Alsim ACT

Technical Description

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alsim
simulator manufacturer

66 Rue Pierre & Marie Curie (Nantes)
44430 LE LOROUX BOTTEREAU
FRANCE
Tel: +33.2.40.03.77.74
Fax: +33.2.51.71.98.06

Web: www.alsim.com

5100 route de l'aéroport
SAINT HUBERT, QC, J3Y 8Y9
CANADA
Phone: (450) 462-3334
Toll Free: 1-877-962-3334
Fax: (450) 462-3339

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Alsim

ALSIM, which is based in Nantes, France, was founded in 1994 by an airline pilot and a computer engineer. Their vision was to develop TFT screens for the display of cockpit instruments without loosing the ergonomic features of traditional instrumentation.

ALSIM has been the first trainer manufacturer to launch entirely re-configurable flight trainers. Different types of planes can therefore be simulated on the same machine : you can choose via a simple mouse click several instruments and flight models according to single piston, twin piston, twin turboprop or generic jet flight model configuration. The different types of planes are simulated in an extremely realistic fashion on the same machine.

ALSIM flight trainers have therefore become the missing link between PC based desk top devices and full flight simulators.

The products range comprise three different types : Basic Instrument Training Device (BITD), Flight Navigation and Procedure Trainer range (FNPT I, II, II MCC) and Flight Training Device (FTD).

These flight trainers are manufactured in compliance with European JAR and American FAR regulations and assure clubs, schools and airline companies optimum credit hours.

In 10 years, ALSIM has become the European leader in the flight trainer market thanks to its strategy based on investments in research and development in order to stay on the cutting edge of technology.

1 Introduction

This document is the technical description of an Alsim ACT.

Informations, drawings and pictures shown in this document are indicative. Configurations and technical features are subject to change without notice.

2 Overview of the ACT

The Alsim ACT (Alsim Compact Trainer) is based on the AL200-DA42 Diamond DA42 TwinStar flight trainer developed by Alsim Simulateurs. This tool allow a cost effective training on the G1000 glass cockpit instruments.

Figure 2.1: The ACT

Below you will find a brief listing of what each element contains, the detailed descriptions will follow later in the document.

2-1 Features

The ACT consists of:

- Garmin 1000 system with:
  - 2 GDU 1040 (PFD and MFD) from Garmin
  - 1 GMA 1347 from Garmin
- ADF Becker 3500
- KAP 140 look-alike autopilot
- Joystick used to simulate : stick, flaps, gear
- Instructor station displayed on a 17 inches TFT screen
- Visual system displayed on a 17 inches TFT screen
- Generic twin piston engine flight model close to Diamond DA42 TDI
- A Dell PC with its keyboard and mouse
- two loudspeakers

2-2 Flight Deck

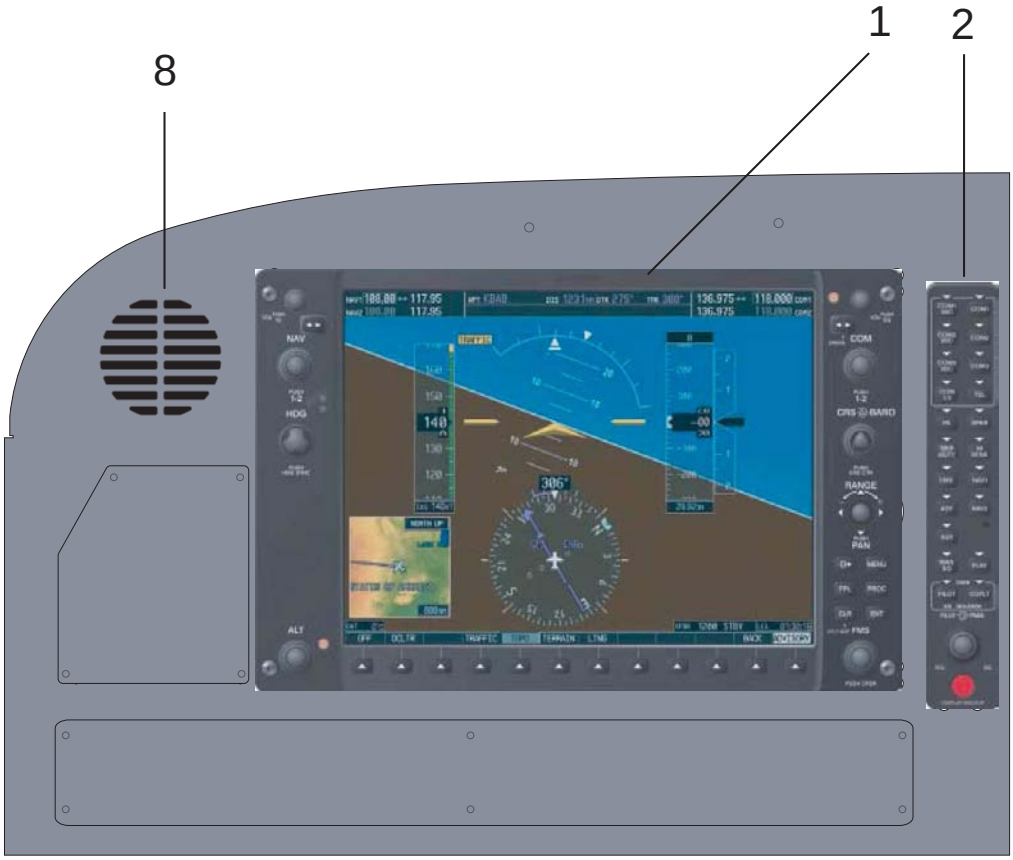


Figure 2.2: Left side flight deck

1. Garmin GDU 1040 (PFD)
2. Garmin GMA 1347
3. Garmin GDU 1040 (MFD)
4. Air hose
5. KAP 140 look-alike Automatic pilot
6. Configuration button
7. Oon/off button
8. Air hose

