



Federal Aviation
Administration



ZODIAC CH 601 XL AIRPLANE SPECIAL REVIEW TEAM REPORT APPENDICES DOCUMENT JANUARY 2010

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Appendix A Acronym Listing

AC	Advisory Circular
AOA	Angle of Attack
AMD	Aircraft Manufacturing & Design
CAA	Civil Aviation Authority
CAR	Civil Aviation Regulation
CASA	Civil Aviation Safety Authority
CFI	Certified Flight Instructor
CFR	Code of Federal Regulations
COS	Continued Operational Safety
CZAW	Czech Aircraft Works
DER	Designated Engineering Representative
E-LSA	Experimental Light Sport Aircraft
EAA	Experimental Aircraft Association
FAA	Federal Aviation Administration
FSDO	Flight Standards District Office
GPS	Global Positioning System
GVT	Ground Vibration Test
KCAS	Knots Calibrated Airspeed
KIAS	Knots Indicated Airspeed
KTAS	Knots True Airspeed
LAA	Light Aircraft Association
LSA	Light Sport Aircraft
LSJSC	Light Sport Joint Safety Committee
MIDO	Manufacturing Inspection District Office
MLA	Microlight Aircraft
MTOW	Maximum Takeoff Weight
MZFW	Maximum Zero Fuel Weight
NTSB	National Transportation Safety Board
POH	Pilot Operating Handbook
RTF	Ready-to-fly
SAIB	Special Airworthiness Information Bulletin
S-LSA	Special Light Sport Category Aircraft
S/N	Serial Number
TUHH	Hamburg University of Technology
UK	United Kingdom
WSTA	Wing Station
ZBAG	Zenith Builder Analysis Group

Appendix B Team Charter


Team Charter & Action Plan



FAA Special Review Team for Zodiac CH 601XL And Design Derivatives

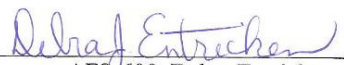
Management Approval Signatures:



ACE-100, Kimberly Smith


AIR-200, Frank Paskiewicz


AIR-100, Dave Hempe


acting AAI-1, Hooper Harris


AFS-600, Debra Entricken


AFS-800, Anne Graham

Final – June 1, 2009

1.0 Introduction

The FAA initially created the Light Sport Aircraft (LSA) category with the intent to raise the level of safety for certain airplanes typically flown as Experimental Amateur Built and as heavy ultra-lights. The intent was not to require the same level of safety expected for type certificated airplanes, but to leverage industry experience through a self-certification process based on ASTM consensus standards. The result has been a rapidly growing LSA industry, with over 60 new LSA designs and 1300 individual airframes recognized under the ASTM consensus standard process. With this rapid growth, the FAA is focused on maintaining a high level of LSA continued operational safety. All indications are that the consensus process is having its intended impact on light airplane safety, though some accidents have occurred. To help understand the nature of these LSA accidents, the FAA and EAA have created the Light Sport Joint Steering Committee. The FAA has also initiated a review program to look into LSA manufacturer's ability to adhere to the intent of the ASTM consensus process for design and airworthiness.

As a natural progression of these efforts to support LSA safety, the FAA is also chartering an internal team to look into details of one particular LSA design that has received recent attention from the media, the NTSB, and other airworthiness authorities: The Zenair Zodiac 601XL and its derivatives. The Zenair Zodiac 601XL is a small single-engine aircraft that has gained recent attention from the NTSB due to several in flight break-up accidents. Structural failures are of particular concern to the FAA and we have been following these accidents closely. This document outlines the team activities associated with this special review of the Zodiac.

2.0 Team Purpose

The FAA has done some preliminary investigations of the Zenair Zodiac 601XL in response to past accidents. Those investigations did not indicate any inherent design flaws with the design. However, the current attention from the NTSB has prompted the FAA to take a more detailed look at the 601XL design. The situation is complicated by the fact the NTSB suggested specific action against the 601XL with emphasis on the Light Sport standards, yet they cite accident data from events involving the SLSA and the Experimental Amateur Built version of the 601XL. Things are further complicated by the fact the Zodiac airplane exists in at least six different "forms": These include the original Zodiac 600, first produced as a kit plane in 1984, the 601HD, the 601HDS, the 601XL, the 601UL, and the 650. These variants share some common design features, but were all designed for different markets, including the home built market, the LSA market, and the European Micro light market.

There is also a Part 23 FAA type validated Zenair airplane called the CH2000 which was a Canadian built design. It is significantly different than the Zodiac series. However, some CH200 structural test data was used to substantiate the wing spar design of the 601XL. Despite these variants, the tendency is for any accidents to reflect poorly on the LSA version of the design, since the LSA consensus process is relatively new to the industry.

To investigate the details of the situation and help focus airworthiness concerns properly, the FAA's Special Review Team will look into the details of the different Zodiac designs and address any safety concerns. The basis for the investigation is 4 in-flight breakups: (2 Special Light Sport (SLSA); 1 Experimental Light Sport (ELSA), and 1 Amateur-

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built). Five other accidents with this model aircraft include 1 SLSA (fuel exhaustion); 2 ELSA (Loss Of Control / stall/spin on T.O.); and 2 Amateur-built (midair / TBD).

These accidents have gained recent attention from the NTSB and prompted recent airworthiness action by other Civil Aviation Authorities around the world. They have taken mixed actions, from limiting the airplane to a smaller operational envelope, to grounding the 601XL altogether. The FAA Special Review Team will investigate the proper action to be taken, focusing on the structure of the design, and the potential for flutter, and whether the airplanes are being operated properly.

3.0 Scope

The Zodiac Special Review Team will focus on design aspects and continued operational safety of all the Zenair designs, ranging from the certified CH200 to the Experimental Amateur built versions of the 601. The intent is to collect specific design and operational data for each design, and compare and contrast this information, identify any safety related issues, and recommend appropriate action to address them as required in a final report. The intent is to help focus NTSB and industry concerns in the right area, since the tendency is for all issues related to the homebuilt version of the Zodiac to be associated with the LSA version, even when this may not be appropriate.

4.0 Team Participation

Terry Chasteen in the Small Airplane Directorate has been chosen as the team lead to coordinate technical details of this Special Review of the Zenair Zodiac 601XL. He was chosen as the team lead since he is the Light Sport Program Manager for the Small Airplane Directorate, and the Zodiac 601XL tends to be seen as a Light Sport design. The team is charged with looking at the design aspects of all these versions to identify any safety related differences.

The Special Review Team will also consist of FAA experts familiar with each type of product, as listed below:

- AIR-200 – To address the Experimental Amateur Built version of the 601XL
- ACE-112 – To address the US built type certificated and Canadian built type validated versions of the airplane.
- ACE-111 – to address any technical issues that would require engineering review, such as concerns regarding structural strength, flutter, etc.
- ACE-114 – to address any issues related to the Special Light Sport version of the 601XL and any items related to the ASTM standards.
- AAI-200 – to provide perspective from FAA Accident Investigation
- AFS-610 – provide Sport Pilot related support as needed.
- Other FAA participants and subject matter experts as needed.

The respective managers of each of these branches are supporting this effort and have assigned points of contact for this effort within their staff. Resources already identified are listed below:

Team Members:

Wes Ryan, ACE-114, Management Focal

Pat Mullen, ACE-111, Alternate Management Focal

Bill Timberlake, ACE-112, Type Certification and Validation Process Focal

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ACE-114, LSA Team Lead and LSA Technical Focal
ACE-114, ASTM Standards Focal
ACE-111, Loads Analysis Engineer
ACE-111, Flutter Analysis Engineer
ACE-111, Stress Analysis Engineer
ACE-111, Flight Test Engineer
ACE-112, Test Pilot
ACE-113, Technical Writer
AIR-240, Manufacturing Focal
AAI-200, Accident Investigation Specialist
AFS-810, AFS General Aviation Branch Focal
AFS-610, Sport Pilot Branch Focal

5.0 Team Objectives

The main objectives of the Zodiac Special Review Team are:

- A. Compare the different versions of the 601XL through a data gathering effort,
- B. Identify any safety related problems for each with a particular focus on structural design, control system rigging, control force gradients, potential for flutter, airspeed calibration, and proper operations.
- C. Identify potential root causes for any safety related problems identified, and
- D. Recommend an acceptable course of action to address them, recognizing each derivative of the Zodiac will be subject to established continued airworthiness enforcement procedures applicable, as follows:
 - Experimental Amateur Built – Potential Airworthiness Action
 - SLSA – Coordination with the SLSA manufacturer according to ASTM Continued Operational Safety procedures, and potential airworthiness action.
 - Canadian Manufactured Aircraft – Coordination with the state of design and potential Airworthiness Directive action
 - Type Certificated Aircraft – Potential Airworthiness Directive Action

6.0 Team Deliverables

The team will be expected to deliver a final report of their findings to FAA management. This report should provide a technical basis to support any suggested course of action for the 601XL. It should also contain a description of the differences in the various Zodiac models.

