspace, this menu item redisplay the dialog with the list of airspace warnings.

7.5 Airspace warning acknowledgement

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

When one or more warnings are visible in the airspace warning dialog, a warning can be acknowledged by pressing one of the buttons along the bottom of the dialog. When the list contains

more than one airspace warning, the rotary button on Altair (or cursor on PDA) can be used to select one for acknowledgement.

The meanings of the acknowledgement buttons are as follows:

- ACK Warn : Acknowledge the current warning level. A new warning will appear only if the warning level increases. (Key F5 on Altair)
- ACK Space : Acknowledge all current and future warning levels from this particular airspace region while the aircraft is within 2.5km horizontal separation and 500m vertical separation. (Key F6 on Altair)
- ACK Day : Acknowledge all current and future warning levels from this particular airspace region for the rest of the flight (specifically, until Altair/XCSoar is restarted). (Key F7 on Altair)
- Enable : Cancels an acknowledgement of the airspace, to reactivate all warnings from this space. (Key F8 on Altair)
- Close : Closes the airspace warning dialog, without acknowledging airspace. The dialog will re-open automatically if the airspace warning level increases.

The general guidelines for using the dialog are:

- Don't acknowledge a warning if you intend to or must avoid the airspace
- 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 an 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).

Acknowledged warnings will repeat after a certain time specified as the 'airspace repeat time' in 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 ‘acknowledgement time’.

Airspace warnings are automatically cleared when both the current glider’s position as well as the predicted advance position are clear of the airspace.

Simultaneous airspace warnings can occur if the aircraft (or its predicted future position) penetrates multiple airspace regions.

7.6 Airspace queries

For touchscreen/mouse devices, when an airspace region is visible on the map area, it may be queried by touching the region on the map. This brings up a status message containing similar SUA details as is provided when an actual warning is raised. Touching the status message or pressing the enter key makes the message disappear (that is, it acknowledges the query). The query returns the details of all airspace regions when overlapping airspace is visible at the query location.

Through the button menus, there is another way of querying airspace. The ‘Nearest Airspace’ query brings up a status message containing SUA details of the nearest airspace region.

Info ▷ Nearest airspace

verify range

This returns at most a single airspace region. The search is limited to 100 km range.

If the glider is outside the airspace, it also describes the distance and bearing to the nearest point on the airspace perimeter to the glider. If the glider is inside the airspace, it also describes the distance and bearing to the nearest exit.

7.7 Airspace filter dialog

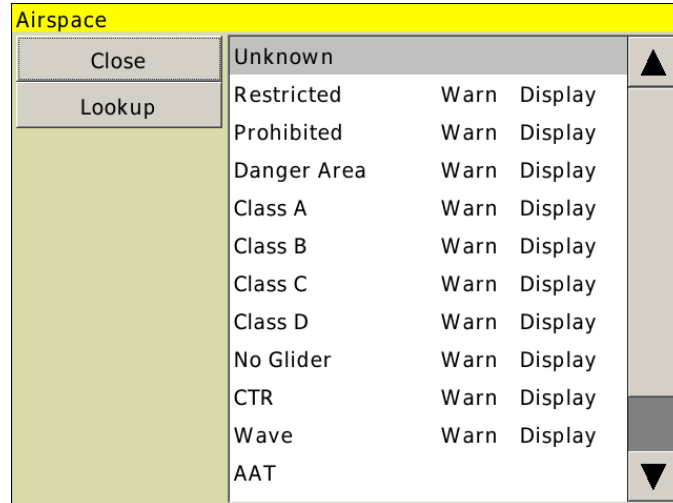
The Airspace Filter dialog allows warnings and display to be enabled or disabled for each class of airspace.

This may be accessed several ways:

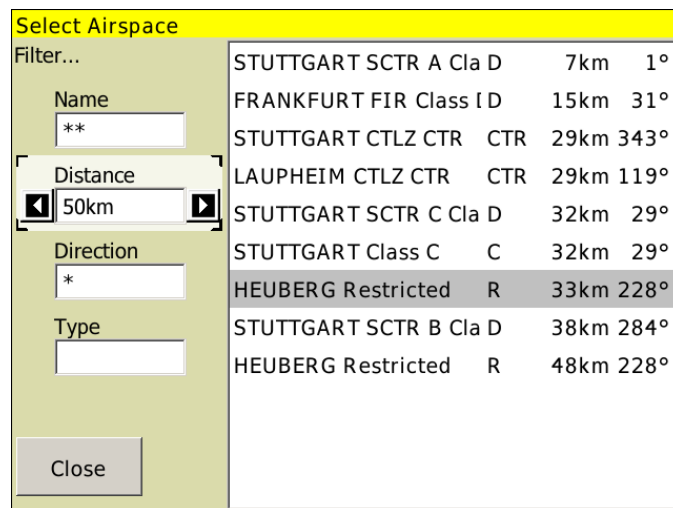
- From the menu **Config** ▷ **Config** ▷ **Settings Airspace**

- From the configuration dialog, menu under **Config** > **Config** > **Setup System** then in the Airspace page, select the button **Filter**

To use the dialog, move up or down the list and the enter key will cycle between the various warning and display options.



Pressing the “Lookup” button brings up the airspace select dialog. This functions similarly to the waypoint lookup dialog, and allows search based on name, distance, direction, and type (class).



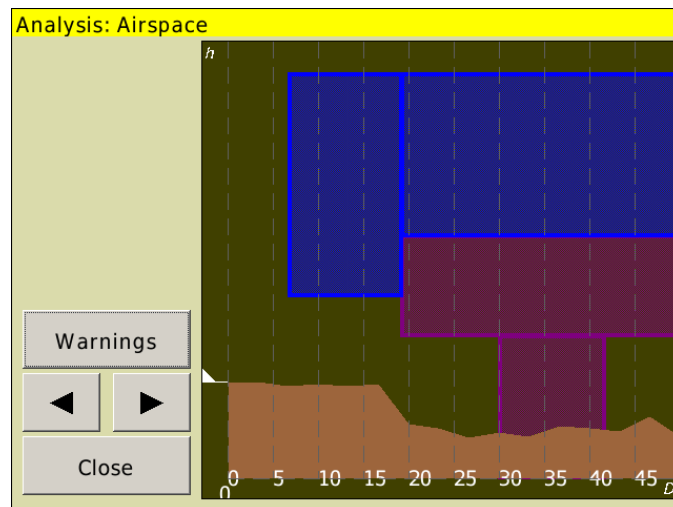
Once an airspace item has been located, selecting it will add it to the airspace management system as acknowledged for the day. From the airspace management dialog it is possible to re-enable it again.

7.8 Analysis dialog

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

Info ▷ Analysis

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.



The “Warnings” button opens the airspace warning dialog if close to airspace.

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 circles and have coloured arrow heads to indicate the direction the FLARM target is

11.5 

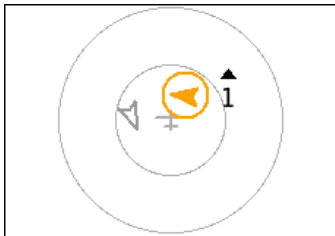
heading, as well as the collision risk. Note that these arrow heads are oriented according to the display orientation. For example, if the orientation is track-up, then the arrows show the relative track bearing of the target to the aircraft. If the orientation is north-up, then the arrows show the absolute 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 Section 12.17 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. FLARM traffic is displayed in identical style.



This FLARM display is oriented track-up and a small glider icon clearly shows that the display is oriented as such. The scale of the display is linear up to maximum distance of 2000 meters. On the background there are two rings; the first is 1000 meters and the second is 2000 meters. Traffic further away than 2000 meters is drawn at the 2000 meter ring.

All the FLARM displays shows FLARM traffic in colours according to the threat level, or team and dialog status. The traffic is coloured:

- No color for level 0, no threat.
- Yellow for level 1, warning.
- Red for level 2 and 3, alert.
- Green for the team mate.
- Blue is the selected target.


For every target above threat level 1 the rough relative height is shown. The supplied figure is the absolute height difference rounded by 100. A small triangle indicates that the target is higher or lower

than you. The example radar shows a target approximately 100 meter (for metric altitude) higher.

The FLARM radar-like display, when enabled, can be suppressed when visible by pressing the enter button (rotary knob on Altair). 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, 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.