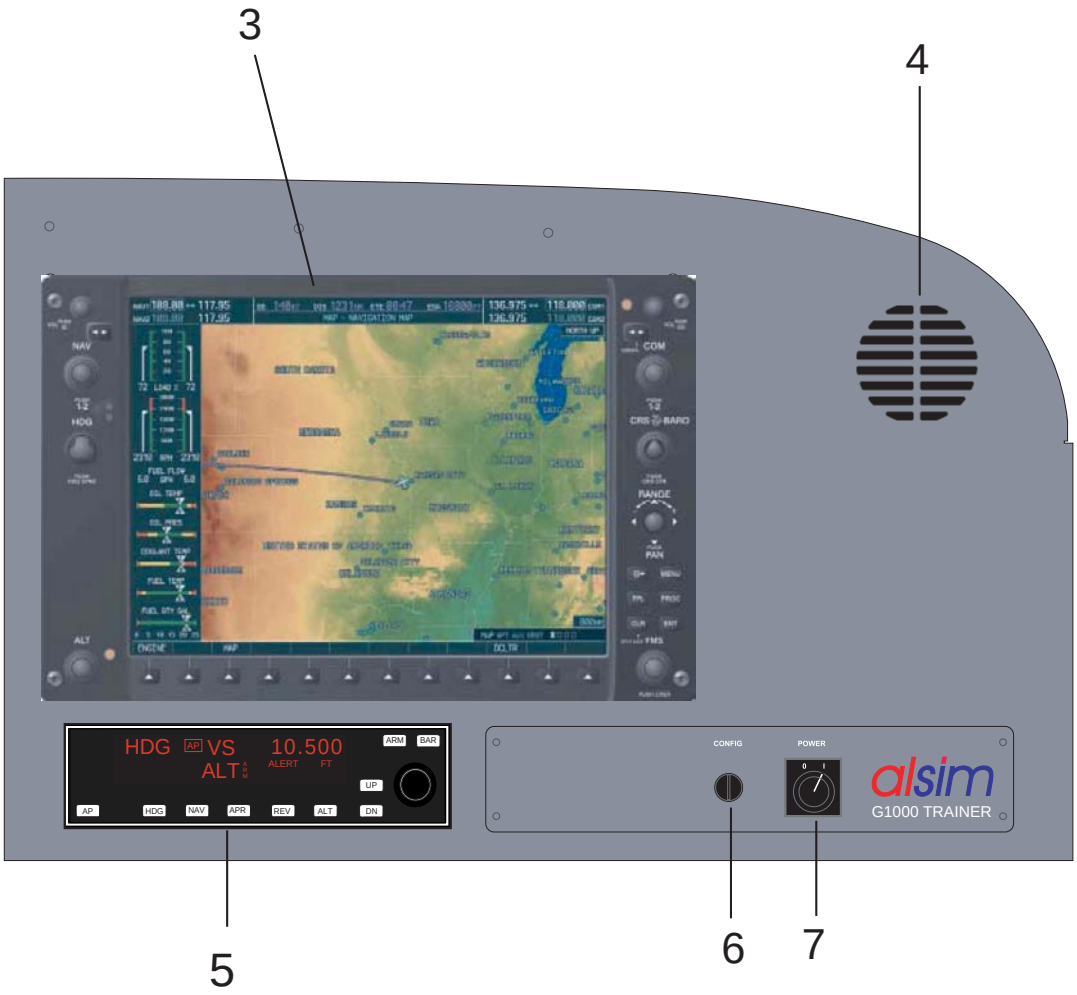


Figure 2.3: Right side flight deck

2-3 Visual System

The ACT is provided with AVS (Alsim Visual System). Specifications are:

- 1024x768
- 16 M colors
- Frame rate: 30ms
- Texture
- Relief
- Coastal lines

The followings parameters can be adjusted through the instructor station:

- Visibility
- Day/night
- Clouds layer
- Rain/snow
- RVR

2-4 Electronic and Software Architecture

The simulation softwares are installed on a DELL computer connected by network to the ACT.

Electronic boards manage all the trainer's signals - both those travelling from, for example, the flight deck to the computer, and those travelling from the computer to the flight deck. The former signals are generated when the pilot moves a lever or pushes a button.

The hardware used for the flight deck comes from Garmin. Instruments and switches are exactly the same than the real aircraft.

2-5 Sound System

The flight trainer's sound system produces all sounds necessary for realistic flight simulation: engine sounds, sounds of landing gear or flaps moving, autopilot connect/disconnect, beacon's morse codes, etc.

3 Navigation Database

The navigation database has been developed by Alsim. It is based on Jeppesen's navigation data. Alsim regularly receives updates and integrates them into the database.

Once a trainer is installed, the operator can either update the database himself by means of the instructor station software, or he can install updates delivered quarterly by Alsim.

The navigation database includes the following items:

- Runways
- VOR
- VOR/DME
- ADF
- ILS
- TACAN
- VOR/TACAN
- Markers
- Waypoints

All beacons emit the correct morse code which can be heard over loudspeakers or headsets in the cockpit.

The database includes all the elements of a given geographical area (for example Germany, or a square area from LAT N45 ° LON E3 ° to LAT N48 ° LON E8 °).

The principle of the database is to fly the airplane like in a real environment. The navigation calculation is organized as follows :

- the airplane is moving in a geo-referenced environment
- all the beacons are geographically positioned as in the real world
- the software is simulating the geographical area covered by each beacon and switches from one to another according to the airplane position.

Every 1/30 s the calculator checks the database contents and compares the airplane position with the closest beacon and determines if the airplane receiver is in the beacon reception area.