7.0 Team Member General Tasking

The Team Members will be tasked according to the following sections, with other detailed duties as assigned by the team lead or management representatives as the investigation matures.

7.1 Management Focal

Task 7.1.1 Provide general leadership to the team to keep team evaluations on track to meet tasking requirements and deliverables of this Charter.

Task 7.1.2 Provide regular status updates to ACE-100 management on the team's progress.

7.2 Light Sport Program Manager & Technical Team Lead

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Task 7.2.1 Provide general guidance to the team to focus team evaluations of the Zodiac derivatives, identifying and comparing any significant differences between the type certificated version, the SLSA version, and the kit built version.

Task 7.2.2 Provide general leadership to the team, coordinate technical disciplines, collect technical information, and coordinate development of the final team report.

Task 7.2.3 Coordinate all contact between team members, stake holders, and interested parties. Organize and host weekly meetings for the team members, providing technical guidance as needed.

Task 7.2.4 Provide status updates to management as requested.

Task 7.2.5 Collect and coordinate all recommended changes to the ASTM standards with the F37 committee. .

7.3 Test Pilot

Task 7.3.1 Evaluate the pilot skills necessary to fly the Zodiac.

Task 7.3.2 Visit with company representatives, owners groups, and others familiar with the design to identify any special characteristics of the design.

Task 7.3.3 Recommend safety related changes to the flight characteristics of the design, as needed.

Task 7.3.4 Evaluate the applicable ASTM standards regarding handling qualities, pilot skill, etc. and recommend changes as needed to the F37 ASTM committee.

Task 7.3.5 Review flight evaluation data, if available, from the NTSB, foreign authorities, and other sources for the Zodiac designs.

Task 7.3.6 Provide appropriate FAA position and recommendations in the FAA final report related to this technical discipline.

7.4 Flight Test Engineer

Task 7.4.1 Evaluate the flight characteristics and performance of the Zodiac designs.

Task 7.4.2 Visit with company representatives, owners groups, and others familiar with the design to identify any special characteristics of the design that distinguish it from other LSA or Homebuilt aircraft.

Task 7.4.3 Recommend safety related changes to the flight characteristics of the design, as needed.

Task 7.4.4 Evaluate the applicable ASTM standards regarding handling qualities, performance, stick force gradients, control system rigging, etc. and recommend changes as needed to the F37 ASTM committee.

Task 7.4.5 Review flight test data, if available, from the NTSB, foreign authorities, and other sources for the Zodiac designs.

Task 7.4.6 Provide appropriate FAA position and recommendations in the FAA final report related to this technical discipline.

7.5 Stress Analysis Engineer

Task 7.5.1 Evaluate the structural design of the Zodiac derivatives, identifying and comparing any significant design changes

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between the type certificated version, the SLSA version, and the kit built version.

- Task 7.5.2** Visit with company structural engineers, their representatives, owners groups, and others familiar with the design to identify any special structural characteristics of the design that distinguish it from other LSA or Homebuilt aircraft.
- Task 7.5.3** Recommend safety related changes to the flight characteristics of the design, as needed.
- Task 7.5.4** Evaluate the applicable ASTM standards regarding structural strength, the data requirements to document compliance to the ASTM standards, and their completeness, recommending changes as needed to the F37 ASTM committee.
- Task 7.5.5** Review flutter analysis data from the NTSB, foreign authorities, and other sources for the Zodiac designs.
- Task 7.5.6** Provide appropriate FAA position and recommendations in the FAA final report related to this technical discipline.

7.6 Load Analysis Engineer

- Task 7.6.1** Evaluate the load analysis for the design of the Zodiac derivatives, identifying and comparing any significant differences between the type certificated version, the SLSA version, and the kit built version regarding items that may have impacted the load analysis.
- Task 7.6.2** Visit with company structural engineers, their representatives, owners groups, and others familiar with the design to identify any special load and center of gravity characteristics of the design that distinguish it from other LSA or Homebuilt aircraft.
- Task 7.6.3** Recommend safety related changes to the load analysis and characteristics of the design, as needed.
- Task 7.6.4** Evaluate the applicable ASTM standards regarding load analysis, the data requirements to document compliance to the ASTM standards, and their completeness, recommending changes as needed to the F37 ASTM committee.
- Task 7.6.5** Review flutter analysis data from the NTSB, foreign authorities, and other sources for the Zodiac designs.
- Task 7.6.6** Provide appropriate FAA position and recommendations in the FAA final report related to this technical discipline.

7.7 Flutter Analysis Engineer

- Task 7.7.1** Evaluate the design of the Zodiac derivatives, identifying and comparing any significant differences between the type certificated version, the SLSA version, and the kit built version regarding items that may have impacted the flutter characteristics and susceptibility of the designs.
- Task 7.7.2** Visit with company structural engineers, their representatives, owners groups, and others familiar with the design to identify any special flutter related characteristics of the design that distinguish it from other LSA or Homebuilt aircraft.

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- Task 7.7.3** Recommend safety related changes to the flutter analysis and characteristics of the design, as needed.
- Task 7.7.4** Evaluate the applicable ASTM standards regarding flutter analysis, the data requirements to document compliance to the ASTM standards, and their completeness, recommending changes as needed to the F37 ASTM committee
- Task 7.7.5** Review flutter analysis data from the NTSB, foreign authorities, and other sources for the Zodiac designs.
- Task 7.7.6** Provide appropriate FAA position and recommendations in the FAA final report related to this technical discipline.

7.8 Type Certification and Validation Focal

- Task 7.8.1** Provide resources related to type validation and type certification procedures for the CH2000 Canadian version of the Zodiac.
- Task 7.8.2** Coordinate contact with foreign authorities as needed to support this effort.

7.9 Manufacturing Focal

- Task 7.9.1** Coordinate with AIR-200 resources and other LSAJSC team members in Headquarters as needed.
- Task 7.9.2** Support manufacturing related data reviews for evaluation of the Zodiac derivatives.
- Task 7.9.3** Support on-site visits to the different production facilities for the Zodiac derivatives, as requested.

7.10 Accident Investigation Focal

- Task 7.10.1** Provide accident data related technical analysis for the Zodiac derivatives, paying particular attention to differences in the operational safety between the type-certificated, the light sport, and amateur built versions of the aircraft.
- Task 7.10.2** Provide analysis of the type of pilot flying each Zodiac derivative, and how this impacts operational safety. This is meant to identify whether Sport Pilots have a different safety record in this type of aircraft than fully rated private pilots.
- Task 7.10.3** Provide input to the final report regarding accident data and accident analysis as requested. This will require the team to agree on a likely root cause for the accidents in question based on the information available.

7.11 Technical Writer

- Task 7.11.1** Provide technical writing resources for creation of team updates, management reviews, and the final reports.
- Task 7.11.2** Collect and communicate final recommendations to the ASTM F37 standards with team lead for coordination with ASTM focal.

8.0 Schedule and Milestones

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Preliminary discussions with the manufacturer to coordinate data sharing occurred on April 13, 2009 and will continue at the Sun-N-Fun Airshow April 21-26 in Lakeland FL. These meetings will be used to determine dates for data collection on site and discussions with the manufacturer, foreign authorities, and other stakeholders. Conceptually, the schedule for this Special Review

Team activity will be:

- Conduct Discussions with the Manufacturer at Sun-N-Fun by April 27
- Hold Team Kick off by May 1 to review deliverables and proposed schedule
- Conduct an on-site visit to Mexico MO for team member familiarization with the Zodiac design in May, 2009. Target date is May 21.
- Conduct on site visits with Transport Canada and Zenair in Midland Ontario, Canada in early June 2009. Target is June 1-5. Engineering data exists for all the Zodiac derivatives at this Zenair facility in Canada.
- Plan for a potential trip to meet with European authorities in Brussels regarding accidents in Europe, and their resulting airworthiness actions that have been taken. This would provide an opportunity for FAA to meet with Zenair representatives from Europe, as well as Dutch, Spanish, English, and German authorities to review the design.
- Coordinate with John Clarke and Brian Murphy to plan for a technical meeting with NTSB. Objective is for them to share their justifications and analysis behind each recommendation. Their decision to ground the entire fleet seems extreme, since most concerns seem to focus on the Amateur built version of the airplane instead of the LSA version.
- Work with Matthew Heinz to schedule flights in the CH2000, and the S-LSA version of the Zodiac for FAA flight test specialists.
- Conduct on site visits with AMD in Eastman, GA as needed with manufacturing team members.
- Provide interim report by end of July, 2009.
- Provide final report by August or September of 2009, depending on technical details uncovered. (Due to the Safety Directive Process, this was delayed until November, 2009)
- Additional items as needed.

