ZODIAC

CH650B S-LSA

V9.70-1.0

Last update :09/08/12

Table of contents

SYMBOLS, ABBREVIATIONS AND TERMINOLOGY

The following definitions are of symbols, abbreviations and terminology used throughout the handbook and those which may be of added operational significance to the pilot.

- General Airspeed Terminology and Symbols

BHP Brake horsepower (= rated horsepower of the engine)

CAS Calibrated Airspeed means the indicated speed of an aircraft, corrected for position and instrument error. Calibrated airspeed is equal to true airspeed in standard atmosphere at sea level.

GPH Fuel consumption in Gallons (U.S.) per Hour.

KCAS Calibrated Airspeed expressed in "Knots".

C.G. Centre of Gravity.

IAS Indicated Airspeed is the speed of an aircraft as shown on the airspeed indicator.

KIAS Indicated Airspeed expressed in "Knots".

L Left

R Right

RPM Revolutions per minute.

S.L. Sea Level

TAS True Airspeed is the airspeed of an airplane relative to undisturbed air which is the CAS corrected for altitude and temperature.

V Speed.

$\mathbf{V_A}$ Maneuvering Speed is the maximum speed at which application of full available aerodynamic control will not overstress the airplane.

$\mathbf{V_{FE}}$ Maximum Flap Extended Speed is the highest speed permissible with wing flaps partially or fully extended.

1 Introduction

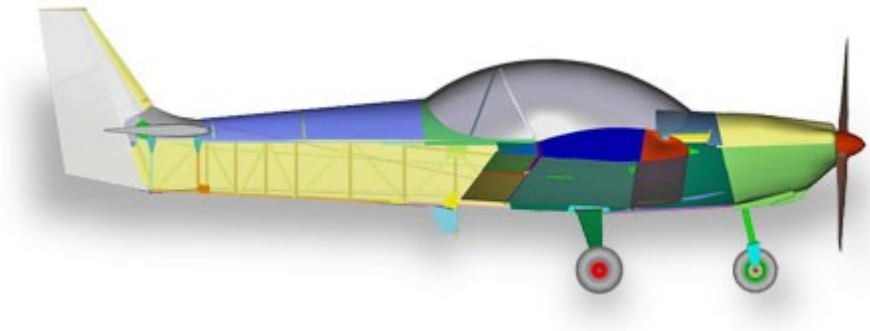
The **Zenith CH 650B LSA** is a second generation light sport aircraft, developed specifically for Sport Pilots. It is the latest model in the Zodiac line of aircraft from aeronautical engineer Chris Heintz, first introduced in 1984. This newest model offers new and updated features including modern new styling with a larger cabin area. The basic aircraft is powered by a 100 HP Continental O-200 engine (although other engine options exist, up to 140 HP).

Based on the Zodiac CH 601 XL model introduced in 2001, the new **ZODIAC CH 650B** has been developed specifically to meet the FAA's Sport Pilot / Light-Sport Aircraft category, and offers maximum performance and capability possible under the new FAA category. With new and updated features and modern styling, the Zodiac CH 650 now replaces the Zodiac XL model.

For more information on these remarkable designs including thousands of pictures and many videos, visit www.zenithair.com and/or www.zenair.com.

The CH 650B S-LSA X-Plane project is a creation of Olivier Faivre and HydroZ in collaboration with Zenair and Zenith Aircraft Co., designers and manufacturers of the CH 650B S-LSA / Experimental aircraft.

The **CH 650B S-LSA X-Plane** program is designed to be used with X-Plane 9.70 and X-Plane 10.05+.



2 Quick start

2.1 Installation

To install the program for this aircraft, you simply unzip the **CH 650B** archive you downloaded, and then copy the whole folder into X-Plane.

While you may copy the folder pretty-much wherever you want within the main X-Plane folder, it is generally advised to have a separate folder for add-on aircraft. We recommend placing the new **CH 650** folder into the existing "*Aircraft*" folder.

2.2 Hardware requirements

For best results, the **CH 650B** X-Plane program should be operated on X-Plane 9.70 or X-Plane 10.05+.

The **CH 650B** add-on has been tested on several configurations of Windows, Mac and Linux OS. It is designed to work at acceptable frame rates on older configurations, but you will likely lose some features, such as illustrated rivet-lines and cockpit lighting.