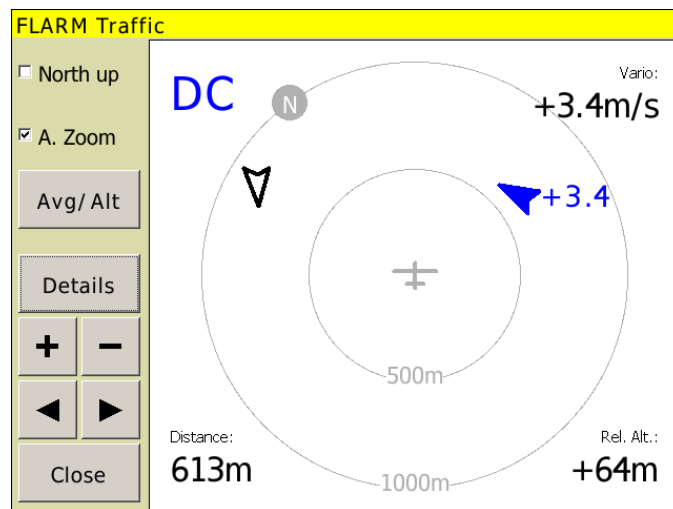
FLARM Traffic dialog

11.16 

Once FLARM has reported traffic and the small radar-style view of the FLARM traffic gets activated you can tap on the FLARM radar to enlarge the view to fullscreen size. This is also accessed via the menu under


Info > Info > Info > FLARM Radar

The fullscreen FLARM display offers all available information about the FLARM traffic and depending on the setup it closes by itself, when all traffic has been gone.







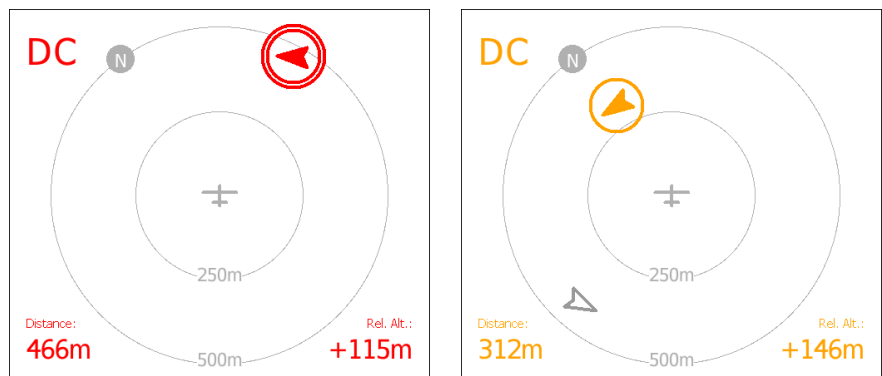
Only a few controls are on the dialog, from top down:

North up : If checked the radar screen is oriented North up, if not the orientation is Track up.

Up - Down  A. Zoom : Automatic zoom scales the radar screen so that the targets

are perfectly visible. If not checked, the screen must be zoomed manually. The Up-Down gesture activates the automatic zoom.

- Right - Left*  Avg/Alt : The button toggles in-between average vario and altitude displayed next to the target.
- Down - Right*  Details : Through the button a separate dialog with all details to the selected target is accessed.
- Up/Down*  +/- : Manually change the zoom from 500 meter to 10000 meter radar range. The zoom gestures also apply here.
- Left/Right*  </> : Select the previous or next target on the radar, gestures work in the same manner.



The three screenshots are taken in a sequence and demonstrate a typical near pass of e.g. two FLARM equipped gliders. The extra information is colour-coded in the already mentioned way. In the four corners of the radar screen is additional info to the selected target displayed:

- Top left : If available the FLARM Id of the selected target.
- Top right : Vario of the target, derived from the consecutive altitude messages.
- Bottom left : The distance to the target.
- Bottom right : The relative height of the target.

From the first to the second FLARM snapshot were passed about 15 seconds. The selected blue target was climbing with 3.4 m/s and had a not as threat recognised course relation. Then in the mean time the “DC” has turned more to the left, became an alerting threat and gets now displayed red. The FLARM radar switched the zoom from 1000 meter to 500 meter. In snapshot three the continuously climbing target becomes classified to thread level 1, gets yellow coloured and seems to no longer a threat.

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.

Support for encrypted team codes will be provided in the future.

To use team code, all pilots in the team should select a waypoint to be used as the reference. This is done via selecting a waypoint from the Waypoint lookup dialog and then pressing the ‘Set team-code’ button in the waypoint details page.

The teamcode dialog is accessed via the menu:

Info ▷ Info ▷ Team Code

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 presses the **Set Mate code** button to open the text entry dialog to allow entry of the mate’s code.

The screenshot shows a dialog box titled "Team code" with a yellow header. Inside, there are several input fields with labels and values: "Own code:" (FZ33C), "Mate code:" (empty), "Range:" (400.8 km), "Bearing:" (341°), "Rel. Bearing:" (81°>), and "Flarm lock:" (empty). At the bottom, there are three buttons: "Flarm Lock", "Set Mate code", and "Close".

After entering the mate’s code, the relative distance and bearing to the mate is calculated and updated in the dialog.

The **Flarm lock** button access the flarm net database. A simple but ambiguous lookup for an competition id delivers an flarm id, which allows you to “lock” your flarm mate from the far.

8 Avionics and Airframe

This chapter 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 Chapter 7, and integration with variometers is covered in Chapter 6.

8.1 Battery life

Most modern PDAs are designed for short sporadic use and so do not have a very good battery capacity when considering the duration of cross-country soaring flights. It is recommended to power the PDA externally, via a transformer connected to the glider battery. This installation should be performed by appropriately qualified personnel, and should contain a fuse and a manual isolation switch.

The greatest cause of power drain by the PDA is the LCD back-light, however domestic PDAs are not particularly bright so they may need to have the back-light up full. However, for EFIS systems such as Altair, it is recommended to use the lowest back-light settings that are comfortable.

When operating PDAs under internal battery, XCSoar detects a low battery condition and allows the operating system to shut down and preserve the memory. In addition, it can be set up to blank the screen after a period of inactivity, so that it can reduce the power consumption. When the screen is blanked, pressing one of the hardware buttons on the PDA activates the screen again. When a status message is issued by the system, the screen becomes activated.

Another way to help conserve battery power is to reduce the computational load by turning off certain features. Drawing terrain and long snail trails contribute significantly to the CPU load.

For Altair/Vega systems, the external supply voltage is displayed on the system status dialog (see Section 8.11).

8.2 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.

8.3 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 on to the PDA or EFIS as special NMEA sentences.
- 1-Wire device : triadis engineering's Altair glide computer and Vega variometer provide a 1-Wire peripheral bus to which various digital and analog sensors can be attached.

Bluetooth device : Many Pocket PC devices support wireless connection to a Bluetooth Game-Pad device that has several buttons. This is more suited to user-interface input devices than airframe monitoring.

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/landing flap, neutral, negative/reflex)
- Landing gear

This set is expected to expand to include engine and fuel monitoring.

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”.

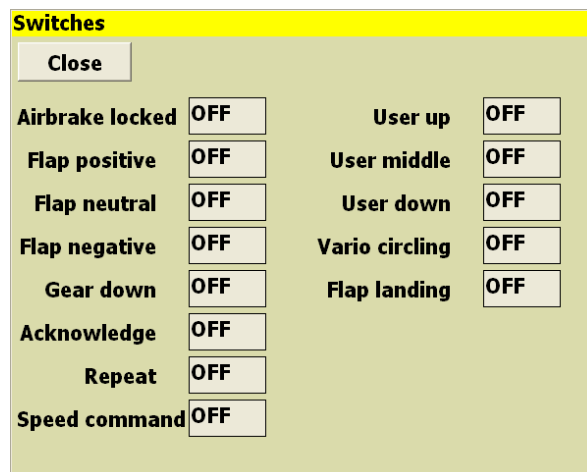
Refer to the Vega documentation and *XCSoar Advanced Configuration Manual* for more details on switch inputs and how they may be used.

8.4 Switch dialog

A dialog displaying switch states for the Vega variometer is available from the menu:



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



8.5 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.

8.6 Mobile telephones

The capability for XCSoar to send and receive position updates and other data (such as weather/task updates) in flight via SMS messages on the GSM mobile phone network has been demonstrated in July 2005. This used a standard consumer mobile telephone over a Bluetooth connection; the same code can be used for similar communications via a serial connection to a GSM or CDMA modem. This code requires further development before being integrated into public releases of the software.