Charter Attachment 1 – Design Details and Investigation Background

1.0 Design Background and Investigation History

LSA Zodiac CH 601XL AMD – Eastman, GA

Design and Production: ASTM International Consensus Standards

- There has been one in-flight breakup accident involving an SLSA aircraft from AMD. The other SLSA involved was manufactured by Czech Aircraft Works.
- Completed FAA review of the aircraft to the design and production standards – ASE Structures from ACE-113 and Light Sport Aircraft Manager - 2006.
- Visited the manufacturer as part of the LSA Manufacturer Assessment Program activity – Sept. 2008. There are now approx. 50 aircraft produced as SLSA by AMD.
- Reviewed structure and flutter concerns of this design – ASE Airframe, ACE-111, Jan. 2009.
- Discussed flutter concerns with Matthieu Heintz of AMD at the US Sport Aviation Expo in Sebring, FL. He responded that they were looking at adding balance weights to the ailerons and introducing friction into the light control system stick forces. They have already issued service information to owners/operators to check the aileron control cable tensions – Jan. 2009.
- EAA and FAA are in the process of forming a team of industry and FAA personnel to work LSA flight safety issues such as this issue with the CH 601XL.
- Recommended to the ASTM F37 Light-Sport Aircraft Committee that a review of the airplane standard for flutter requirements be reviewed for adequacy – Apr. 2009.

Amateur-Built Kit Zodiac CH 601XL Zenith Aircraft Company – Mexico, MO

Design and Production: No standards

- There has been one in-flight breakup accident involving an amateur-built aircraft.
- No FAA review has been conducted of the amateur-built process for this aircraft design.
- Any FAA investigation conducted for amateur-built aircraft will need to be coordinated through AIR-200.
- Aircraft builder is allowed to deviate in any way from the kit supplied by the manufacturer.

FAA Type Certified Alarus CH2000 Zenair LTD – Ontario, CANADA

Design and Production: FAA TCDS TA5CH / PC 339CE (Canadian DOT Approval No. A-185)

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- Canada is state of design and state of manufacturing for certain serial numbers; Aircraft Manufacturing & Development Co. in the U.S. is also the manufacturer of certain serial numbers.
- No FAA review has been conducted of the design of this model aircraft subsequent to initial approval.
- Until the PC was surrendered, the U.S. manufacturer was under the production surveillance process as required by Order 8120.2.

2.0 Design History

LSA Zodiac CH 601XL

The Zenith Zodiac CH-601 XL is a high-performance single-engine, two-seat, low-wing, all metal microlight airplane with a fixed tricycle undercarriage with steerable nosewheel. The CH-601 was developed in the early 1990s by Chris Heintz, founder and chief designer of Zenair. The Zodiac CH 601 HD (heavy-duty model) is the basic Zodiac model, based on the original CH 600 aircraft developed in 1984 as a primary trainer. The **Zodiac CH 601 XL** has a new airfoil and larger wing area than its predecessor. In 1992, Heintz licensed the kit manufacturing and marketing rights to Zenith Aircraft Company for the Zodiac CH 601 and the STOL CH 701 designs. In 1992, Heintz also entered into a license agreement with Czech Aircraft Works of Stare Mesto, Czech Republic, to produce and market his Zodiac CH 601 and STOL CH 701 designs for the European market. The Czech-produced Zodiacs were modified and lightened to meet European rules for microlight aircraft. CZAW produced some 750 such machines under this agreement. On 31 December 2006, after the license agreement, under which the Zenair Zodiac CH 601 and STOL CH 701 light aircraft designs were produced by CZAW, was terminated the Czech production came to an end. Zenith's Zodiac XL factory demonstrator is powered by a six cylinder 110 HP Jabiru 3300 engine. The 116 HP Lycoming O-235, the 100 HP Continental O-200, the 100 HP Rotax 912S and the 110 HP Corvair engines have also been installed and successfully flown.

AMD is now also offering the newly redesigned Zodiac - the Zodiac CH 650 LS and LSi - fully certified SLSA.



AMD

Heart of Georgia Regional Airport
415 Airport Road,
Eastman, Georgia 31023 USA

Appendix B
Amateur-Built Kit Zodiac CH 601XL

The Zenair CH-601 is manufactured in kit form by Zenith Aircraft Company, Mexico, Missouri in the USA. In kit form, the aircraft is deliverable as a Basic kit and as a Quick-build kit. The Basic kit, or 49% Zodiac airframe kit requires about one year (or about 450 hours) to build the aircraft, the quik-build kit just 120 hours.



Zenith Aircraft Company
Mexico Memorial Airport, PO Box 650
Mexico, Missouri, 65265-0650 USA.

FAA Type Certified Alarus CH2000

The Alarus is FAA type certified Utility/Normal and IFR. This is NOT a Light Sport Aircraft (LSA). The all metal, semi-monocoque stressed skin construction with internal ribs, longerons, and bulkheads distribute the loads.

Currently the Alarus is offered in two variants: the AMD Alarus CH2000 general aviation aircraft and the SAMA CH2000 Military Tactical Surveillance Aircraft (MTSA).

In February 2008 there were 113 CH2000 Alarus registered in the USA and four in Canada. (They do not share a similar wing design with the CH 601 XL or CH 650.)



Zenair Ltd
P.O. Box 235
Midland ON Canada L4R 4K8

Appendix C CH 601 XL and CH 650 Design Details

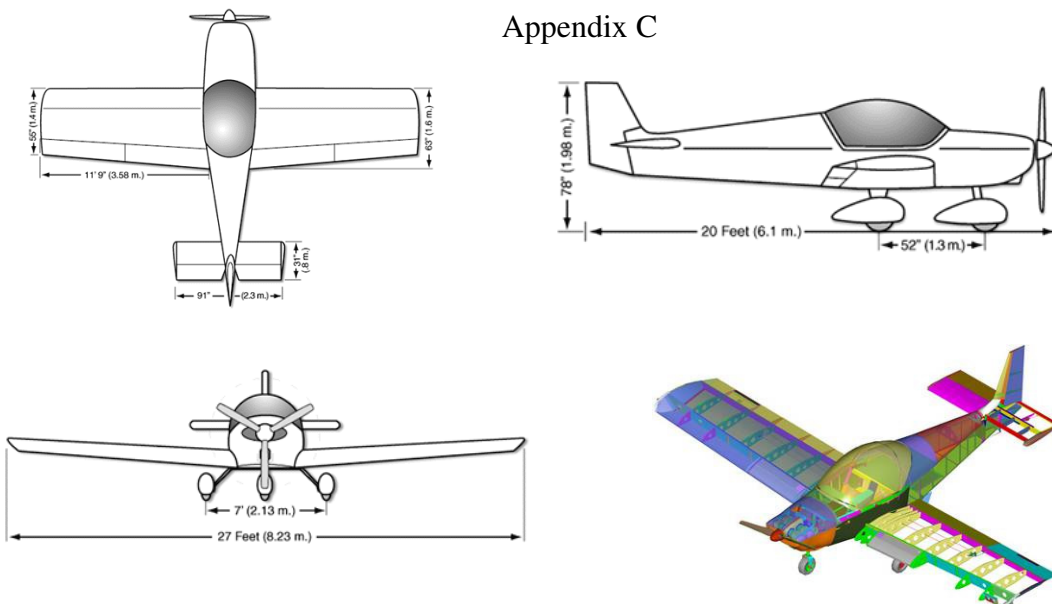
Zenith Aircraft Company introduced the Zodiac CH 601 XL at the 1998 Experimental Aircraft Association (EAA) AirVenture. The CH 601 XL was referred to as a fresh design “off the drafting table.” Zenith reported the Zodiac CH 601 XL as having “a new airfoil and larger wing area than its predecessor, which allows the new aircraft to perform faster and with higher payloads. With wing flaps, stall speed has been kept low for recreational pilots” and that “the XL has been configured to take full advantage of its increased useful load: New and larger wing tanks offer a larger fuel capacity (26 US Gal.) resulting in superior range and endurance....”

The Zodiac CH 601 XL is an all-metal, two seat, low-wing, fixed-gear, single engine airplane. The Zodiac CH 601 XL received its first airworthiness certificate as an S-LSA in 2005. The aircraft is available for purchase either as a kit that the owner assembles (amateur-built) or a ready-to-fly light-sport category aircraft.