4 The Flight Controls

Figure 4.1: ACT Joystick

The trainer joystick simulates the following functions:

- Stick (pitch & roll)
- Power controls
- Pitch trim
- Flaps
- Gear

5 The Visual System

5-1 Visual System Technology

5-1-1 Accuracy

JAR STD requirements define what has to be displayed and what kind of accuracy has to be obtained. The highest degree of precision is demanded for runway lights: lights types must be distinguished at a distance similar to reality, taking care of the real zone occupied by the light, versus the observer field of view (FOV) in reality, the atmospheric attenuation and perturbations. These conditions define the final screen resolution in which the virtual scene has to be rendered, in our case 1024x768 pixels.

5-1-2 Real Time Rendering

The human eye and brain are capable of 'interpolating' visual gaps in the screen space and in the moving virtual space and to filter fast visual events. This is partially due to eye light remanence which is about 1/24 sec. In order for the eye to perceive a continuous film, there must be at least 24 frames per second. Any less and one sees slow image rendering and 'waits' for the next image. As most other visual systems, ALSIM's runs at 30 frames per second.

5-1-3 Real Time Response

In addition to the real time rendering aspect, there is the visual system time response; that is the capability of the visual system to react to an event in a defined delay.

Alsim's visual system has been developed so that an event can be treated and be visually effective by the next frame. If an event (for example a REIL light illuminating) occurs during a frame rendering, this event will be visible on the next frame 1/30 s later.

Plane movements are treated the same way. If the pilot pulls the stick, visual reaction will occur no later than 1/30 s later. This time is short enough to prevent the pilot from feeling a delay between what he does and what he sees. Though these elements are very subjective, they are very important for the pilot's immersion into a virtual reality and for realistic-looking rendering.

5-1-4 Atmospheric and Environmental Artifacts

JAR STD requirements expect visual systems to model fog and night/day rendering, as they are important elements for piloting and decision making.

Night and day level (from full night to full day view) can be set as required, and the visibility (fog) can be changed from 0 m to 95,000 m. Cloud base and cloud layer can also be adjusted.

As lights can appear before the rest of the scene, depending on the fog density, an RVR functionality has also been implemented.

5-2 Visual Feature Recognition

5-2-1 What Has To Be Drawn

JAR STD requirements expect visual systems to be able to represent runways, runway markings and runway lights up to CAT III. These requirements define the maximum accuracy and representation fidelity to be obtained for being JAR certified.

The Alsim visual system represents runway configurations according to the JEPPESEN database. The following elements are represented with trilinear texture mapping, for improving user immersion into virtual reality.

5-2-2 Runways and Runway Markings

Runways are displayed with correct length and surface type (grass, concrete) and their real position and heading.

The following runway markings are represented:

- Runway axis bands
- Touchdown zone
- Displaced threshold
- Runway heading with realistic sizes and shapes
- Threshold markings
- Centerline lights
- High intensity approach lights system (HIALS)
- Threshold and runway end lights
- PAPI sidebar and angles
- REIL

Runway lights are simulated in a generic way and comply with ICAO annex 14 requirements.

5-2-3 Airports Infrastructure

Most of the airports have generic taxiways and no buildings at all.

For a number of airports buildings and taxiways are displayed in the correct configuration (computer-generated pictures based on photographs of the real airports).

Examples of such realistic airports:

Belgium

- Bruxelles EBBR

Croatia

- Zadar LDZD

Finland

- Helsinki (Malmi) EFHF
- Helsinki (Vantaa) EFHK

France

- Nantes LFRS
- Agen LFBA
- Lognes LFOX
- Etampes LFPL
- Montpellier LFMT
- Marseille LFML
- Cannes LFMD
- Vias LFMU
- Caumont LFMV

France (taxiway only)

- Bordeaux LFBD
- Bergerac LFBE
- Limoges LFBL
- Toulouse LFBO
- Pau LFBP
- Perigueux LFBX
- Biarritz LFBZ
- Rodez LFCR
- Perpignan LFMP

Germany

- Augsburg EDMA
- Munich EDDM
- Francfort EDDF
- Hambourg EDDH
- Dusseldorf EDDL

Italy

- Costa Smeralda LIEO
- Torino LIMF

Netherlands

- Amsterdam EHAM
- Groenningen EHGG
- Maastricht EHBK
- Lelystad EHLE
- Rotterdam EHRD