Applications of this technology include:

- Tracking of gliders from the home base for spectator displays
- Automatic broadcast of last known position when outlanding to home base and retrieve crews
- Team flying, and to assist lead and follow training

8.7 Supported variometers

Currently XCSoar supports inputs from triadis Engineering Vega intelligent variometer, TR-DVS digital voice system, the Cambridge Aero Instruments 302 (and 302A) DDV and GPSNAV, Borgelt B50/B500, LX Navigation LX1600 variometers, Zander variometers, ILEC SN10 variometer, Tasman Instruments variometer, Flymaster F1, Flytec, and Leonardo.

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.

8.8 Other avionics devices

Support for other instruments, such as a magnetic compass or Attitude Heading Reference System (artificial horizon), may be implemented in the future. Make a request to the XCSoar developers if you are interested in support for other instruments.

Support for the Honeywell Digital Compass HMR3000 is under development.

8.9 Slave mode

A device type in the configuration settings, “NMEA Out” is defined for use in joining two Altair or PDA 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.

As an example where two Altairs are being connected together, 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).

8.10 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. These will be improved in the future.

Volkslogger

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

When the **Declare** button is pressed in the task editor, the current task, and 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!

The support for synchronising the waypoint database between XCSoar and the Volkslogger will be improved in the future.

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 the **Declare** button is pressed in the task editor, the current task, will be uploaded to the Volkslogger.

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 the **Declare** button is pressed in the task editor, the current task, and pilot name, aircraft type and competition ID will be uploaded to the CAI 302.

8.11 System status dialog

The system status dialog (see Section 2.4) is used primarily as a systems check, to see how the host computer and connected devices are performing.

This is accessed via the menu under

Info ▷ **Info** ▷ **Status**

and then selecting the page 'System'.

All dynamic values (e.g. battery voltage, number of satellites in view) are updated continuously.

9 Quickstart

This chapter 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

1. Turn on the device.
2. Open the **Flight Setup** dialog and adjust the bugs and ballast as required. Set the maximum forecast temperature. Close the dialog.
3. Open the **Task Edit** dialog, and create a blank task by pressing **New**.
4. Select "Touring" as task type.
5. Once the task is created, move the cursor to the "add waypoint" item and press enter. Select the start waypoint from the list, e.g. first item is the home base, and press enter. Press close or escape.
6. Select another one "add waypoint", and enter the same waypoint as finish point.
7. Now the task contains one waypoint to home.

In-flight

1. At the appropriate times, set the MacCready manually from the menu, task calculator or from the variometer.
2. Change the bugs/ballast settings as required.
3. At any time, the glider can reach home when the altitude difference bar is a green arrow pointing upwards.
4. Optionally, activate **MC 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

1. The **Status** dialog shows the elapsed flight time.
2. The analysis dialog can be used to analyse or review the flight.
3. The IGC logger replay can be used to replay the flight.
4. 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

1. Turn on the device.
2. Open the **Flight Setup** dialog and adjust the bugs and ballast as required. Set the maximum forecast temperature. Close the dialog.
3. Open the **Task Edit** dialog, and create a blank task by pressing **New**. Select “FAI triangle” as task type.
4. Move the cursor to the “add waypoint” item and press enter. Set the start and sector type and select the desired waypoint from the list and press enter. Once finished, press close.
5. Move the cursor to the “add waypoint” item again and press enter. Select the waypoint from the list and press enter. This will add the first waypoint to the task.

6. Repeat the procedure for the second waypoint. A good idea to find the right second turn is to filter the waypoint list by bearing (+120) and the proper distance of the triangles edge. The filter references to the first waypoint of our trianlge.
7. Repeat the last step as required for an additional waypoint. The last waypoint is the finish waypoint.
8. The task is now entered. You may declare it and send the task to a connected logger device.

In-flight

1. The current waypoint will advance automatically as the pilot flies through the observation zones.
2. After the task is started, the **Status** dialog can be opened to verify a valid start was detected. “Valid Start” should be tagged as true, The start time can be reviewed, the start height is saved and the min. finish high according given rules is shown.
3. 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.
4. If **Zoom Auto** is activated, the map will automatically zoom in as task waypoints are approached.
5. At the appropriate times, adjust the MacCready by the menu, the task calculator or the connected variometer; or activate **MC 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.
6. Change the bugs/ballast settings as required.
7. Refer to the **Analysis** dialog as required.
8. Refer to the **Status** dialog as required. This shows the start time, elapsed time on task, estimated arrival time, average task speed etc.
9. At any time, when the altitude difference bar is a green arrow pointing upwards the glider can finish the task.

After landing

As described in Section 9.1.

9.3 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

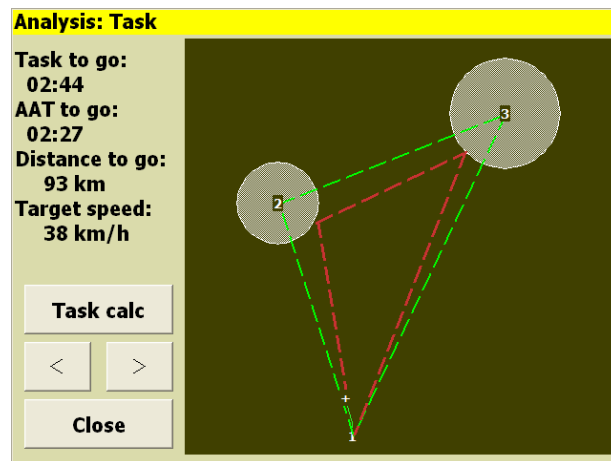
1. Turn on the device.
2. Open the **Flight Setup** dialog and adjust the bugs and ballast as required. Set the maximum forecast temperature. Close the dialog.
3. Open the **Task Edit** dialog, and create a blank task by pressing **New**. Select “AAT” as task type.
4. Once the task is created, move the cursor to the ‘add waypoint’ item and press enter. Add waypoints in the already described way.
5. The AAT requires additional input to the kind and size of the observation zone. Adjust AAT sector parameters for this waypoint and press close or escape.
6. Repeat the last two steps as required for additional waypoints. The last waypoint is the finish waypoint.
7. The AAT task is now entered. Open the **Properties** dialog and set the given task time.
8. The estimated elapsed time to complete the task with different MacCready settings can be explored from the **Task Calc** dialog. Adjusting the MacCready value and see what “AAT Range” setting is suggested by XCSoar.

In-flight

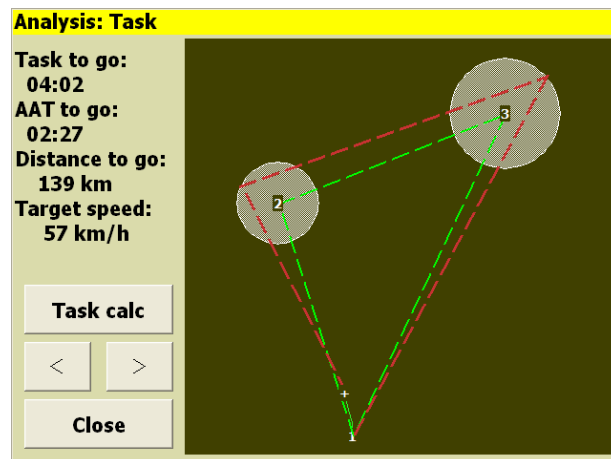
1. When the pilot is ready to start the task, press the **Arm Start** button. The current waypoint will then advance automatically once, as the pilot flies through the start sector. After this occurs, the advance trigger is disarmed.
2. In order to re-start, the pilot needs to manually revert to the **Start Turnpoint** and again press the **Arm Start** button prior to flying through the start sector again.
3. After the task is started, the **Status** dialog 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. Otherwise it will display “INVALID”.

- During flight, the estimated elapsed time to complete the task with different MacCready settings can be explored from the **Task Calc** dialog. Once a decision is made to extend or reduce the AAT range this can be done by manually manipulate the **Target**. This allows the pilot to effectively increase or decrease the task distance and estimate the consequence in AAT time.

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 the **Task Calc** dialog. 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 the **Arm Turn**

button. The current waypoint will then advance automatically once, if the pilot is inside the observation zone. After this occurs, the advance trigger is disarmed.