If you are using an old graphic card with a low amount of video RAM, you can lower texture resolution in the rendering setting menu. This will improve overall performance without affecting cockpit texture and the instruments should remain readable even at low resolution.

Scenery also has a big impact on frame-rate and you may encounter slower fps while flying above complex backgrounds; this effect applies to all aircraft programs, not just this one.

2.3 X-Plane settings

For the best in-flight experience, you may set the lateral field of view (FOV) to 60°. That is a common setting for 16/10 screen. You may still fine-tune this value a little, depending of your preferences and screen configuration; this is done in the "*Rendering Options*" menu.

X-plane can be operated with a simple mouse but your experience will be greatly enhanced and much more realistic with a joystick and rudder pedals.

2.4 Simulator Controls

As with all modern aircraft programs now available for X-Plane, the **CH 650B** add-on allows for varied control inputs to enhance the “pilot’s” flight experience.

Use of manipulators (mouse, joystick, etc.) allow the operator to smoothly push/pull levers or flip switches with the cursor. Action will change based on the shape of cursor: The standard arrow flips toggle switches and the “hand” cursor drags levers and handles.

In order to navigate naturally and more easily, players should ensure that their joystick is properly set with left/right and up/down functions. With X-Plane, the 3D cockpit mode is not adapted for instrument panel manipulations with a mouse. Where applicable, the **CH 650B** program will in most cases show 3D cockpit renditions as 2D.

For advanced players, a tracking device like a TrackIr can further enhance the simulator experience.

2.5 SASL Plug-in enhancement

This add-on use**s a SASL plug-in to increase realism of specific systems.**

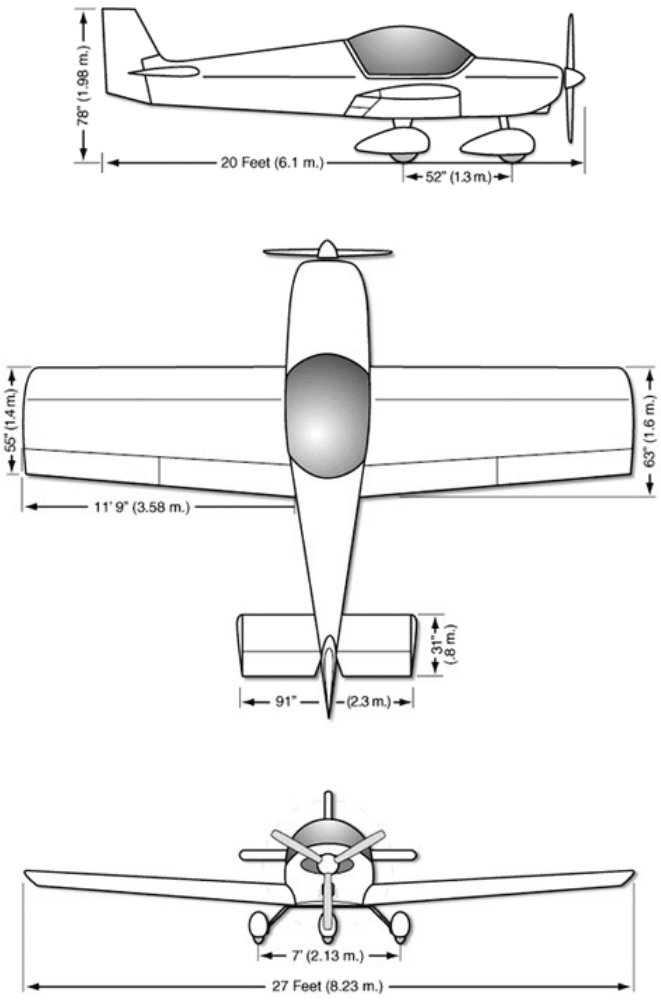
All files located in the “Custom avionics” folder are under GPL license and can be redistributed under the same terms.

2.6 Paint-kit

A paint-kit **is available to allow players to personalize their own aircraft. You can download the paint kit on** Hydroz.net.