Poland

- Varsovie EPWA

Spain

- Malaga LEMG
- Almeria LEAM
- Grenada LEGR

Switzerland

- Zurich LSZH

United Kingdom

- Bournemouth EGHH
- Cranfield EGTC
- Exeter EGTE
- Bristrol EGGD

Turkey

- Esenboga LTAC
- Antalya LTAI
- Eskisehir LTBI

Malaysia

- Kuala Lumpur WMKK
- Langkawi WMKL
- Ipoh WMKI
- WMKJ
- WMKC

Australia

- Sydney YSSY
- Brisbane YBBN
- Gold Coast YBCG
- Maroochydoore YBMC

Vietnam

- Cam Ranh VVCR
- Ho Chi Minh VVTS

Tunisia

- Carthage DTTA

Iceland

- Rejkavik BIRK
- Kevlavik BIKF

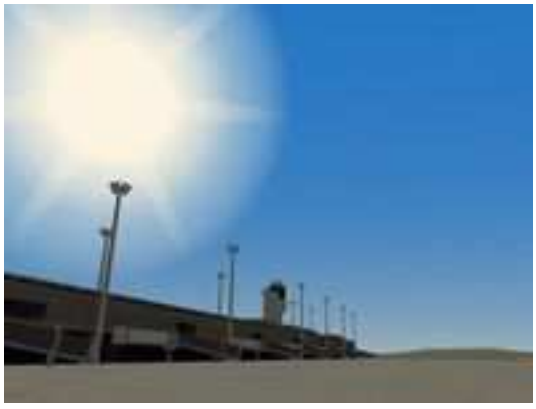
USA

- Andrews C20
- South Bend KSBN
- Chicago O'Hare KORD

Canada

- Vancouver CYVR

5-3 Screenshots of the visual system

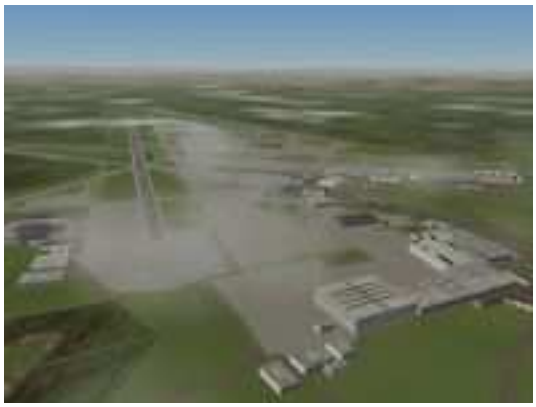


Sun glare (Advanced meteo settings option)

Heavy fog (Advanced meteo settings option)

Light effects

Sunset (Advanced meteo settings option)



Fog patches (Advanced meteo settings option)

In the clouds (Advanced meteo settings option)

Snow storm (Advanced meteo settings option)

Thunder storm (Advanced meteo settings option)

6 The Instructor Station

Figure 6.1: ACT Instructor Station screen (on the right)

6-1 The Instructor Station Software

The instructor station software serves to:

- Modify the aircraft's position and/or heading
- Replay the day's flight lessons
- Set or cancel failures on the aircraft or on navigation beacons
- Record or activate preset configurations
- Change weather conditions
- Change the aircraft being simulated (flight deck and performance of the trainer)
- View and modify the navigation database

6-1-1 Screen Display

This is the map and position window, which is activated when the instructor station starts:

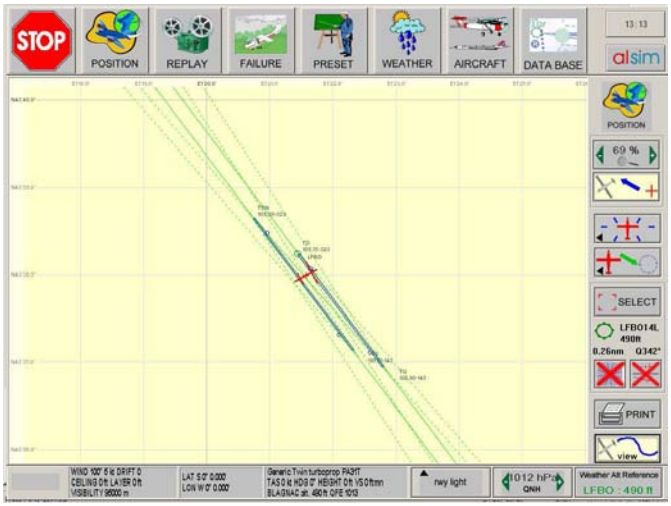


Figure 6.2: Instructor station screen at startup

The screen is divided into four zones which serve different purposes:

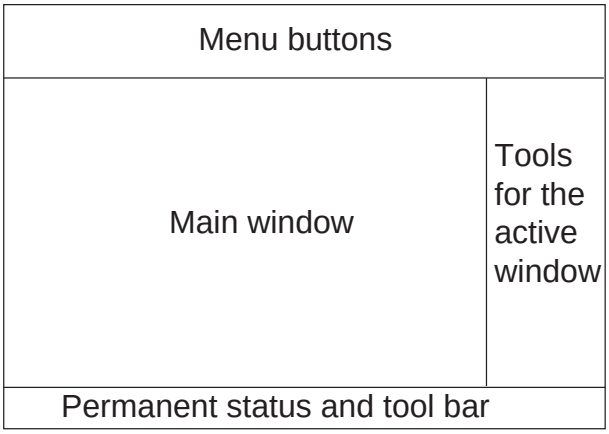


Figure 6.3: Parts of the screen display

The main part of this window consists of a map which allows to place the aircraft relative to runways and beacons. The visible part of the map can be shifted by "dragging" it with the mouse (clicking on the map and keeping the left mouse key pushed while moving the mouse) or, as the instructor station is equipped with a touch screen, by putting your finger on the screen and moving it.

6-1-2 Function Buttons

On the right-hand edge of the screen you will find the currently active function buttons. Depending on which window is being displayed on the screen, the active functions will vary. Below you see the function buttons of the position window.