7. If Auto Zoom is activated, the map will automatically zoom in as task waypoints are approached.
8. At the appropriate times, adjust the MacCready by the menu, the task calculator or the connected variometer; or activate **MC 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.
9. Change the bugs/ballast settings as required.
10. Refer to the **Analysis** dialog as required.
11. Refer to the **Status** dialog as required. This shows the start time, elapsed time on task, estimated arrival time, average task speed etc.

After landing

As described in Section 9.1.

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

H 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. The right/left arrow keys also cause the glider to turn.

Height AGL

H 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

H Gnd

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

Pressure Altitude

H Baro

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

QFE GPS

QFE GPS

This is the height above the home airfield calculated by subtracting the airfield elevation from the altitude reported by the GPS.

10.2 Aircraft state

Bearing

Bearing

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

Speed ground

V Gnd

Ground speed measured by the GPS. If this infobox is active in simulation mode, pressing the up and down arrows adjusts the speed, left and right turns the glider.

Track

Track

Magnetic track reported by the GPS. Touchscreen/PC only: If this infobox is active in simulation mode, pressing the up and down arrows adjusts the track.

Airspeed IAS

V IAS

Indicated Airspeed reported by a supported external intelligent vario.

G load

G

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

Bearing Difference

Brng D

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

V TAS

True Airspeed reported by a supported external intelligent vario.

10.3 Glide ratio

L/D instantaneous

L/D Inst

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 '—'. If this infobox is active, pressing the enter cursor button brings up the bugs and ballast dialog.

L/D cruise

L/D Cru

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

Fin 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 '—'.

Final GR

Fin GR

Geometric gradient to the arrival height above the final waypoint. This is not adjusted for total energy.

Next L/D

WP 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

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 '—'.

L/D Average

L/D Avg

The distance made in the configured period of time, divided by the altitude lost since then. Negative values are shown as ^^ and indicate climbing cruise (height gain). Over 200 of LD the value is shown as +++ . You can configure the period of averaging in the Special config menu. Suggested values for this configuration are 60, 90 or 120: lower values will be closed to LD INST, and higher values will be closed to LD Cruise. Notice that the distance is NOT the straight line between your old and current position: it's exactly the distance you have made even in a zigzag glide. This value is not calculated while circling.

10.4 Variometer

Thermal last 30 sec

TC 30s

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

Last Thermal Average

TL Avg

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

Last Thermal Gain

TL Gain

Total altitude gain/loss in the last thermal.

Last Thermal Time

TL Time

Time spent circling in the last thermal.

Thermal Average

TC Avg

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

Thermal Gain

TC Gain

The altitude gained/lost in the current thermal.

Thermal All

TC All

Time-average climb rate in all thermals.

Vario

Vario

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

Netto Vario

Netto

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 V

Wind speed estimated by XCSoar. Touchscreen/PC only: Manual adjustment is possible by pressing the up/down cursor keys to adjust magnitude and left/right cursor keys to adjust bearing when the infobox is active. Pressing the enter cursor key saves the wind value as the initial value when XCSoar next starts.

Wind Bearing

Wind B

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

OAT

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

Relative Humidity

RelHum

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

Forecast Temperature

MaxTemp

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**

MacCready

The current MacCready setting. This infobox also shows whether MacCready is manual or auto. Touchscreen/PC only: Also used to adjust the MacCready Setting if the infobox is active, by using the up/down cursor keys. Pressing the enter cursor key toggles Auto MacCready mode.

Speed MacCready

V MC

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

% Climb

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

Speed Dolphin

V Opt

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**

WP Dist

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

Next Altitude Difference

WP AltD

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

Next Altitude Arrival

WP AltA

Absolute arrival altitude at the next waypoint in final glide.

Next Altitude Required

WP AltR

Altitude required to reach the next turn point.

Final Altitude Difference

Fin AltD

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

Final Altitude Required

Fin AltR

Altitude required to finish the task.

Speed Task Average

V Task Av

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

Speed Task Instantaneous

V Task Ins

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

Speed Task Achieved

V Tsk Ach

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

Final Distance

Fin Dis

Distance to finish around remaining turn points.

AA Time

AA Time

Assigned Area Task time remaining.

AA Distance Max <input type="text" value="AA Dmax"/>	Assigned Area Task maximum distance possible for remainder of task.
AA Distance Min <input type="text" value="AA Dmin"/>	Assigned Area Task minimum distance possible for remainder of task.
AA Speed Max <input type="text" value="AA Vmax"/>	Assigned Area Task average speed achievable if flying maximum possible distance remaining in minimum AAT time.
AA Speed Min <input type="text" value="AA Vmin"/>	Assigned Area Task average speed achievable if flying minimum possible distance remaining in minimum AAT time.
AA Distance Tgt <input type="text" value="AA Dtgt"/>	Assigned Area Task distance around target points for remainder of task.
AA Speed Tgt <input type="text" value="AA Vtgt"/>	Assigned Area Task average speed achievable around target points remaining in minimum AAT time.
Distance Home <input type="text" value="Home Dis"/>	Distance to the home waypoint (if defined).
Online Contest Distance <input type="text" value="OLC"/>	Instantaneous evaluation of the flown distance according to the configured Online-Contest rule set.

10.8 Waypoint

Next Waypoint <input type="text" value="Next"/>	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 <input type="text" value="Time flt"/>	Time elapsed since takeoff was detected.
Time local <input type="text" value="Time loc"/>	GPS time expressed in local time zone.
Time UTC <input type="text" value="Time UTC"/>	GPS time expressed in UTC.
Task Time To Go <input type="text" value="Fin ETE"/>	Estimated time required to complete task, assuming performance of ideal MacCready cruise/climb cycle.
Next Time To Go <input type="text" value="WP ETE"/>	Estimated time required to reach next waypoint, assuming performance of ideal MacCready cruise/climb cycle.

Task Arrival Time

Fin ETA

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

Next Arrival Time

WP ETA

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

Task Req. Total Height Trend

RH Trend

Trend (or neg. of the variation) of the total required height to complete the task.

10.9 Team code**Own Team Code**

TeamCode

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

Team Bearing

Team Brng

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

Team Bearing Diff

Team B D

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

Team range

Team Dis

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

10.10 Navigation gadget**Battery Voltage**

Battery

Displays percentage of device battery remaining (where applicable) and status/voltage of external power supply.

10.11 Alternates**Alternate1 name**

Altrn 1

Displays name and bearing to the best alternate landing location.

Alternate2 name

Altrn 2

Displays name and bearing to the second alternate landing location.

Alternate1 GR

Altrn1 GR

Geometric gradient to the arrival height above the best alternate. This is not adjusted for total energy.

11 Configuration

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

11.1 Scope of configuration

There are several ways 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; the user is referred to the *XCSOar Advanced Configuration Manual* for more details.

9: Write a advanced config manual

11.2 Modifying settings

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

Config > Config > 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 on Altair to close the dialog and return the program back to normal map mode.



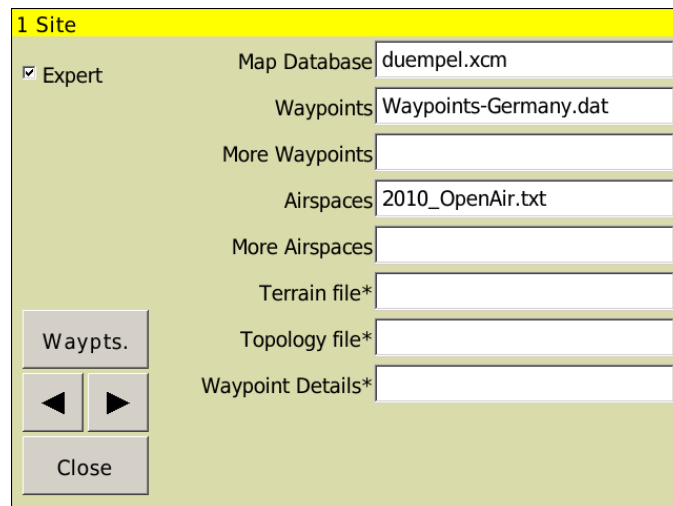
Once you are happy with your configuration settings, save the profile file and make a backup so that you can later restore the settings if your PDA's memory is accidentally erased.

See Chapter 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.

The main configuration dialog (Setup System) can be run in Basic or Expert user level, via a selectable field on the left of the dialog. When in Basic mode, many of the less commonly used and advanced configuration settings are hidden. In the descriptions below, all of the parameters marked with an asterisk are only visible in expert user level.