Pre-set **designs may be incorporated in further program updates, in agreement with livery author.**

3 Main characteristics of CH 650B



- **CH 650B SPECIFICATIONS**

WING SPAN	27 FT.
WING AREA	132 SQ. FT.
LENGTH	20 FT.
HEIGHT	8 Ft. 8 In
HORIZONTAL TAIL SPAN	7 Ft. 7 In.
CABIN WIDTH	44 In.
WING LOADING	9.85 LBS/FT2
POWER LOADING	13 LBS/BHP

- **ENGINE**

  4 Cylinders Horizontally Opposed - Air Cooled

  Engine Manufacturer: Teledyne Continental Motors

  Engine Model Number: O-200-D

  Rated Horsepower: 100

  RPM Rating, standard atmosphere: Max. 2750 continuous

  Recommended cruising RPM: 2500

  Compression Ratio: 7.0:1

- **FUEL**

  Standard Fuel Capacity: 30 U.S. gal. left + right tanks (15 gal ea.)

  Usable Fuel (U.S. gal) (total): 28 U.S. gal left + right tanks (14 gal ea.)

  Minimum fuel grade: See engine manual (80/87)

- **PROPELLER**

  Fixed Pitch

  Propeller Manufacturer: Sensenich

  Model: W68GK-56-58

  Number of Blades: 2

  Propeller Diameter (inches): 68-70

- **OPERATING WEIGHTS***

  Maximum Takeoff Weight (lbs): 1320 lbs

  Maximum Landing Weight (lbs): 1320 lbs

  Maximum Weight in Baggage Compartment: 40 lbs

  *See weight and balance

3.1 Operating limitations

This section includes operating limitations and marking markings necessary for safe operation of the airplane, its engine, standard systems and standard equipment.

AIRSPEED LIMITATIONS

SPEED	KCAS (knots)	REMARKS
VS Stall speed at Maximum takeoff weight – Flaps up	43	
VSO Stall speed at Maximum takeoff weight – Flaps down	38	
VFE Maximum flap extend speed	70	Do not exceed this speed with flaps extended
VA Design maneuvering speed	82	Do not make full or abrupt control movements above this speed
VNE Never exceed speed	140	Do not exceed this speed in nay operation
VC Design cruise speed	108	Do not exceed this speed except in smooth air and then only with caution

V_{NE}	Never Exceed Speed is the speed limit that may not be exceeded at any time.
V_C	Maximum Structural Cruising Speed is the speed that should not be exceeded except in smooth air and only with caution.
V_S	Stalling Speed or the minimum steady flight speed at which the airplane is controllable (flaps up).
V_{SO}	Stalling Speed at which the airplane is controllable in the landing configuration.
V_X	Best Angle-of-Climb Speed is the air speed which delivers the greatest gain of altitude in the shortest horizontal distance.
V_Y	Best Rate-of-Climb Speed is the air speed which delivers the greatest gain in altitude in the shortest time.

Crosswind and wind limitation: 20kts

Service ceiling: 15,000 feet

Load factors (Limit):

Flap up:	Positive +4g Negative -2g	Flap extended:	Positive +2g Negative -0g

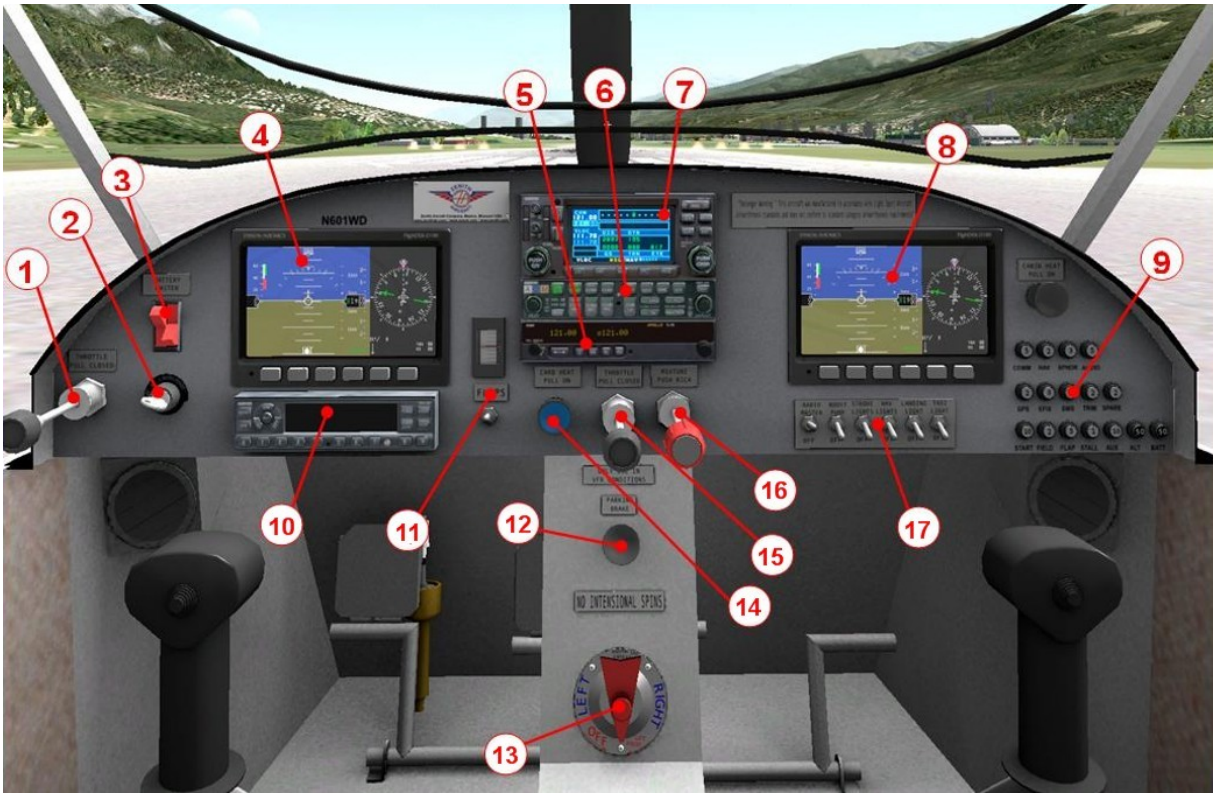
Prohibited maneuvers:

Intentional spins and aerobatics prohibited.

Flight into known or forecast icing conditions is prohibited.

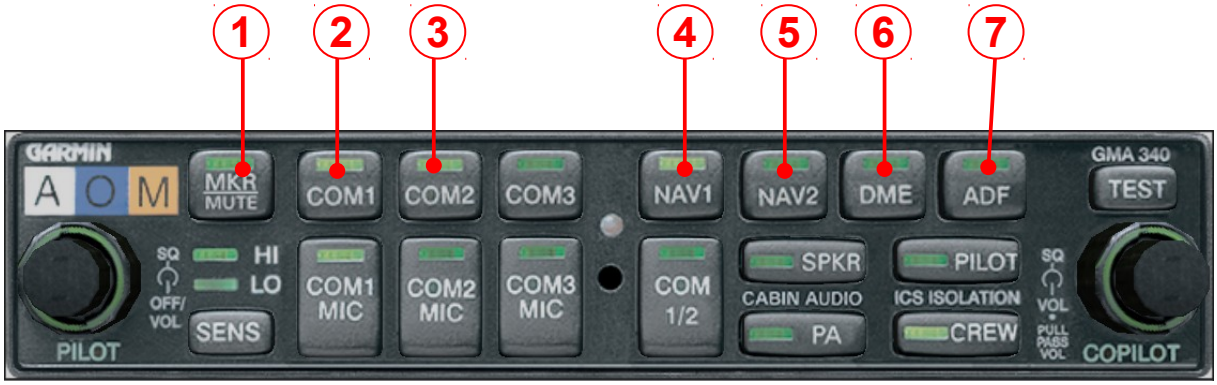
4 Cockpit description

4.1 General layout



1. Throttle handle
2. Ignition
3. Master switch
4. EFIS/ECAM
5. Radio COM
6. Audio panel
7. GNS540
8. EFIS/ECAM
9. Fuses
10. Transponder
11. Flaps control
12. Parking brake
13. Fuel selector
14. Carburetor heat
15. Throttle handle
16. Mixture handle
17. System switches

4.2 Garmin GMA340 Audiopanel*



1. Marker switch
2. Com1 switch
3. Com 2 switch
4. Nav1 switch
5. Nav2 switch
6. DME switch
7. ADF switch

* Light glows when selected, other buttons are inactive in this version.

4.3 Garmin SL40 COM

1. Power switch
2. Active/standby switch
3. Frequency selector

4.4 Garmin GNS430 GPS

See joined doc.