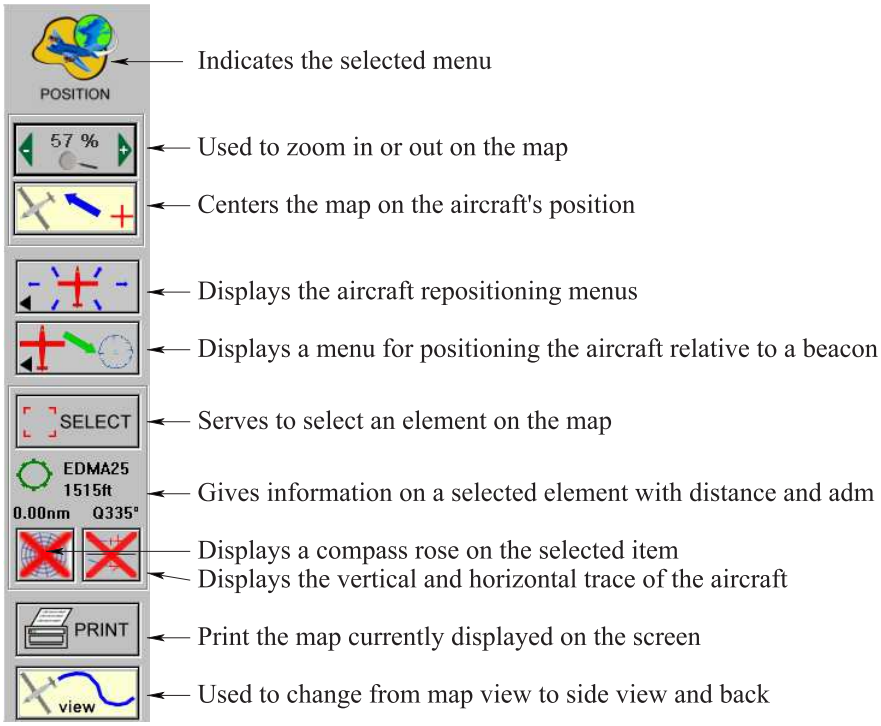


Figure 6.4: Function buttons

6-1-3 Status Bar

A status bar is always displayed on the bottom of the screen:

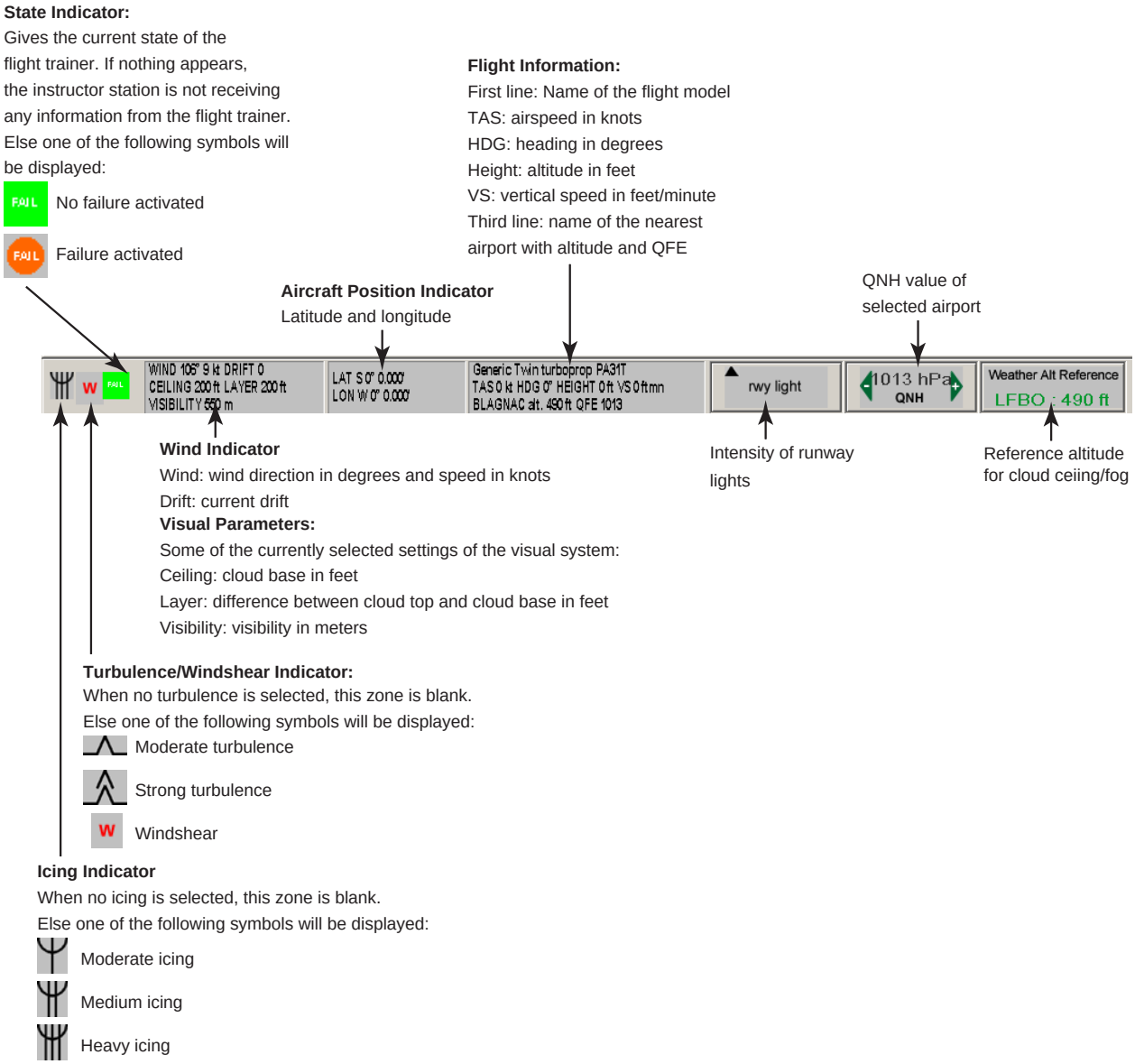


Figure 6.5: Status bar

6-1-4 Menu Buttons and windows screenshots

The different windows are activated by means of the menu buttons in the upper part of the screen.

Stop/Go: This button, which changes when you click on it, serves to freeze or continue the flight. When stop is selected, the flight is completely frozen, for example for giving explanations. You can stop and continue the lesson any time.