Basic user level:

Expert user level:



1 Site

Expert

Map Database: duempel.xcm

Waypoints: Waypoints-Germany.dat

More Waypoints:

Airspaces: 2010_OpenAir.txt

More Airspaces:

Terrain file*:

Topology file*:

Waypoint Details*:

Waypts.

◀ ▶

Close

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. See Section 11.13 for customisation.

Note: In simulator mode the configuration settings dialog will also be available in flight.

11.3 Site

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

- Map Database :** The name of the map file (XCM) containing digital elevation terrain data, topology, and optionally waypoints, airspace etc. A good prepared database file covers all the needs for this page.
- Waypoints :** Primary waypoints file. If left blank, waypoints are loaded from the map file (if available).
- More Waypoints :** Secondary waypoints file. This may be used to add waypoints for a competition.
- Airspaces :** The file name of the primary airspace file. If left blank, airspaces are loaded from the map file (if available).
- More Airspaces :** The file name of the secondary airspace file.
- Terrain file* :** The name of the file containing digital elevation terrain data. Typically left blank, because terrain is loaded from the map file.
- Topology file* :** Specifies the file defining the topological features. The topology file defines the map topology in terms of points, lines and areas with optional labels. Typically left blank, because topology is loaded from the map file.
- Waypoint Details* :** The airfields file may contain extracts from Enroute Supplements or other contributed information about individual airfields.

Airspace files define Special Use Airspace. Up to two files may be specified, the first for the main SUA file, and the second is intended

for use with NOTAM airspace, and is referred to as the additional airspace file.

The XCM map database concept is the recommended way to setup a site to fly. The old method (XCSoar v5.x) requires each to be separate files and to be specified separately (as the “Terrain file” and “Topology file” respectively).

When XCM map files are used, however, then these files contain terrain, topology and optionally waypoints. In this case, the “Terrain file”, “Topology file” and “Primary waypoint file” may be left blank and the system will load those items from the map file. However, if a map file is used, the user can still specify the other files and they will be used instead of the data in the map file.

See Section 12.7 for more details on map files.

11.4 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. The airspace filter dialog also allows filtering of display and warnings independently for each airspace class.

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

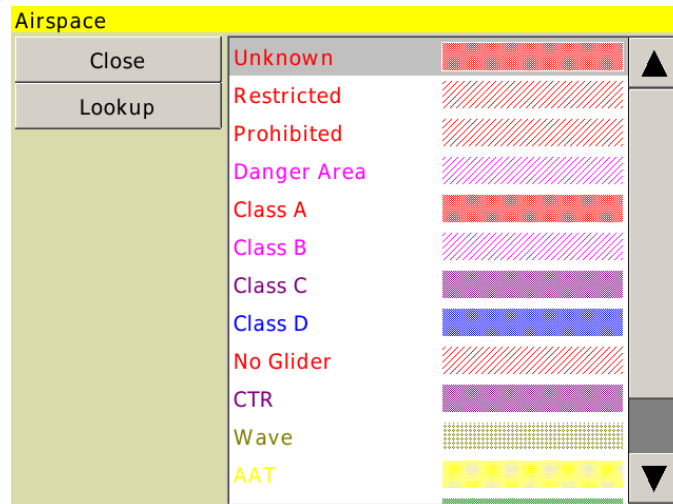
This page also has **Colours** and **Filter** buttons which can be used to review or change the colours/patterns used by each

airspace class, and whether each airspace class will be filtered out of warnings and/or display.

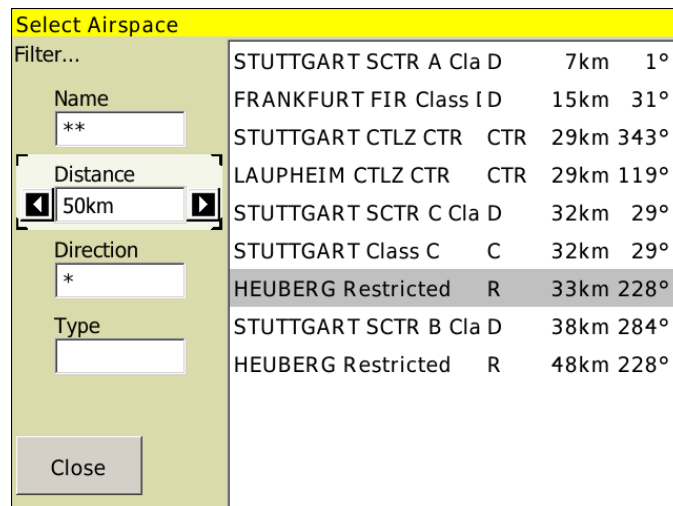
Colours

This function is used to determine the colours used to draw each type of airspace.

First select the airspace type you wish to change.



Pressing the **Lookup** button brings up the airspace select dialog. This functions similarly to the waypoint lookup dialog, and allows search based on name, distance, direction, and type (class).



Now select the colour and pattern you wish the selected airspace to be drawn in.

Filters

The filter function is described in Section 7.7.

11.5 Map Display

This page provides options relating to the map display.

3 Map Display

Expert

Labels: Names

Trail length: Full

Cruise Orientation: North up

Circling Orientation: North up

Circling zoom: ON

Trail drift*: ON

Trail type*: Vario #2

Trail width*: 30

Detour cost markers*: OFF

FLARM map: ON/Scaled

Close

Labels : This setting determines the label displayed with each waypoint. There are 7 options:

Names : The full name of each waypoint is displayed.

Numbers : The waypoint enumeration of each waypoint is displayed, as read from the waypoint file. Referring to this number is not reliable, thus the feature will die soon.

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 3 : The first 3 letters of the waypoint name are displayed.

First 5 : The first 5 letters of the waypoint name are displayed.

First word : Only the first word (up to the first space) of the waypoint name is displayed.

Trail length : Determines whether and how long a snail 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)

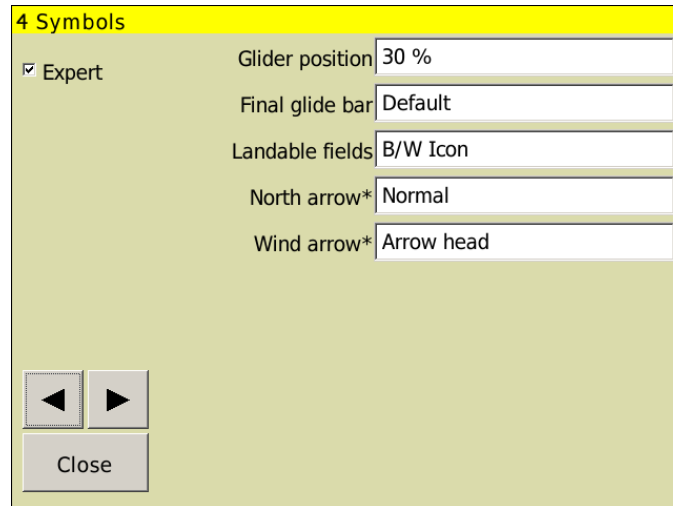
Full : A trail for the entire flight is drawn

Cruise/Circling Orientation : This determines how the screen is rotated with the glider, depending on it's current display mode.

- North up : The moving map display will always be orientated true north to south and the glider icon will be rotated to show its course (corrected for wind).
- Track up : The moving map display will be rotated so the glider's track is oriented 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.
- Target up : The moving map display will be rotated so the current target direction is oriented up.
- Circling zoom : This determines whether separate zoom levels will be maintained for circling and cruise modes. 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 snail trail is drifted with the wind when displayed in circling mode. When OFF, the snail trail is uncompensated for wind draft.
- Trail type* : Sets the type of the snail trail display.
 - Vario #1 : Within lift areas lines get displayed green and thicker, while sinking lines are shown red and thin. Zero lift is presented as a grey line.
 - Vario #2 : The climb colour for this scheme is orange to red, sinking is displayed as light blue to dark blue. Zero lift is presented as a yellow line.
 - Altitude : The colour scheme corresponds to the height.
- Trail width* : Sets the width of the snail trail display.
- Detour cost markers* : If enabled this displays in cruise flight some figures projected in front of the nose of the glider icon. This is the additional distance in percent if you fly up the position of the figure and after that again straight towards the target, compared to the straight distance to target.
- FLARM map : This enables the display of FLARM traffic on the map window as well as the pop-up radar-like display.
 - OFF : FLARM map display disabled
 - ON/Fixed : FLARM map display enabled with fixed scale.
 - ON/Scaled : FLARM map display enabled and auto scaled. The FLARM targets on the map display are scaled so that when the map is at large zoom levels, targets are still visible.