4.5 Garmin GTX 327 Squawk

Standby mode switch

1. Power On switch
2. Altitude mode switch
3. Power Off switch
4. Ident switch
5. VFR switch (squawk to 1200)
6. 0 to 7 switches
7. Reset timer
8. Start/Stop timer
9. Inop in this version

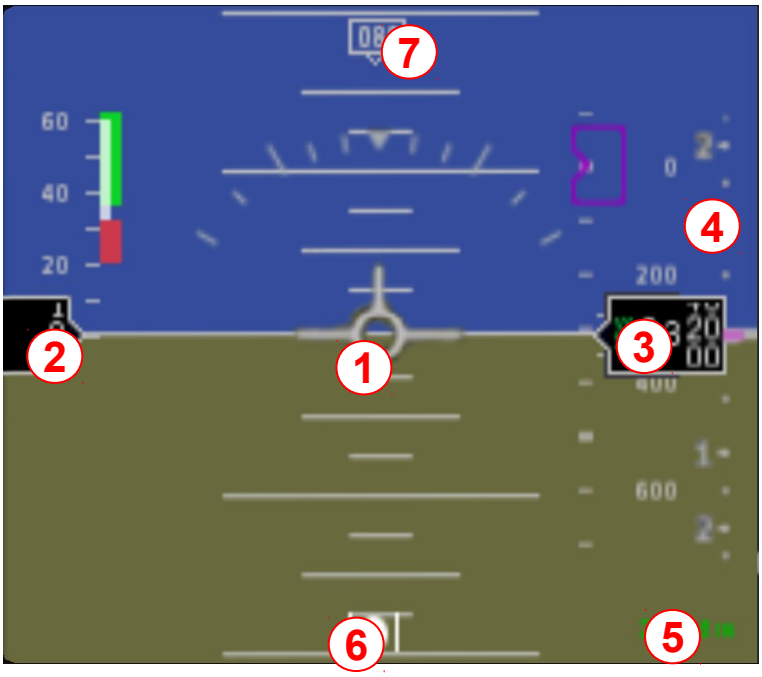
4.6 Dynon D180 EFIS

4.6.1 Buttons description

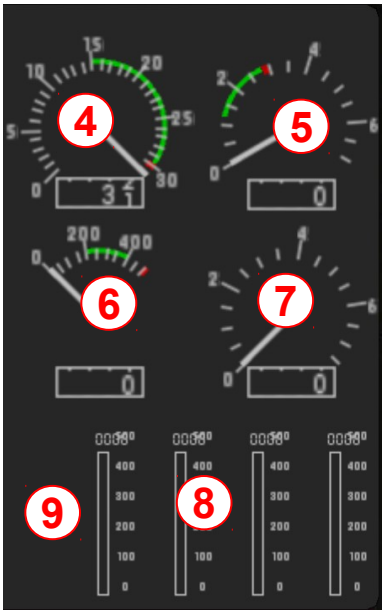
1. Inop in this version
2. Decrease HSI heading
3. Increase HSI heading
4. Set higher barometric pressure
5. Set lower barometric pressure
6. Cycle between right screens

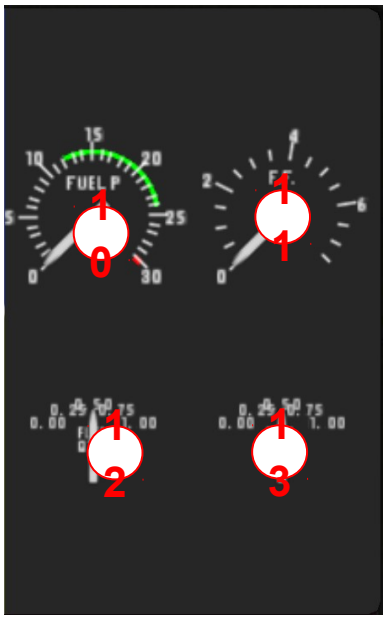
Inop = out of order (not used)

4.6.2 Screen descriptions



1. Artificial horizon
2. Indicated airspeed
3. Altitude
4. Vertical speed
5. Barometric pressure
6. Slide indicator (ball)
7. Heading





1. HSI
2. Wind direction and force
3. Ground speed
4. Manifold pressure
5. Engine RPM
6. Cylinder heat temperature (average)
7. Fuel flow
8. Cylinder heat temperature (each)
9. Flaps position
10. Fuel pressure
11. Fuel flow
12. Fuel quantity (left tank)
13. Fuel quantity (right tank)

5 Checklist

5.1 Starting

- Fuel selector . . . . . On
- Battery switch . . . . . On
- Mixture . . . . . Full Rich
- Carburetor heat . . . . . Pushed in
- Throttle . . . . . As required
- Prime . . . . . As required
- Auxiliary fuel pump . . . . . .On
- Starter . . . . . Engage until engine starts, then release
- Oil Pressure . . . . . .Check
- Alternator switch . . . . . .On