Position: This button opens the map and position window:

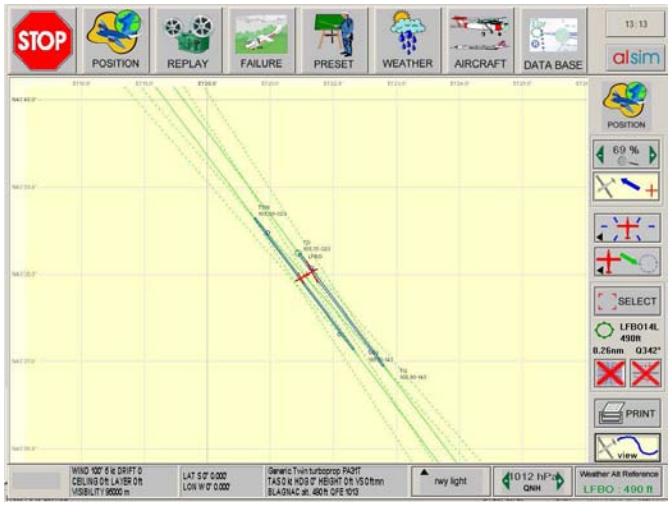


Figure 6.6: Position window

Replay: Opens the window where you can replay all the lessons of a day (which are automatically recorded).

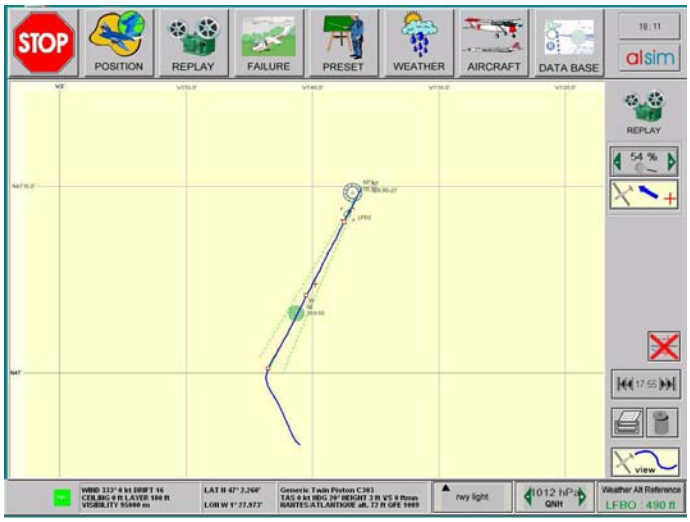


Figure 6.7: Replay window

Failure: Opens the window where you can set and cancel failures on the flight trainer. Failures are specifically designed for the DA42

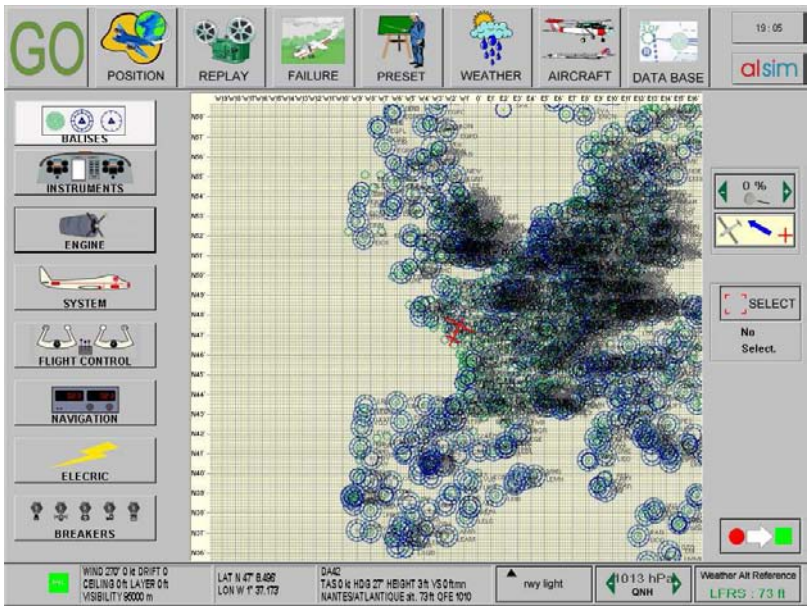


Figure 6.8: Failure window (beacon failures)

Preset: Opens the window where you can record the current parameter settings (aircraft, weather and position) in a file. Each preset can be loaded at any moment during the session.

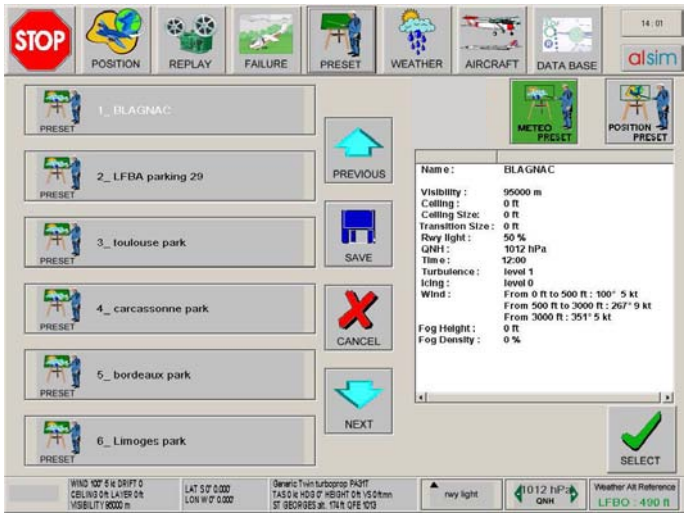


Figure 6.9: Preset window

Weather: Opens the window where you can adjust weather conditions: wind, icing, turbulence, cloud base, cloud top, outside air temperature, night/day and visibility.