11.6 Symbols

This page provides options relating to the items overlaying the map display.



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 : Three styles are available: Purple circles (WinPilot style), a high contrast (monochrome) style with icons, or orange icons. See Section 3.5 for details

Wind arrow* : Determines the way the wind arrow is drawn on the map.

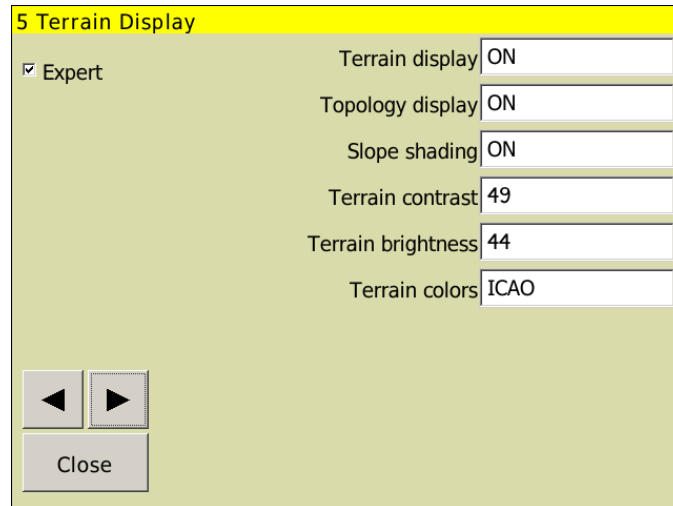
Arrow head : Draws an arrow head only

Full arrow : Draws an arrow head with a dashed arrow line

North arrow* : Two styles are available. Normal, or with a white outline.

11.7 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.

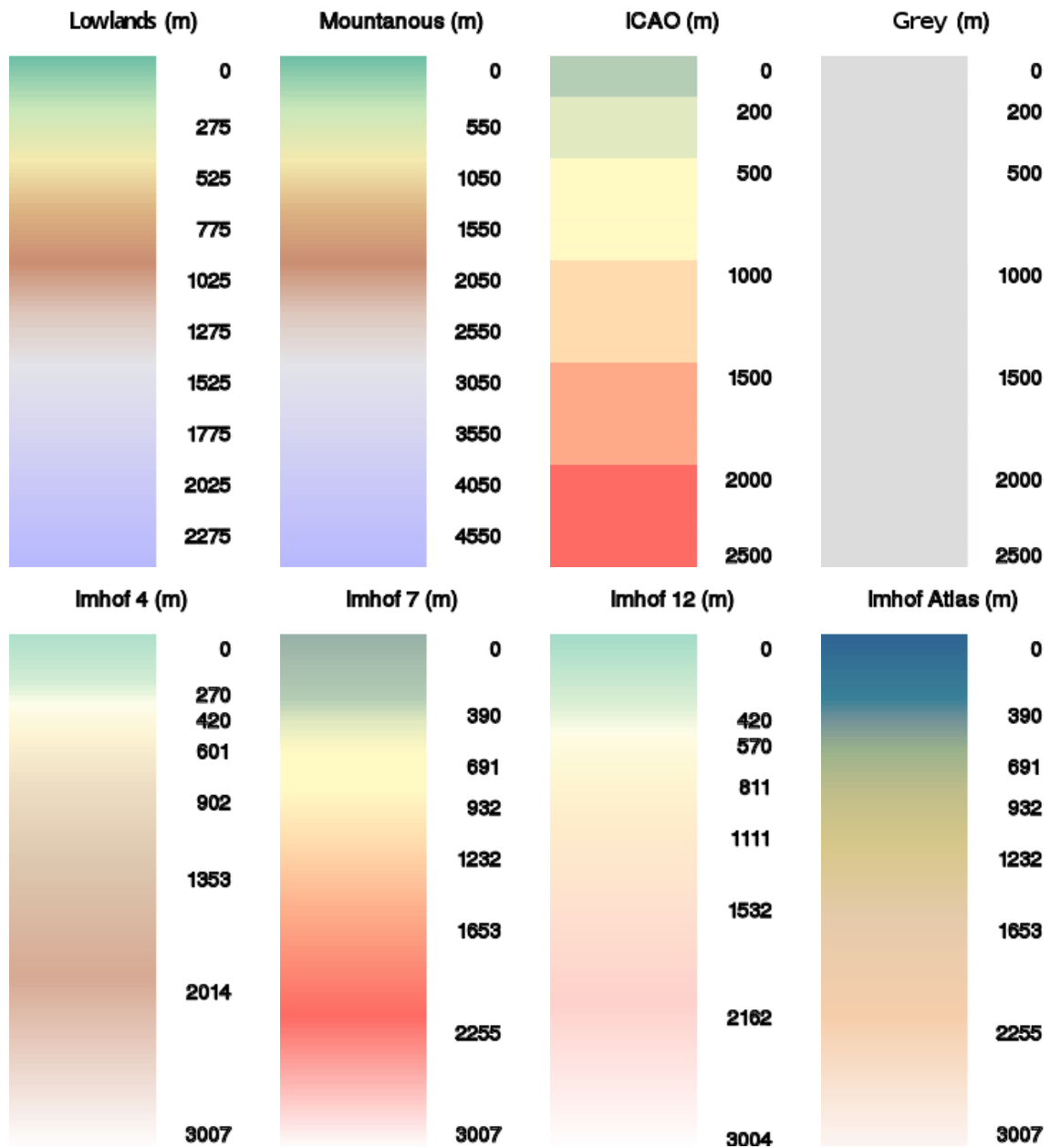
Slope shading : Slopes faced to the wind get displayed brighter and the averted slopes get darker.

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 colour 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 colour schemes are illustrated in the table below.



11.8 Glide computer

This page allows glide computer algorithms to be configured.

6 Glide Computer	
<input checked="" type="checkbox"/> Expert	
Glide terrain line	Line
Auto wind	Both
External wind	ON
Auto MC mode	Both
Block speed to fly*	OFF
Nav by baro altitude*	OFF
Flap forces cruise*	OFF
L/D Average period*	90 seconds
<input type="button" value="◀"/> <input type="button" value="▶"/> <input type="button" value="Close"/>	

Glide terrain line : This determines whether the glide terrain range is calculated and drawn as a line resp. a shade on the map area.

Auto wind : This allows switching on or off the automatic wind algorithm.

Manual : When the algorithm is switched off, the pilot is responsible for setting the wind estimate.

Circling : Circling mode requires only a GPS source,

ZigZag : ZigZag requires an intelligent vario with airspeed output.

Both : Uses Circling and ZigZag.

External wind : If enabled, the wind vector received from external devices overrides XCSoar's internal wind calculation.

Auto MC mode : This option defines which auto MacCready algorithm is used. For more details see Section 5.13.

Final glide : Final glide adjusts MC for fastest arrival.

Trending Average climb : Sets MC to the trending average climb rate based on all climbs.

Both : Uses trending average during task, then fastest arrival when in final glide mode.

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.

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.

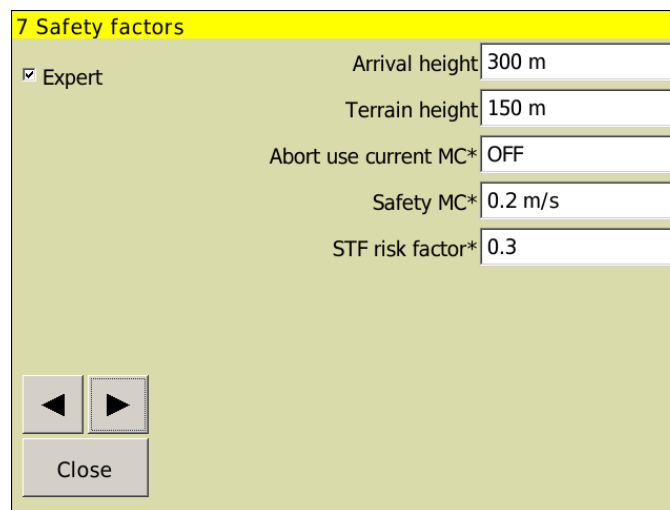
Flap forces cruise* : When this option is enabled, causes the flap switches in Vega to force cruise mode when the flap is not positive. This means that when departing a thermal, switching to neutral or negative flap will immediately switch XCSoar's mode to cruise mode.