SPECIFICATIONS ZODIAC CH601 XL	<u>Jabiru 3300</u> (110 hp @ 3000 rpm)		<u>Rotax 912S</u> (100 hp)		<u>Lycoming O-235</u> (116 hp)	
WING SPAN	27 FT.	8.23 m.	27 FT.	8.23 m.	27 FT.	8.23 m.
WING AREA	132 SQ. FT.	12.3 m.sq.	132 SQ. FT.	12.3 m.sq.	132 SQ. FT.	12.3 m.sq.
LENGTH	20 FT.	6.1 m.	20 FT.	6.1 m.	20 FT.	6.1 m.
HORIZONTAL TAIL SPAN	7 FT. 7 IN.	2.30 m.	7 FT. 7 IN.	2.30 m.	7 FT. 7 IN.	2.30 m.
RUDDER TIP HEIGHT	6 FT. 6 IN.	1.98 m.	6 FT. 6 IN.	1.98 m.	6 FT. 6 IN.	1.98 m.
EMPTY WEIGHT	695 LB.	318 kg.	690 LB.	312 kg.	800 LB.	362 kg.
USEFUL LOAD	625 LB.	282 kg.	630 LB.	285 kg.	520 LB.	235 kg.
GROSS WEIGHT	1,320 LB.	595 kg.	1,320 LB.	595 kg.	1,320 LB.	595 kg.
WING LOADING	9.85 psf	48 kg/sq.m.	9.85 psf	48 kg/sq.m.	9.85 psf	48 kg/sq.m.
FUEL CAPACITY (wing tanks)	= 24 Gal. (US)	2 x 46 l. = 92 l.	= 24 Gal. (US)	2 x 46 l. = 92 l.	= 24 Gal. (US)	2 x 46 l. = 92 l.
POWER LOADING	11.8 LB./HP	5.3 kg/HP	13 LB./HP	5.9 kg/HP	11.2 LB./HP	5.1 kg/HP
CABIN WIDTH	44 INCHES	112 cm.	44 INCHES	112 cm.	44 INCHES	112 cm.
LOAD FACTOR (G) ultimate	+/- 6 g		+/- 6 g		+/- 6 g	

Figure 1 Zodiac CH 601 XL Specifications

Appendix C



PERFORMANCE	<u>Rotax 912S</u> (100 hp)		<u>Jabiru 3300</u> (110 hp @ 3000 rpm)		<u>Lycoming O-235</u> (115 hp)	
ZODIAC CH601 XL	Gross Weight 1,300 lbs.	Gross Weight 590 kg.	Gross Weight 1,300 lbs.**	Gross Weight 590 kg.**	Gross Weight 1,300 lbs.	Gross Weight 590 kg.
MAX CRUISE (sea level, continuous)	134 mph	216 km/h	138 mph	222 km/h	138 mph	222 km/h
75% CRUISE @ 8,000 ft. (TAS*)	155 mph	250 km/h	160 mph	258 km/h	160 mph	258 km/h
VNE	180 mph	290 km/h	180 mph	290 km/h	180 mph	290 km/h
Vs1 STALL SPEED - no flaps	51 mph	82 km/h	51 mph	82 km/h	52 mph	84 km/h
Vso STALL SPEED - flaps down	44 mph	70 km/h	44 mph	70 km/h	44 mph	70 km/h
RATE OF CLIMB	900 fpm	4.6 m/s	1200 fpm	6.1 m/s	930 fpm	4.8 m/s
TAKE-OFF ROLL	550 feet	168 m.	500 feet	152 m.	500 feet	152 m.
LANDING DISTANCE	500 feet	152 m.	500 feet	152 m.	500 feet	152 m.
RANGE (std., SM)	656 miles	1056 km.	662 miles	1065 km.	575 miles	925 km.
ENDURANCE (std.)	4.9 hours	4.9 hours	4.8 hours	4.8 hours	4.2 hours	4.2 hours
LOAD FACTOR (G) ultimate	+/- 6 g	+/- 6 g	+/- 6 g	+/- 6 g	+/- 6 g	+/- 6 g

Performance figures given at standard atmosphere, sea level, no wind, unless otherwise indicated. All technical data, specification and performance figures subject to change without notice. Range and endurance figures are quoted with no fuel reserve.

* TAS is indicated airspeed corrected for temperature and altitude. The corrections are approximate.

** Jabiru 3300: preliminary flight test results, with 350 lbs. load. Cruise at 2800 rpm.

Figure 2 – Zodiac CH 601 XL Performance

<i>AMD ZODIAC</i>			
PERFORMANCE (AT GROSS)	CONTINENTAL 0-200 (100 HP)	SPECIFICATIONS (STANDARD)	CONTINENTAL 0-200 (100 HP)
CRUISE SPEED (TAS)	130 MPH	CABIN WIDTH	44 INCHES
STALL NO FLAPS (LSA)	51 MPH	EMPTY WEIGHT	770 LBS
STALL WITH FLAPS	44 MPH	GROSS WEIGHT	1320 LBS
RATE OF CLIMB	1,000 FPM	USEFUL LOAD	550 LBS
FUEL CAPACITY	30 GAL	DESIGN LOAD (ULT)	+6/-3 G
ENDURANCE	5.5 HRS	SERVICE CEILING	12,000 FT
RANGE (MILES)	715 MILES	WING AREA	132 SQ. FT

Figure 3 – Zodiac CH 650 Performance

Appendix C

Summary of design variations	Zodiac CH 601 XL					
	Zodiac CH601XL Kit or Plans Built from Zenith	Zodiac CH601XL E-LSA Kit or Plans Built from Zenith	Zenair CH 601 XL	Zenair CH 601 XL	Zenair CH 601 XL	ZODIAC CH 601 XL
Producer	Zenith Aircraft Co.	Zenith Aircraft Co.	Czech Aircraft Works (CZAW)	Czech Aircraft Works	Czech Aircraft Works	AMD
Form	Build from Plans-Only, Component Kits or Parts, Complete Kit (49%)	Build from Plans-Only, Component Kits or Parts, Complete Kit (49%)	RTF, Kits, Some component kits / plans	RTF, Kits, Some component kits / plans	RTF	RFT S-LSA
	Standard Kit	Standard Kit	European Microlight		USA S-LSA or E-LSA	USA S-LSA
Airworthiness Category / Registration	Amateur Built - Experimental	E-LSA (some registered as E-LSA during the transition phase)	Microlight, ULM, "experimental"	Amateur-Built Experimental	S-LSA / E-LSA	S-LSA
Location	Worldwide / Except Europe	Worldwide / Except Europe	Europe (France, UK, Belgium, Germany, etc.)	Outside Europe (USA, Canada, Asia...)	USA	USA
Empty Weight	700 - 850 lbs.	700 - 850 lbs.	?	?	?	800
Gross Weight	1232 - 1320 lbs.	1232 - 1320 lbs.	490 kg (1000 lbs)	?	?	1320
Installed Powerplant	Jabiru 3300, O-200, Subaru, O-235, etc	Jabiru 3300, O-200, O-235	Rotax 912S, Jabiru 3300	Rotax 912S	Rotax 912S	O-200
Wing Span	27 ft.	27 ft.	27 ft.	27 ft.	27 ft.	27 ft.
Standard:	Built to Plans, as issued by Chris Heintz	Built to Plans, as issued by Chris Heintz	Built to Plans, as issued by Chris Heintz, Modified to meet category	??	??	Built to Plans, as issued by Chris Heintz to meet US S-LSA
Deviation:	Amateur Built Manufacturer is the amateur builders	Amateur Built Manufacturer is the amateur builders	??	??	??	S-LSA
	Engine choices (see above)	Engine choices (see above)				
Option: Landing Gear Configuration	Tricycle (standard) or taildragger	Tricycle (standard) or taildragger	Tricycle / taildragger	Tricycle / taildragger	Tricycle / taildragger	Tricycle Only
Gear Spring	6061-T6 spring gear	6061-T6 spring gear	2-piece Fiberglass gear spring (lightweight)	2-piece Fiberglass gear spring (lightweight)	2-piece Fiberglass gear spring (lightweight)	6061-T6 spring gear
Control system	Single stick (standard) / Dual stick option	Single stick (standard) / Dual stick option	Single stick (standard) / Dual stick option	Single stick (standard) / Dual stick option	Single stick (standard) / Dual stick option	Dual stick only
Wing Baggage Lockers	Optional Wing Baggage lockers	Optional Wing Baggage lockers	Optional Wing Baggage lockers	Optional Wing Baggage lockers	Optional Wing Baggage lockers	??
Aileron Hinge System	Flex skin standard; optional piano hinge	Flex skin standard; optional piano hinge	??	??	??	Piano hinge only
Wing Spars Assembly	Zenair Ltd.	Zenair Ltd.	CZAW	CZAW	CZAW	Zenair Ltd.
Fuel System	12 gal. X 2; or optional 15 gal. X 2	12 gal. X 2; or optional 15 gal. X 2	??	??	??	12 gal. X 2

Figure 4 – Zodiac CH 601 XL Design Variations

Appendix D Applicable 14 CFR Part 1 and 21 Requirements

Sec. 1.1

General definitions.