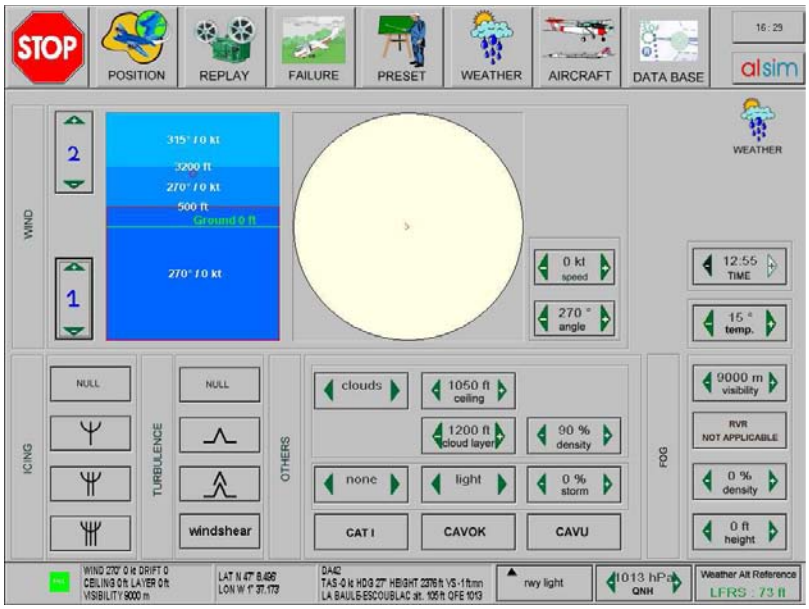


Figure 6.10: Weather window

Aircraft: Allows to set the aircraft weight, the fuel in board, the volume.

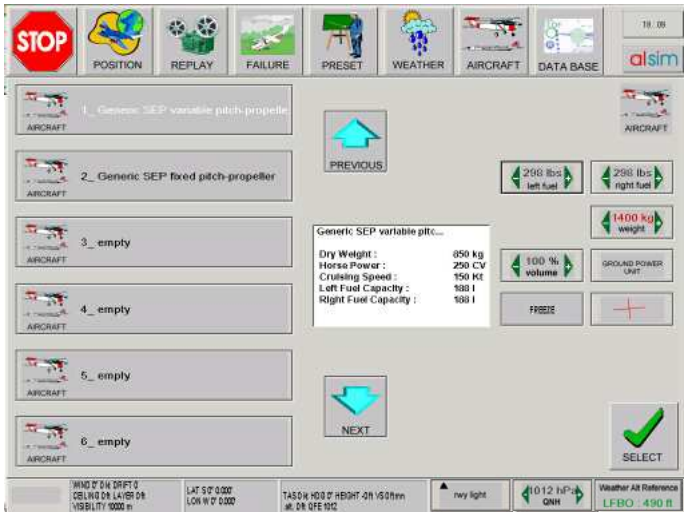


Figure 6.11: Aircraft window

Database: Opens the window where you can add, remove or modify all the elements of the navigation database which are used to provide all the runways and beacons information.

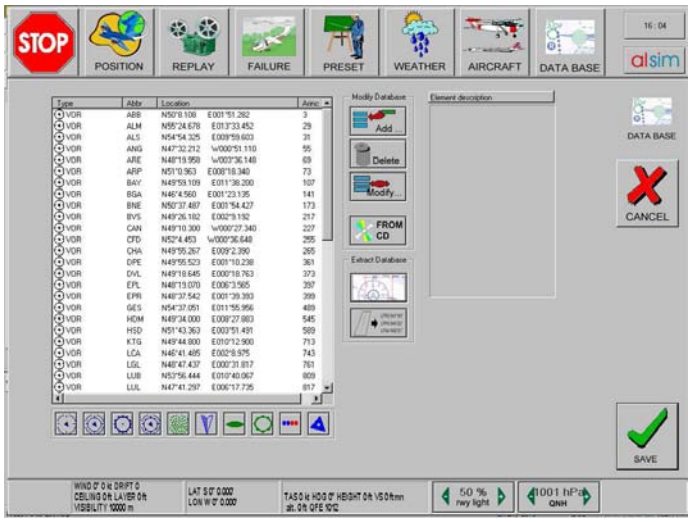


Figure 6.12: Database window

Clock: Shows the current time and, when clicked, displays a window that gives a summary of the trainer's use

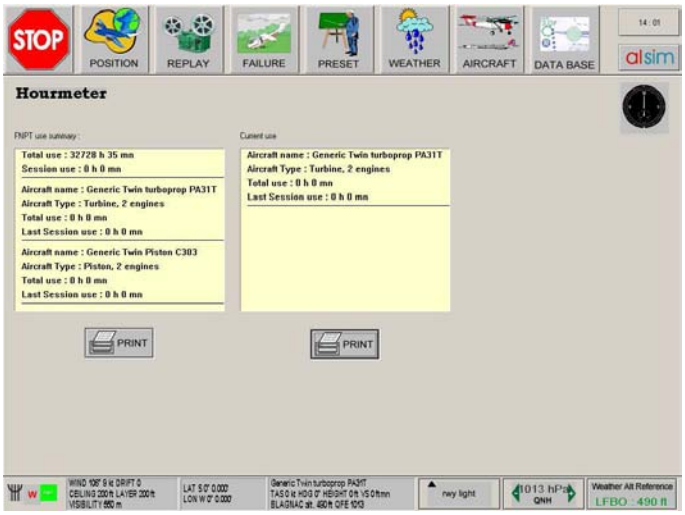


Figure 6.13: Trainer use's window

alsim: Displays the tools window which serves, amongst others, to shut down the instructor station