Similarly, for Borgelt B50 systems, the speed command switch forces XCSoar's climb or cruise mode.

L/D Average period : Average glide ratio is always calculated in real time. Here you can decide on how many seconds of flight this calculation must be done.

11.9 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.

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 after a task abort.

Safety MC* : The MacCready setting used for task abort and for determining arrival altitude at airfields.

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 Section 5.7 for more details.

See Section 5.8 for more details on the meanings of the safety heights.

11.10 Polar

This page allows the glide polar to be defined.

The screenshot shows a dialog box titled "8 Polar". It features a yellow title bar and a light green background. On the left, there is a checked checkbox labeled "Expert". To the right, there are several input fields: "Type" with the value "Ventus 2c (18m)", "Polar file" (empty), "V rough air" with "220 km/h", "Handicap" with "120 %", and "Dump time" with "140 s". At the bottom left, there are two arrow buttons (left and right) and a "Close" button.

Type : This contains a selection of gliders of different performance classes, as well as a special entry for “External Polar File”.

Polar file : When “External Polar File” is the polar type, this is the name of the file containing the glide polar data in WinPilot format.

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.

Dump time : The time in seconds needed for dumping full ballast.

11.11 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.

9 Devices	
<input checked="" type="checkbox"/> Expert	
Device A	Name: CAI 302
	Port: COM3
	Baudrate: 19200
Device B	Name: Generic
	Port: COM7
	Baudrate: 4800
	Use GPS time: ON
	Ignore checksum*: ON
<input type="button" value="◀"/> <input type="button" value="▶"/> <input type="button" value="Close"/>	

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.

The specific type of device can also be selected from a list in order to enable support for devices with proprietary protocols or special functions.

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.

Use GPS time : This 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.

Ignore checksum* : If your GPS device outputs invalid NMEA checksums, this will allow it's data to be used anyway.

11.12 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, temperature, task speed and latitude/longitude.

10 Units	
<input checked="" type="checkbox"/> Expert	Aircraft/wind speed Metric
	Distance Metric
	Lift M/s
	Altitude Meters
	Temperature C
	Task Speed Metric
	Lat/Lon DDMSS
	UTC Offset 1.0
	Local time 18:34

Navigation buttons: Left arrow, Right arrow, Close

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.

11.13 Interface

This page allows to customize the way the user controls and interacts with XCSoar.

- Auto Blank :** This determines whether to blank the display after a long period of inactivity when operating on internal battery power (visible for PDA only).
- Safety lock :** This determines whether the configuration settings dialog is accessible during flight.
- Gestures :** Enable this, if you run XCSoar on a touch-screen device and like the gestures to control it.
- 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. Select “None” for a native English interface, “Automatic” to localize XCSoar according to the system settings.
- 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 timeout* :** This is the minimum interval between the system recognizing 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.

Text Input Style* : Determines which style for text entries is used. See Section for further information on text entries.

HighScore Style : For entering text you have to change the underlined character to the relevant letter.

Keyboard : Uses the on-screen keyboard for entering text.

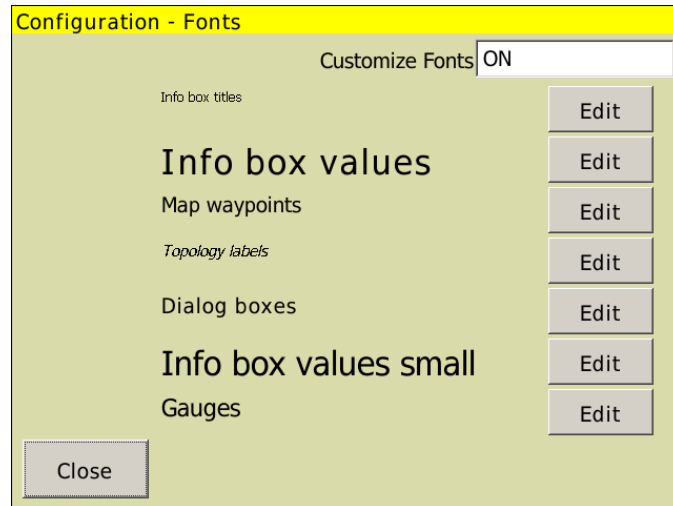
Default : Uses the default input style for your platform.

Some Pocket PC devices have poorly designed keys that are subject to accidental multiple key presses, which is known as key 'bouncing'. The de-bounce timeout sets a minimum time between successive key presses that is detected by XCSoar, to alleviate this problem. If this value is set very high, then the user interface will feel unresponsive; if the value is set too low, then bouncing may occur.

Press the **Fonts** button to adjust the fonts XCSoar uses.

11.14 Fonts

This page enables customisation of fonts in various fields of the programm.

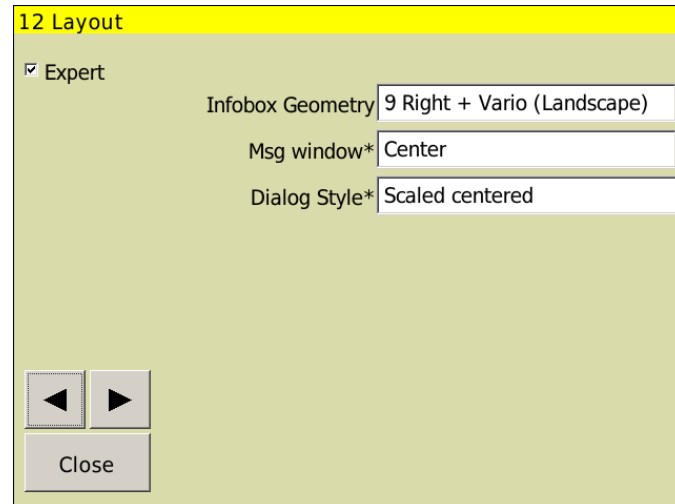


Once the customisation is enabled, the **Edit** buttons allow to change some parameters (Font Face, Height, Bold and Italic) of the chosen font.

If customisation is disabled, default fonts will be used.

11.15 Layout

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



Infobox Geometry : Sets the geometry values for infoboxes. In landscape mode infoboxes are placed left and right, in portrait mode top and bottom of the screen. The numbers in front refer to the total number of infoboxes.

Msg window* : Defines the alignment of the status message box, either centered or in the top left corner.

Dialog Style* : Determines the display size of dialogs.

11.16 FLARM and other gauges

13 FLARM and other gauges	
<input checked="" type="checkbox"/> Expert	Speed arrows ON
	Show average ON
	Show MacReady ON
	Show bugs* ON
	Show ballast* OFF
	Show gross* OFF
	Averager needle* ON
<input type="button" value="◀"/> <input type="button" value="▶"/>	FLARM radar ON
<input type="button" value="Close"/>	Auto close FLARM ON
	ThermalAssistant OFF

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.

FLARM radar : Enables the display of the FLARM radar gauge. The track bearing of the target relative to the track bearing of the aircraft is displayed as an arrow head.

Auto close FLARM : This will close the FLARM radar view when all FLARM traffic has gone.

ThermalAssistant : Enables the display of the ThermalAssistant gauge.

In all FLARM environment, the colour of the target indicates the threat level.

11.17 Default Task Rules

Task rules may be defined to limit valid starts according to competition rules.

14 Default task rules	
<input checked="" type="checkbox"/> Expert	Start max speed 150 km/h
	Start max speed margin 0 km/h
	Start max height 1500 m
	Start max height margin 0 m
	Start height ref AGL
	Finish min height 0 m
	Online contest OLC Classic
<input type="button" value="◀"/> <input type="button" value="▶"/>	
<input type="button" value="Close"/>	

Start max speed : Maximum speed allowed in start observation zone. Set to 0 for no limit.

Start max speed margin : Maximum speed above maximum start speed to tolerate. Set to 0 for no tolerance.

Start max height : Maximum height above ground while starting the task. Set to 0 for no limit.

Start max height margin : Maximum height above maximum start height to tolerate. Set to 0 for no tolerance.

Start height ref : Reference used for start max height rule

MSL : Reference is altitude above mean sea level

AGL : Reference is the height above the start point

Finish min height : Minimum height above ground while finishing the task. Set to 0 for no limit.