Light-sport aircraft means an aircraft, other than a helicopter or powered-lift that, since its original certification, has continued to meet the following:

- (1) A maximum takeoff weight of not more than--
 - (i) 1,320 pounds (600 kilograms) for aircraft not intended for operation on water; or
 - (ii) 1,430 pounds (650 kilograms) for an aircraft intended for operation on water.
- (2) A maximum airspeed in level flight with maximum continuous power (VH) of not more than 120 knots CAS under standard atmospheric conditions at sea level.
- (3) A maximum never-exceed speed (VNE) of not more than 120 knots CAS for a glider.
- (4) A maximum stalling speed or minimum steady flight speed without the use of lift-enhancing devices (VS1) of not more than 45 knots CAS at the aircraft's maximum certificated takeoff weight and most critical center of gravity.
- (5) A maximum seating capacity of no more than two persons, including the pilot.
- (6) A single, reciprocating engine, if powered.
- (7) A fixed or ground-adjustable propeller if a powered aircraft other than a powered glider.
- (8) A fixed or autofeathering propeller system if a powered glider.
- (9) A fixed-pitch, semi-rigid, teetering, two-blade rotor system, if a gyroplane.
- (10) A nonpressurized cabin, if equipped with a cabin.
- (11) Fixed landing gear, except for an aircraft intended for operation on water or a glider.
- (12) Fixed or retractable landing gear, or a hull, for an aircraft intended for operation on water.
- (13) Fixed or retractable landing gear for a glider.

Sec. 21.190

[Issue of a special airworthiness certificate for a light-sport category aircraft.]

[(a) Purpose. The FAA issues a special airworthiness certificate in the light-sport category to operate a light-sport aircraft, other than a gyroplane.

(b) Eligibility. To be eligible for a special airworthiness certificate in the light-sport category:

- (1) An applicant must provide the FAA with--
 - (i) The aircraft's operating instructions;
 - (ii) The aircraft's maintenance and inspection procedures;
 - (iii) The manufacturer's statement of compliance as described in paragraph (c) of this section; and
 - (iv) The aircraft's flight training supplement.
- (2) The aircraft must not have been previously issued a standard, primary, restricted, limited, or provisional airworthiness certificate, or an equivalent airworthiness certificate issued by a foreign civil aviation authority.
- (3) The aircraft must be inspected by the FAA and found to be in a condition for safe

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operation.

(c) Manufacturer's statement of compliance for light-sport category aircraft. The manufacturer's statement of compliance required in paragraph (b)(1)(iii) of this section must--

- (1) Identify the aircraft by make and model, serial number, class, date of manufacture, and consensus standard used;
 - (2) State that the aircraft meets the provisions of the identified consensus standard;
 - (3) State that the aircraft conforms to the manufacturer's design data, using the manufacturer's quality assurance system that meets the identified consensus standard;
 - (4) State that the manufacturer will make available to any interested person the following documents that meet the identified consensus standard:
 - (i) The aircraft's operating instructions.
 - (ii) The aircraft's maintenance and inspection procedures.
 - (iii) The aircraft's flight training supplement.
 - (5) State that the manufacturer will monitor and correct safety-of-flight issues through the issuance of safety directives and a continued airworthiness system that meets the identified consensus standard;
 - (6) State that at the request of the FAA, the manufacturer will provide unrestricted access to its facilities; and
 - (7) State that the manufacturer, in accordance with a production acceptance test procedure that meets an applicable consensus standard has-
 - (i) Ground and flight tested the aircraft;
 - (ii) Found the aircraft performance acceptable; and
 - (iii) Determined that the aircraft is in a condition for safe operation.
- (d) Light-sport aircraft manufactured outside the United States. For aircraft manufactured outside of the United States to be eligible for a special airworthiness certificate in the light-sport category, an applicant must meet the requirements of paragraph (b) of this section and provide to the FAA evidence that--
- (1) The aircraft was manufactured in a country with which the United States has a Bilateral Airworthiness Agreement concerning airplanes or Bilateral Aviation Safety Agreement with associated Implementation Procedures for Airworthiness concerning airplanes, or an equivalent airworthiness agreement; and
 - (2) The aircraft is eligible for an airworthiness certificate, flight authorization, or other similar certification in its country of manufacture.]

Sec. 21.191

Experimental certificates.

Experimental certificates are issued for the following purposes:

(g) *Operating amateur-built aircraft.* Operating an aircraft the major portion of which has been fabricated and assembled by persons who undertook the construction project solely for their own education or recreation.

[(i) *Operating light-sport aircraft.* Operating a light-sport aircraft that-

- (1) Has not been issued a U.S. or foreign airworthiness certificate and does not meet the

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provisions of §103.1 of this chapter. An experimental certificate will not be issued under this paragraph for these aircraft after January 31, 2008;

(2) Has been assembled-

(i) From an aircraft kit for which the applicant can provide the information required by §21.193 (e); and

(ii) In accordance with manufacturer's assembly instructions that meet an applicable consensus standard; or

(3) Has been previously issued a special airworthiness certificate in the light- sport category under

§21.190.]

Appendix E Number of AMD S-LSA Airplanes and Dates Manufactured

Airplane Model	Serial Number	Registration Number (N – number)	Date of Manufacture
CH 601 XL	6-9581	N601NC	08/11/2005
CH 601 XL	005	N601KF	12/07/2005
CH 601 XL	601-001S	N601ZP	12/29/2005
CH 601 XL	601-002S	N343SS	03/17/2006
CH 601 XL	601-003S	N915WD	03/17/2006
CH 601 XL	601-004S	N684JM	04/01/2006
CH 601 XL	601-005S	N2601	04/01/2006
CH 601 XL	601-006S	N601NM	04/28/2006
CH 601 XL	601-007S	N/A	N/A
CH 601 XL	601-008S	N324RJ	06/01/2006
CH 601 XLi	601-009S	N323SQ	05/17/2006
CH 601 XL	601-010S	N/A	N/A
CH 601 XL	601-011S	N189GS	06/12/2006
CH 601 XL	601-012S	N602BS	06/28/2006
CH 601 XL	601-013S	N620TH	08/03/2006
CH 601 XL	601-014S	N106WL	07/12/2006
CH 601 XL	601-015S	N/A	N/A
CH 601 XL	601-016S	N158MD	07/20/2006
CH 601 XL	601-017S	N601VB	08/15/2006
CH 601 XLi	601-018S	N701DP	08/28/2006
CH 601 XLi	601-019S	N6170G	09/06/2006
CH 601 XL	601-020S	N/A	N/A
CH 601 XL	601-021S	N183AM	09/28/2006
CH 601 XL	601-022S	N849XL	10/25/2006
CH 601 XL	601-023S	N406CB	09/13/2006
CH 601 XL	601-024S	N601WH	10/25/2006
CH 601 XL	601-025S	N329JG	10/26/2006
CH 601 XLi	601-026S	N623HS	11/07/2006
CH 601 XL	601-027S	N7812P	12/08/2006
CH 601 XLi	601-028S	N601GH	01/30/2007
CH 601 XLi	601-029S	N807HA	0219/2007

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Airplane Model	Serial Number	Registration Number (N – number)	Date of Manufacture
CH 601 XL	601-030S	N9743V	03/23/2007
CH 601 XL	601-031S	N39DN	03/16/2007
CH 601 XL	601-032S	N45FB	04/18/2007
CH 601 XL	601-033S	N601JH	05/08/2007
CH 601 XL	601-034S	N653AM	05/22/2007
<i>CH 601 XL</i>	<i>601-035S</i>	<i>N/A</i>	<i>N/A</i>
<i>CH 601 XL</i>	<i>601-036S</i>	<i>N/A</i>	<i>N/A</i>
<i>CH 601 XL</i>	<i>601-037S</i>	<i>N/A</i>	<i>N/A</i>
CH 601 XL	601-038S	N928WB	06/05/2007
CH 601 XLi	601-039S	N308DH	06/25/2007
CH 601 XLi	601-040S	N601PH	07/18/2009
CH 601 XL	601-041S	N601HG	08/10/2009
CH 601 XLi	601-042S	N668WC	09/06/2007
CH 601 XL	601-043S	N601ES	09/11/2007
CH 601 XL	601-044S	N207WC	10/02/2007
CH 601 XL	601-045S	N130AW	10/13/2007
CH 601 XL	601-046S	N601DN	10/21/2007
CH 601 XL	601-047S	N131AW	11/30/2007
CH 601 XLi	601-048S	N615CB	12/14/2007
CH 601 XL	601-049S	N132AW	02/14/2008
CH 601 XL	601-050S	N154BT	11/13/2007
CH 601 XLi	601-051S	N117FA	01/14/2008
CH 601 XL	601-052S	N921V	02/07/2008
<i>CH 601 XL</i>	<i>601-053S</i>	<i>N/A</i>	<i>N/A</i>
CH 601 XL	601-054S	N454BB	03/12/2008
<i>CH 601 XL</i>	<i>601-055S</i>	<i>N/A</i>	<i>N/A</i>
CH 601 XLi	601-056S	N117FA	07/22/2008
CH 601 XLi	601-057S	N601ZY	03/27/2008
CH 601 XLi	601-058S	N601KE	04/06/2008
CH 601 XL	601-059S	N314SK	06/10/2008
CH 601 XLi	601-060S	N55ZC	06/06/2008
CH 601 XL	601-061S	N601WD	07/02/2008
CH 601 XLi	601-062S	N8870Z	05/19/2008