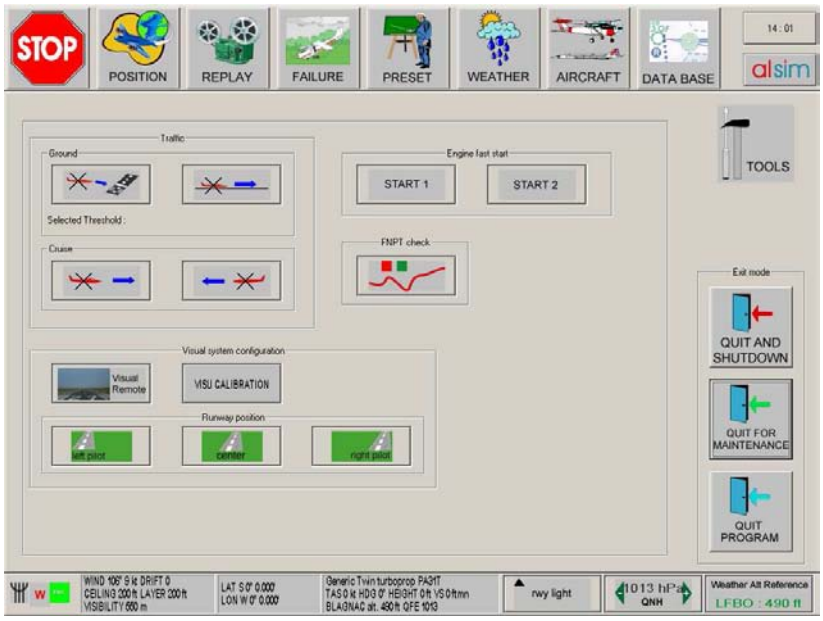


Figure 6.14: Tools window

7 Installation Requirements

7-1 Power Requirements

7-1-1 Europe

Electrical power 230V, 50Hz, 16A Power consumption : 1 KW

7-1-2 North America

Electrical power 110V, 60Hz, 16A Power consumption : 1 KW

7-2 Environmental Requirements

- Temperature from 0 ° C to +25 ° C (stable temperature recommended)
- Humidity inferior to 80%
- The room has to be as dark as possible (shutter, curtain...)
- Air conditionning is preferable.
- Appropriate floor preparation.
- The simulator room has to be equipped with an internet connection for maintenance.

If some internet access restrictions exist, please contact us for further details.

CAUTION
Even though the cockpit is mounted on wheels to facilitate installation, the flight trainer is not to be moved once installed and qualified! Moving a qualified flight trainer would necessitate a new qualification.

8 Alsim Service Contract

Our technical team offers its diagnostic and problem-solving skills, a permanent stock of spare parts (for replacement and/or loan), a telemaintenance system and an experienced logistics organisation. Thanks to the service contract, training organizations can rely on optimum availability of their equipment at limited costs.

The following document details Alsim's services. In order to evolve with you, Alsim will gladly receive all your suggestions and offer a personalized service.

Summary of the Service Contract

Services offered:

Maintenance Training (English/French)	Initial technical training of at least 2 days at Alsim's in France at the delivering of the device
Telephone help desk	Unlimited from Monday to Friday (9 to 12.30 a.m. and 2 to 5 p.m.), French public holidays excluded. Maximum delay for return calls 24 working hours (average delay is actually 2 hours).
Access to telemaintenance system	Unlimited from Monday to Friday (9 to 12.30 a.m. and 2 to 5 p.m.), French public holidays excluded
Instructor station database	Quarterly updates
Labour for in-factory repairs	Free of charge
On-site intervention	50% of usual daily cost, priority for visits
Standard exchange of parts	50% of Alsim's list price
Preventive maintenance	Once a year Alsim offers a maintenance visit to the customer's site or another maintenance training.
Individual follow-up	Alsim precisely tracks all maintenance operations done on the customer's trainer.

Access condition:

Trainer is checked and functional	No more than 30 days have passed after the end of the warranty period or a previous service contract. If more time has passed, the after-sales team needs to check (and if necessary repair) the trainer before the service contract becomes valid.
Service contract	Two copies signed, initialled and stamped by the company.

Characteristics of the contract:	
Duration	3 years, renewed tacitly except if there is a notice for termination three months before the end of the year.
Invoice and payment	Yearly in advance

Important:

- The service contract exludes the following costs: Consumables (lamps, ink cartridges, etc.), shipping costs and taxes for parts, transport, food and accomodation costs for Alsim personnel for all on-site interventions.
- Modification requests made by the relevant aeronautic authority during the trainer's recurrent evalutions are exluded from the service contract.

Description of the Services

Maintenance Training:

At the delivery of the trainer, Alsim organises in its premises a personalized technical training for one to two people. It will help the future users optimize their use of the trainer, give them good technical knowledge of our material and a common language with our technical team.

Telephone Help Desk:

Alsim's technical team is available to help the customer exploit their material. If there is a malfunction, Alsim's engineer will guide the customer through diagnostics and repair. Our engineers are capable of answering in English or French by telephone or e-mail.

Telemaintenance:

Alsim has perfected a telemaintenance system that allows to remote-control the material for diagnostics operations, failure corrections or software updates. This service has been offered for several years and allows to solve most of the problems a customer might have.

Database updates:

Each quarter Alsim will deliver to the customer an update of the AIP database in accordance with JAA requirements. The update is shipped as a CD-ROM or installed via telemaintenance.

Preventive maintenance and upkeep of skills:

Once a year Alsim will offer the customer a day with an Alsim engineer free of charge. Depending on the priorities Alsim has defined for the customer, the day will be dedicated to preventive maintenance or the training of the customer's personnel. This day will take place either at the customer's site or on Alsim's premises.

Parts repair and loan of spare parts:

Labour for the repair of all parts is included in the contract. Alsim gives priority to the demands of customers with a service contract. During repair, Alsim will lend the customer functioning parts from its stock of spare parts (depending on their availability).

Standard exchange:

Alsim offers customers with a service contract a reduction of 50% on the price of new parts.

On-site intervention:

If there is a malfunction that demands Alsim's on-site intervention, priority will be given to customers with a service contract. Moreover, they will benefit from a 50% reduction on the price of on-site labour.

Exclusions:

- Real avionics devices.
- Consumables such as projector lamps, ink cartridges, etc.
- Shipping costs and taxes on material
- Travel expenses, accomodation and food for Alsim personnel during on-site interventions
- Modifications due to the demands of aviation authorities made during recurrent qualifications of the trainer