Online contest : Determines the rules used to optimise On-Line Contest paths. The implementation conforms to the official release 2010, Sept. 23.

OLC Sprint : Up to 5 points including start and finish, maximum duration 2.5 hours, finish height must not be below start height.

OLC FAI : 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.

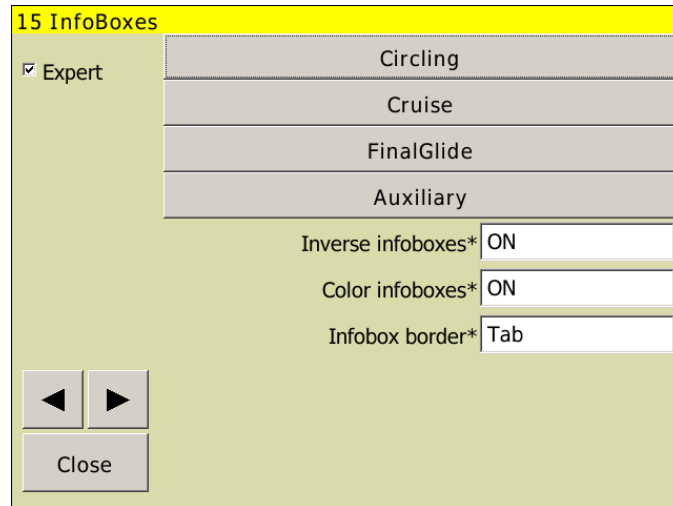
OLC Classic : Up to seven points including start and finish, finish height must not be lower than start height less 1000 meters.

OLC League : A contest on top of the classic task optimization, cutting a 2.5 hours segment over max. 3 of the turns. Finish height must not be below start height.

OLC Plus : A combination of Classic and FAI rules. 30% of the FAI score are added to the Classic score.

11.18 InfoBoxes

This page allows the configuration of four InfoBoxe sets to be defined for each display mode (circling, cruise, final glide) and one auxiliary set. See Section 10 for a description of the infobox types and their meanings.



To arrange a set of InfoBoxes press one of the buttons labeled with the name of the set. The InfoBoxes are numbered; the location of the InfoBoxes depends on the screen geometry. The table below shows the infobox numbers for landscape screen layout (Altair):

1	
2	
3	
4	7
5	8
6	9

The table below shows the infobox numbering for portrait screen layout:

1	2	3	4
5	6	7	8

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.

11.19 Logger

This page allows you to set the pilot and aircraft details used for annotating XCSoar's IGC logger.

Time step cruise* : This is the time interval between logged points when not circling.

Time step circling* : This is the time interval between logged points when circling.

Pilot name : This is the pilot name used in the internal software logger declaration.

Aircraft type : This is the aircraft type used in the internal software logger declaration.

Competition ID : This is the aircraft competition ID.

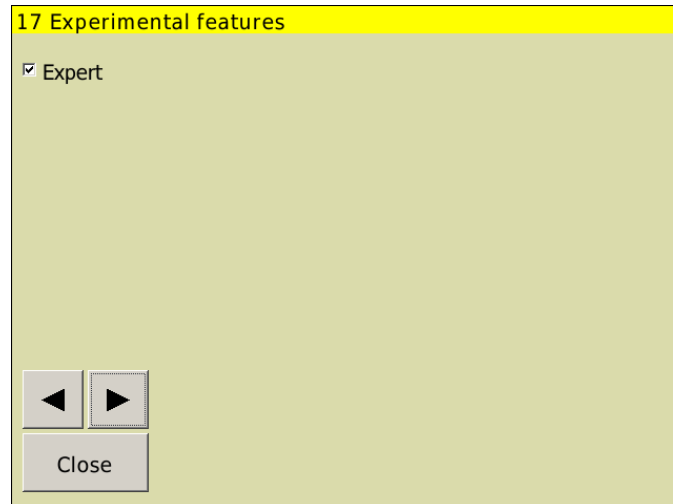
Logger ID : This is the logger registration.

Short file name : This determines whether the logger uses the short or the long IGC file name.

Auto logger* : Enables the automatic starting and stopping of the logger on takeoff and landing respectively. Disable when flying paragliders to prevent the low ground speeds from triggering the automatic logger.

11.20 Experimental features

This page provides experimental features which are not finished yet.



Device model : This setting allows the adaptation to specific hardware XCSoar runs on (visible for PDA only).

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. These are the files that are most likely to be modified or set by normal users.
- 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 chapter 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.

Although it is a generally good idea to have data files located in nonvolatile memory, the use of SD cards and other removable media in PDAs can cause performance issues; for smaller files, and files that are only accessed at start-up (waypoints, airspace, glide polars, configuration files), this is acceptable. However, terrain and topology files are accessed continuously while XCSOar is running, so these should be located in faster storage memory.

Many PDAs provide a 'file store' which is nonvolatile; the same arguments above apply regarding their use and performance.

All data files should be copied into the directory:

My Documents/XCSOarData

For PDA users, data can also be stored on the operating system file store, on Compact Flash cards or SD cards under the directory XCSOarData.

For example:

SD Card/XCSOarData

IPAQ File Store/XCSOarData

10: Explain where files are generated to and search paths.

Note that due to limitations in the Pocket PC and Windows Mobile operating system, additional subdirectories under “My Documents/XCSoarData” are not allowed.

12.2 Composed Mapfile

11: What is the new xcm file format capable, and what does it replace

12.3 Terrain

12: xcm impact?

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.

12.4 Topology

13: xcm impact?

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. Details on the file format will be provided in a separate document.

The topology data itself uses ERSI 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.

12.5 Waypoints

14: add new waypoint formats

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 Server¹:

<http://acro.harvard.edu/SOARING/JL/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.

12.6 Airspace

XCSoar supports airspace files (extension `.txt`) using a sub set of the widely distributed OpenAir format. Files are available from the Special Use Airspace section of the Soaring Server:

<http://acro.harvard.edu/SOARING/JL/SUA>

15: support for TNP airspace files

16: interference, preference to airspace data in xcm file?

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”.

12.7 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.

¹ Mirrors to this website exist, google search for “worldwide soaring turnpoint exchange” if the main server is inaccessible.

12.8 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]
Blah blah blah blah
...
```


12.9 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
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
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

Name	Empty mass (kg)	Ballast mass (kg)	V1 (kph)	W1 (m/s)	V2 (kph)	W2 (m/s)	V3 (kph)	W3 (m/s)
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
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
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
Speed Astir	351	90	90	-0.63	105	-0.72	157	-2.0
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
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
ASW28-18	345	190	65	-0.47	107	-0.67	165	-2.0

12.10 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), for example:

```
StartDistance=1000
```

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.

12.11 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
...
```

12.12 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.

12.13 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.

17: Describe use of FPLT to add events to the replay.

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.

A future version of the flight logger will allow all input events to be stored in the IGC file in this fashion, thus replaying the flight will give a very faithful reproduction of the actual flight and how the software was used. This is expected to be useful for training and coaching purposes.

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.

12.14 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
- Support a new set or layout of buttons (organiser hardware buttons)
- Support an external device such as a bluetooth keyboard or gamepad
- Customise any button/key event
- Do multiple events from one key or glide computer triggered process

For more information on editing or writing your own input event file, see the *XCSoar Advanced Configuration Manual*.

12.15 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.

12.16 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
```

12.17 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.

12.18 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.

Refer to the *XCSoar Advanced Configuration Guide* for more details.

13 History and Development

13.1 Product history

18: Describe background of XCSoar and its developers, development process, get on board! If you want something, ask (nicely)

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 through 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.

What happened in the three years up to Version 6.0

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.

Flight testing is certainly the best sort of test, but we have also been able to conduct the bulk of testing by using XCSoar in a car, and more recently, by replaying IGC flight logs.

In general, we don't want the program to crash or hang, ever, and if it does so during testing, then whatever bug caused the problem has to be fixed as top priority.

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

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Shapelib : Frank Warmerdam

Least squares : Curtis Olson <http://www.flightgear.org/~curt>

Aviation Formulary : Ed Williams

JasPer : Michael D. Adams <http://www.ece.uvic.ca/~mdadams/jasper/>

KFlog : Volkslogger code by Heiner Lamprecht

Volkslogger support : Garrecht Ingenieurgesellschaft

Appendix A GNU General Public License

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Version 2, June 1991

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