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Airplane Model	Serial Number	Registration Number (N – number)	Date of Manufacture
<i>CH 601 XL</i>	<i>601-063S</i>	<i>N/A</i>	<i>N/A</i>
CH 601 XLi	601-064S	N635LS	03/05/2008
<i>CH 601 XL</i>	<i>601-065S</i>	<i>N/A</i>	<i>N/A</i>
<i>CH 601 XL</i>	<i>601-066S</i>	<i>N/A</i>	<i>N/A</i>
<i>CH 601 XL</i>	<i>601-067S</i>	<i>N/A</i>	<i>N/A</i>
CH 601 XL	601-068S	N4218	05/30/2008
CH 650 XL	650-101	N822PS	08/15/2008
CH 650 XL	650-102	N637LS	09/04/2008
CH 650 XL	650-103	N86RB	09/15/2008
CH 650 XL	650-104	N232PA	09/30/2008
CH 650 XL	650-105	N638LS	11/20/2008
CH 650 XL	650-106	N159DF	10/15/2008
CH 650 XL	650-107	N639LS	02/14/2009
CH 650 XL	650-108	N660TX	12/24/2008

Appendix F FAA Aircraft Registration Database

Airworthiness Certificate Data for CH 601 XL Aircraft

AW Year	AW Month	Experimental Amateur- Built	Experimental Operating Light-Sport Kit-Built *	Experimental Reg. Prior to 01/31/08	Light Sport Airplane	Special Flight Permit Production Flight Testing	(blank)	Grand Total
2001	03	1						1
2001 Total		1						1
2002	11	1						1
2002 Total		1						1
2003	01	2						2
	04	1						1
	07	2						2
	08	3						3
	09	1						1
	11	1						1
2003 Total		10						10
2004	02	1						1
	03	1						1
	04	1						1
	05	3						3
	06	2						2
	07	3						3
	08	2						2
	09	2						2
2004 Total		15						15
2005	04			1				1
	05	4						4
	06	1						1
	08	3						3
	09	5						5
	10	2			1			3
	11	1			1			2
	12	2		2	2			6
2005 Total		18		3	4			25
2006	03	4			2			6
	04	4			3			7
	05				1			1
	06	1			3			4
	07	2		1	2			5
	08	1			3			4
	09	2			3			5
	10	3			3			6
	11	2			1			3
	12	1		1	1			3
2006 Total		20		2	22			44

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2007	01					1			1
	02	2			1	1			4
	03	2				2			4
	04	6				1			7
	05	3				2			5
	06	4				1			5
	07			1		1			2
	08	5		1		1			7
	09	2		2		1			5
	10	4		1		3			8
	11	1				2			3
	12	4		5		1			10
2007 Total		33		11		17			61
2008	01	1		5		1			7
	02	2				2	1		5
	03	1				2			3
	04	1		1		1			3
	05	2	1			2			5
	06	3				1	1		5
	07	7		1		2			10
	10	7							7
	11	5							5
2008 Total		29	1	7		11	2		50
2009	01	1							1
	02			1					1
	03	2							2
	04	2							2
	05	2	1						3
2009 Total		7	1	1					9
(blank)	(blank)							82	82
(blank) Total								82	82
Grand Total		134	2	24		54	2	82	298

* The CH 601 XL is not available as an “Experimental Operating Light-Sport Kit-Built.”
Airplanes listed in this column are “Experimental Amature-Built.”

Appendix G Summary of Zodiac In-Flight Structural Failure Accidents

This section contains a brief summary of each structural in-flight break up accident of the CH 601 XL, and contains links to more detailed data for each. It does not attempt to examine accidents that were not identified as structural failures, although the other CH 601 XL accidents appear to share similar root causes to type certificated aircraft, such as accidents during landing, take-off, etc. More detailed analysis is available from the NTSB and other sources for each of these accidents at the following link:

http://www.nts.gov/recs/letters/2009/A09_38_40.pdf

Summary of S-LSA Accidents

Reg. #	Manufacturer	Accident Date	Accident Location	Pilot
N158MD	AMD	November 4, 2006	Yuba City, California	Private Pilot
N357DT	CZAW	April 7, 2008	Polk City, Florida	Private Pilot

Note 1: AMD is Aircraft Manufacturing & Design located in Eastman, Georgia

*Note 2: CZAW is Czech Aircraft Works located in the Czech Republic (Konovice Airport)
CZAW manufactured the CH 601 XL under license*

N158MD – NTSB Factual Report (excerpt):

The airplane's entire structure was examined by an aerospace engineer from the Safety Board's Aviation Engineering Division, Washington, D.C. The engineer reported that all of the fracture surfaces examined exhibited features consistent with static overload.

More detailed information is available at the following link:

<http://www.nts.gov/nts/GenPDF.asp?id=LAX07FA026&rpt=fa>

N357DT – NTSB Factual Report (excerpt):

All of the fracture surfaces examined exhibited features consistent with static overload with no evidence of metal fatigue.

The structural analysis reviewed for the wing, empennage and fuselage structure were consistent with industry accepted practices and American Society for Testing and Materials (ASTM) consensus standards. The documents and testing indicated that the airplane met the ASTM requirements for limit loads; however may not have fully met the 6g ultimate load requirements.

More detailed information is available at the following link:

<http://www.nts.gov/nts/GenPDF.asp?id=NYC08FA158&rpt=fa>

Summary of E-LSA Accidents

Reg. #	Manufacturer	Accident Date	Accident Location	Pilot
N10028	Amateur-built (Zenith Kit) Registered E-LSA prior to 1/31/2008	May 2, 2007	Canadian, TX	Sport Pilot

Note 3: Zenith Aircraft Company is located in Mexico, MO

N10028 – NTSB Probable Cause (excerpt):

The pilot's improper pre-flight planning and decision to depart into deteriorating weather conditions, which resulted in a loss of control and subsequent in-flight break up.

More detailed information is available at the following link:

<http://www.nts.gov/nts/GenPDF.asp?id=DFW07LA102&rpt=fi>

Summary of Amateur-Built Accidents

Reg. #	Manufacturer	Accident Date	Accident Location	Pilot
N105RH	Amateur-built (Zenith Kit)	February 8, 2006	Oakdale, California	Private Pilot
N3683X	Amateur-built (Zenith Kit)	March 3, 2009	Antelope Island, Utah	Commercial Pilot
N538CJ	Amateur-built (Zenith Kit)	November 6, 2009	Agnos, Arkansas	Sport Pilot

N105RH – NTSB Factual Report (excerpt):

Investigators noted multiple S-bends and distortions of the spars of both wings in multiple directions at the wing root areas.

Investigators noted that both wings were displaced forward of their normal position along their lateral axis. The left wing front spar rotated aft, with a sharp bend about midspan of the wing near a support doubler. At that point, the wing spar rotated forward. At the center spar to wing root attachment area, the spar had a "U" shape to it with the opening of the "U" towards the bottom of the wing. The wing spar material from the wing root outboard to the support doubler had splayed apart. The center spar to the right wing root was bent down about 2 feet, then the front portion of the wing spar rated forward. About mid wing span the front wing spar rotated in an aft direction. The aft spar attach point was intact.

The Safety Board calculated the weight and balance for the airplane utilizing the following information:

Basic Empty Weight 754.5 pounds

Pilot 1 - 200 pounds

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Pilot 2 - 230 pounds (estimated weight provided by the Coroner 220-240 pounds)

Baggage - 10 pounds

Fuel - 12.45 gallons (74.7 pounds)

The calculations yielded the following information:

At 6.23 gallons of fuel, the airplane's gross weight was 1,289.5 pounds.

At 9.34 gallons of fuel, the airplane's gross weight was 1,308.2 pounds.

At 12.5 gallons of fuel, the airplane's gross weight was 1,326.7 pounds.

More detailed information is available at the following link:

<http://www.nts.gov/nts/GenPDF.asp?id=LAX06LA105&rpt=fa>

N3683X – NTSB Preliminary Report (excerpt):

On March 3, 2009, about 0838 mountain standard time, an experimental amateur-built Stephenson Zodiac CH 601 XL, N3683X, collided with mountainous terrain on Antelope Island, approximately 12 miles southwest of Syracuse, Utah. The commercial pilot, who was the sole occupant, was killed. The airplane is owned by a private party and was being operated by the pilot as a visual flight rules (VFR) personal/pleasure flight under the provisions of 14 Code of Federal Regulations (CFR) Part 91, when the accident occurred. Visual meteorological conditions prevailed, and no flight plan was filed for the flight.

More detailed information is available at the following link:

<http://www.nts.gov/nts/GenPDF.asp?id=WPR09FA141&rpt=p>

N538CJ – NTSB Preliminary Report (excerpt):

On November 6, 2009, approximately 1100 central standard time, a Zenith Aircraft Company Zodiac 601XL, N538CJ, experimental light sport airplane, was destroyed when it impacted terrain, following an in-flight breakup 1.5 miles south of Agnos, Arkansas. Visual meteorological conditions prevailed at the time of the accident. The personal flight was being conducted under the provisions of Title 14 Code of Federal Regulations Part 91 without a flight plan. The sport pilot was fatally injured. The cross-country flight departed Sharp County Regional Airport (KCVK), Ash Flat, Arkansas, approximately 0930.