5.2 Taxiing

- Flaps. . . . . Checked up
- Elevator trim . . . . . Set to neutral / take off position
- Fuel selector valve . . . . . Checked
- Oil pressure and oil temperature. . . . . Checked
- Fuel quantity . . . . . Checked
- Volts and Amp meter. . . . . Checked
- Lights . . . . . .As required
- Radios and Navigation aids.. . . . . Set
- Mixture. . . . . .Full rich
- Auxiliary fuel pump . . . . . .On
- Set throttle for 1700 RPM. Check magnetos from "BOTH" to “R”, then from "BOTH" to “L”, and back to "BOTH" (on either one magneto, the RPM drop is approximately 100).
- Pull carburetor heat to check operation. (RPM will decrease by approximately 100 at 1700 RPM). Push carburetor heat in after check.

- Altimeter. . . . . Set
- Fasten seat belts, tighten. . . . . .Checked
- Canopy locked securely . . . . . Checked
- Freedom and deflection of controls. . . . . Checked

5.3 Normal Takeoff

- Brakes . . . . . .Released
- Mixture. . . . . Full rich
- Slowly advance throttle to Full Throttle
- Rotate approximately at Vy

5.4 Climb

- Max. power. . . . . 2750 RPM
- Canopy locked securely. . . . . .Checked
- Trim. . . . . .Set
- Oil temperature and pressure. . . . . .Checked

5.5 Cruise

- Trim. . . . . .Set
- Auxiliary fuel pump. . . . . Off
- Engine power. . . . . Set to 2550 RPM

5.6 Before Landing Check

- Auxiliary Fuel Pump. . . . . .On
- Mixture. . . . . Full rich
- Carburetor heat. . . . . On
- Flaps. . . . . As Required

- Speed. . . . . As Required
- Fasten seat belts, tighten. . . . . .Checked
- Lights . . . . . As Required

5.7 Landing (Flaps up)

- Approach Airspeed . . . . . .60 KIAS
- Trim. . . . . Set
- Landing speed. . . . . 60 to 65 KIAS
- Braking . . . . . .Minimum required

5.8 Landing (Flaps down)

- Approach Airspeed . . . . . .55 KIAS
- Trim. . . . . Set
- Landing speed. . . . . 55 to 60 KIAS
- Braking . . . . . .Minimum required

5.9 Shutdown

- Flaps . . . . . Up
- Magnetos. . . . . Checked
- Radios and Nav aids . . . . . .Off
- External lights . . . . . Off
- Auxiliary Fuel pump . . . . . .Off
- Mixture . . . . . .Pull/Out
- Magnetos (when propeller stops) . . . . . .Off
- Master. . . . . .Off
- All switches. . . . . .Off

6 Troubleshooting – Frequently asked questions (FAQ)

- I am getting an “error” message from X-Plane while loading the aircraft :

This add-on has been developed for X-Plane V9.70 and X-Plane 10.05+. Make sure you have these versions; if not, you should update your X-Plane to at least these versions. Go to x-plane.com and download the updater from the download section.

- My aircraft has a weird behavior, controls don’t respond as they should :

This may be caused by plug-ins provided with other aircraft. Try to de-activate them in the plug-in menu or move them out of the plug-in folder and then restart X-plane.

- My aircraft jerks on the ground, even with engine not running :

Try to adjust the number of flight models per frame in the “*Operations & warnings*” menu. A good value for most aircraft is between 2 and 3, but should be more (3-4) for light aircraft and helicopters. Changing this will have a limited impact on fps and you should always lower the rendering setting instead of lowering flight-model calculation to get higher frame-rate.

- Does this add-on will works in X-Plane 10 ?

Sure. It will be updated to run off X-plane 10.

7 Credits

Aircraft, textures, cockpit objects and panel by Olivier Faivre - HydroZ

Sounds courtesy of Nils (from x-plane.org)

Special thanks to:

- Zenith Aircraft Co. (USA)
- Zenair Limited (Canada)
- Nils who kindly allowed me to use his sounds.

Any problems ? Contact me at : contact@hydroz.net

8 Updates history

-16/02/2012

Starting development of the CH650B S-LSA

-06/07/2012

Version 1.0 ready !