According to the Arkansas State Police, the pilot departed KCVK approximately 0930 and was en route, either to Flippin or Mountain View, Arkansas, with the intention of returning to KCVK no later than 1200. A local rancher located the wreckage in a field approximately 1230.

The debris field was scattered over 600 feet on a magnetic bearing of 35 degrees. The right wing assembly initiated the debris field, coming to rest in a pond. The left wing assembly came to rest approximately 200 feet from the right wing. The left wing spar, left wing fuel tank, various cockpit items, and personal effects were located in the debris field. The fuselage, empennage, engine, and propeller assembly came to rest, inverted, approximately 600 feet from the right wing. There were no ground scars identified

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between the right wing and the main wreckage that could be associated with the left or right wing, empennage, or fuselage. The wreckage was recovered and relocated to a facility in Clinton, Arkansas, for further examination.

Early indications are this latest accident shares the same characteristics of other in-flight break up accidents, so it is being treated as such. More detailed information is available at the following link: <http://www.nts.gov/ntsb/GenPDF.asp?id=CEN10FA042&rpt=p>

Summary of European Micro-light Accidents

Reg. #	Manufacturer	Accident Date	Accident Location	Pilot
EC-ZMJ	Kit-built (CZAW Kit)	February 5, 2008	Barcelona, Spain	Ultralight Pilot
PH-4B6	Kit-built (CZAW Kit)	14 Sep 2008	Netherlands	Unknown

Note 1: CZAW is Czech Aircraft Works located in the Czech Republic (Konovice Airport)

Note 2: These aircraft were certified to the European micro-light requirements and are limited to 450kg, or roughly 990 lbs.

EC-ZMJ – CIAIAC – Cooperator (National Aviation Investigation Board) Report (excerpt):

Some engineers think the wings must have suffered some kind of torsion that finally led to the bending of the wing.

This model of aircraft suffered similar accidents some years ago and although a thorough revision of its design by an external independent aeronautical engineer was suggested, nothing ever happened. At present we are in the same situation, with the same kind of accidents in several countries.

The final outcome is that a wing folded during flight with the result of two people killed. There are speculations about possible weaknesses of the aircraft but without evidence to prove it.

The opinion of the investigator is that this specific model of Zenair is weaker because of the modifications it had to undergo to comply with the European regulations. The way of piloting the aircraft (not very smooth), a sensitive horizontal stabilizer and airspeeds too close to VNE may also be a factor. I am no engineer but after flying for almost 30 years I cannot think that so many aircraft of this model collapsing in flight is normal nor reasonable.

PH-4B6 – Dutch Report (translated) (excerpt):

- A calculation shows that the mass of the airplane at the start probably at or slightly above the maximum allowable mass of 450 kg.

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- The acting load factor of the wings was far below the permissible load factor.
- A comprehensive examination of the subject drawings of the U.S. draft has shown that the outcome of the strength calculations by the designer was probably too optimistic.

PRELIMINARY CONCLUSION

The study by the Research Council for Security to the cause of this accident is not yet completed. Nevertheless, the Council decided, in view of the seven similar incidents elsewhere in the world and pending the final results of his research, in this interim report all directly and indirectly involved must seriously warn against the obvious risks in the use of this type plane.

Appendix H CH 601 XL Safety Alert/ Safety Directive

Notification Number: Saturday November 07, 2009



Aircraft Manufacturing & Design LLC
Heart of Georgia Regional Airport
441 Airport Road, Eastman Georgia 31023 USA
www.newplane.com
TEL: (478) 374-2-SKY FAX:(478) 374-2793

SAFETY ALERT / SAFETY DIRECTIVE

Release Date:

Saturday, November 07, 2009 (revision 1)

Effective Date:

Immediate

Subject/Purpose:

Mandatory Upgrade, before next flight.

Limitations:

None, once upgrade is complete.

Affected Models:

Aircraft Manufacturing & Development and Aircraft Manufacturing & Design (AMD) Zodiac CH 601 XL and CH 650 aircraft.

Owner/Operators of CH 601 XL and CH 650 aircraft in the Experimental Amateur Built category are encouraged to reference related information from Zenith Aircraft, Co. available at:

<http://www.zenithair.com/news/ntsb-astm-4-09a.html>

Serial numbers:

All

Notification Number:

Saturday, November 07, 2009

Does this Notice supersede another document?

Yes – Aircraft POH and all other aircraft documents that makes reference to flight limitations and Weight & Balance including pre-flight check list.

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Discussion:

This Safety Alert is based on the “Chris Heintz” letter of July 7, 2009 and on the FAA’s and other airworthiness authority’s review of the design. Chris Heintz is the designer and owner of the Zodiac designs; AMD has a license agreement with Mr. Heintz for the manufacturing of the Zodiac 601XL and 650 in the USA under the SLSA category.

A number of accidents involving the CH 601 XL aircraft type have occurred in 2006-2009 causing different authorities to conduct full reviews of the design.

Two aircraft (a CH 601 XL as well as a CH 650) were delivered to a flutter specialist in Germany for the purpose of thorough Ground Vibration Testing. It is important to note that both aircraft used in these tests were professionally built and, therefore in compliance with design specifications. The result of these real-world tests (not just a computer simulation) can be viewed on the AMD web site (at [CH 650](#) and [ZODIAC XL](#)). The tests concluded that there are no flutter concerns for these planes. However, an on-going question that remains is: is flutter possible if a similar aircraft is not built or maintained as per the design specifications?

Chris Heintz agrees that one way to address this question is to follow the UK LAA’s mandated upgrade to install aileron counter balance weights. AMD is now mandating this modification as part of the upgrades covered by this Safety Alert.

Additionally, the German laboratory in charge of the GVT also conducted non-linear test analysis of the design and concluded that the aileron bellcrank area of the CH 601 XL could be reinforced to minimize the possibility of non-linear-type vibrations in that area. This is why the reinforcement parts for this area are also part and parcel of the upgrade kit mandated by this Safety Alert.

Finally, Chris Heintz completed a series of static load tests this summer where the Zodiac design was load tested by as much as 6% beyond the SLSA requirements - without failure. This Safety Alert includes extra material which was not part of the tested airframes, further increasing the safety margins of the seat area, main spar bolt area, and rear spar area. The current upgrade kit therefore increases a number of safety margins on the aircraft even further than those on the tested airframes.

The purpose of this multi-part upgrade kit is to not only comply with the different interpretation of regulations by different authorities, but to also make sure that the aircraft is significantly tougher overall and less prone to vibrations, including everyday wear-and-tear.

Overloading of the airframes is still an important concern. In a number of cases, this overloading was probably due to exceeding Vc in turbulent conditions - which significantly increases the loads on the airframe. It is therefore imperative that all Zodiac 601XL and 650 aircraft be retrofitted with the upgrade kit covered in this Service Alert, and that pilots become and remain well aware of the aircraft limitations including Vc, and that the ASI of every aircraft be well calibrated and properly marked.

Appendix H

Corrective Action:

Complete the installation of the upgrade kit as per the following.

1. All work is to be performed by a certified mechanic as per maintenance manual “(a / b) Major Alterations / Major Repairs. Must be pre-approved by the Manufacturer or other identity and performed by an FAA certified A&P” or FAA certified repair station.
 - a) Complete the upgrade by using the following information:
 - i. Drawing 6-ZU-1, 6-ZU-2, 6-ZU-3, and 6-ZU-4.
 - ii. Photo guide with construction standards
 - iii. Use “FAA AC-43.13.-1B and 2A if additional information is required
 - iv. Use the UK LAA's modification MOD/162B/004 dated 18/08/09 for only the installation of the aileron counter balance weights. Drawings and assembly instructions are part of the modification.
 - b) Additionally:
 - i. When removing and reassembling the wings, ailerons and flaps, follow the procedure in the service manual section VII
 - ii. When removing and reinstalling the wing tanks follow the procedure in the service manual section VIII
 - iii. Inspect the aircraft using the [Zodiac series checklist](#). This is a 41-page checklist to help owners thoroughly inspect their aircraft before flying again.
 - iv. Use the checklist with the Service Manual as you complete a 100 hour inspection as per table 1.
 - v. Ground and flight test procedures for the return to service after upgrade Follow Appendix 1 for “major repairs and alterations”
 - vi. For calibration of the ASI with a GPS, proper outside air temperature must be taken with a temperature gauge while doing the flight test as actual outside air temperature is required to allow proper correction.
 - vii. Complete a new weight & balance as per procedure in POH section 4. Update the “INSTALLED EQUIPMENT LIST”, “WEIGHT & BALANCE REPORT” and “WEIGHT & BALANCE UPATE” in the POH.

Appendix H

In addition to this and before each flight:

1. Check all control cable tensions by hand. If in doubt about the cables being properly tensioned, check them with a calibrated cable tension gauge. If necessary, adjust the cable tension to the proper values. If unsure, get a licensed mechanic to check or adjust the cables.

WARNING: Do not fly with control cables that are too loose or too tight.

2. Check for free play in the aileron control system. When holding the control stick stationary, beyond minor flexing, there should be no free play in the system when gently pushing up or down on the aileron trailing edges. Note that if the ailerons are not locked when the aircraft is parked outside, wind can damage the system.

WARNING: Do not fly with loose, sloppy or damaged controls.

3. Check the flaps for positive firm contact with the flap stops when in the “up” (retracted) position. Check for movement by gently pushing up and down on the flap trailing edges. **WARNING:** The flap system can get damaged if the flaps are stepped on. Do not fly with loose or damaged flaps.

4. When placing luggage/items in the wing lockers, baggage area behind seats, or in other places, check that it is well secured before take-off.

WARNING: Do not fly with loose luggage or other items in the aircraft.

5. Make sure the colored arcs on your ASI all properly indicate the correct speed limits (CAS). Incorrect markings could cause the pilot to unintentionally exceed aircraft limitations. Before flying your aircraft, know all the flight limitations including VA and Vc. Mark VA on your airspeed indicator (or panel). Remember that all aircraft limitations should be included in your flight manual (POH).

6. Check that your canopy closes and latches properly on both sides. If in doubt, add a secondary latching system as recommended by the Australian CAA. If your canopy does open in flight, keep your hands on the controls, lower your speed to approximately 60 knots, keep flying the aircraft and land as soon as practicable.

WARNING: Do not try to close the canopy in flight: Fly the aircraft!

7. “Self checkout” is not recommended. Before flying the aircraft, make sure that you have been properly checked out and that you are familiar with all flight limitations and the handling characteristics (feel and responsiveness) of the controls. Remember that, as with any light aircraft, if you encounter unexpected turbulence while cruising, ride it out rather than fight it – and slow down!

REMINDER TO PILOTS: Always get to know a new aircraft you plan to fly before taking the controls (this applies to any aircraft). A thorough condition inspection of the aircraft is essential; learn the operating limitations from the POH (and respect them); and get properly checked out to be familiar with the aircraft’s handling qualities.

Appendix H

OPERATING LIMITS AFTER UPGRADE IS COMPLETE:

1. The aircraft **MUST** comply with all Safety Directives issued by AMD except for operating limitations of [July 08, 2009](#).
2. The aircraft **MUST** have a current Weight and Balance, and should be within limits.
3. Aircraft VNE to be as per POH of November 2009
4. Gross weight, baggage and passenger limits to be as per POH of November 2009
5. Your POH and an instrument placard **MUST** reflect POH marking of November 2009.
6. Use applicable sections of Appendix 1 in the Service Manual of November 2009 to calibrate your ASI.
7. Use November 2009 POH only after the aircraft has been signed off by a certified mechanic, clearly stating that the aircraft complies with this Safety Alert.

Reminder

AMD reminds the Owner/Operator of AMD aircraft that compliance with all Safety Directives, Aircraft Operating Instructions, Maintenance Manuals as well as the reporting of any and all Safety of Flight or Service Difficulties by the Owner/Operator is *mandatory* for the operation of an SLSA aircraft.

- [AMD Safety Alerts](#), Service Bulletins and Notices can be viewed and downloaded at:
http://www.newplane.com/amd/CH2000_Service.html
- UK LAA aileron balance can be downloaded from:
http://www.lightaircraftassociation.co.uk/engineering/engineering_updates.html

Appendix I FAA Special Airworthiness Information Bulletin CE-10-08



FAA
Aircraft Certification Service

SPECIAL AIRWORTHINESS INFORMATION BULLETIN

SAIB: CE-10-08

SUBJ: Wings: Zodiac CH601XL and CH650 Wing Structural Modifications **Date:** November 7, 2009
This is information only. Recommendations aren't mandatory.

Introduction

This Special Airworthiness Information Bulletin informs you of an airworthiness concern on all variants of Zodiac CH601XL and CH650 airplanes, all serial numbers, including special light-sport category aircraft (S-LSA), experimental light-sport aircraft (E-LSA), and experimental amateur-built aircraft.

Background

Since April 2009, the FAA has been conducting a special review of the Zodiac CH601XL and the nearly identical CH650 to evaluate design and operational details of these aircraft. This review was a continuation of efforts to investigate several in-flight structural failures of the CH601XL dating back to 2005. Five in-flight structural failure accidents have occurred in the United States and several abroad. The U.S. accidents involved two S-LSA, one E-LSA, and two experimental amateur-built kit aircraft. The design of all CH601XL & CH650 airplanes is essentially the same, but only the S-LSA aircraft are designed and produced to ASTM International LSA standards. We quickly launched the FAA special review because of the accidents exhibited signs of structural failures. After the review we made a determination that these accidents did not clearly indicate a single root cause. Instead, it implicated the potential coupling of design and operational aspects of the aircraft.

Our analysis did reveal several areas of concern regarding the CH601XL design that may impact the overall safety of the design. Those causing the greatest concern are as follows:

- **Wing structure:** FAA analysis shows bending loads used to design the wing structure were non-conservative and the basic static strength of the CH601XL/CH650 does not appear to meet the intent of the ASTM standards for a 600kg (1320 lb) airplane, given the current flight envelope in the Pilot Operating Handbook.
- **Structural Stability:** Other aviation authorities have noted the presence of buckling in the wing structure, including in the center section. Such structural instabilities can have a significant effect on static strength and flutter characteristics.
- **Flutter:** Our detailed review of available flutter analysis reports was inconclusive. However, accident photos clearly indicated flutter was present during the in-flight structural failures. The FAA believes flutter may either be a first order root cause of in-flight structural failure or a secondary cause after some initial wing structural deformation or twisting.
- **Airspeed calibration:** Calibration procedures do not appear to adequately account for basic static pressure source error due to the location of the static port. This could lead to potential airspeed indication anomalies, particularly since the CH601XL/650 derivatives can be delivered/built with several different airspeed indicators installed or without an indicator at all. The situation could lead to the potential of operating the airplane above the maneuver speed and/or the design cruise speed, potentially leading to structural failure.

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- **Stick force characteristics:** Flight test data from foreign authorities indicates at aft center of gravity the stick forces become very light. The FAA believes this may be a contributing factor in structural failure accidents if coupled with operations over gross weight, at speeds higher than V_{A_0} and/or for aircraft loaded improperly. In such conditions, it would be very easy to dynamically load the CH601XL/CH650 wing beyond its design structural load limit.

Recommendations

In order to prevent potential catastrophic structural failure, we strongly recommend that all owners and operators of Zodiac CH601XL/CH650 comply with actions outlined in a forthcoming Aircraft Manufacturing & Design, LLC (AMD) Safety Directive / Safety Alert to address the above-referenced concerns before further flight.

For SLSA owners and operators: We remind all owners and operators of their regulatory obligation to comply with Safety Directive / Safety Alert issued by AMD in accordance with the ASTM International consensus standards safety directive process and recommend the following:

- Reference 14 CFR §21.190(c)(5) – The manufacturer’s requirement to issue safety directives.
- Reference 14 CFR §91.327(b)(4) – Owner/operator compliance with each safety directive.
- Obtain and install AMD’s modification kit (i.e., major alteration) per drawings and instructions.
 - ✓ Contact AMD for any requests to correct the unsafe condition in a manner different from that specified in the safety directive.
 - ✓ Since the AMD safety directive adheres to the applicable consensus standard, the FAA will not likely issue any waivers from the provisions of the safety directive.
- Adhere to the manufacturer’s drawings and instructions. These drawings and instructions address the structural design changes that are required to meet the ASTM design and performance standard T they also address other operating limitations.
- If necessary, obtain a special flight permit to fly the aircraft to a location where the safety directive modifications can be made. The FAA may add special requirements for operating your aircraft to a place where the modifications can be done. The FAA may also decline to issue a special flight permit in particular cases if we determine you cannot move the aircraft safely. To apply for a special flight permit, follow the procedures in 14 CFR 21.199.

For amateur-built and E-LSA owners and operators: Due to shared design characteristics that amateur-built and E-LSA aircraft have with S-LSA, we strongly recommend compliance with the drawings and instructions contained in the AMD Safety Directive/Safety Alert and recommend the following:

- Reference 14 CFR §91.7: “(a) No person may operate a civil aircraft unless it is in an airworthy condition. (b) The pilot in command of a civil aircraft is responsible for determining whether that aircraft is in condition for safe flight. The pilot in command shall discontinue the flight when un-airworthy mechanical, electrical, or structural conditions occur.”

Appendix I

- Obtain and install the kit manufacturer's structural modification kit. The modification kit addresses the structural design changes and operating limitations required to meet a safe condition for operation.
- Contact the kit manufacturer with any modifications already incorporated to correct the identified unsafe condition to validate safety-of-flight issues.
- If necessary, obtain a special flight permit to fly the aircraft to a location where the safety directive modifications can be made. The FAA may add special requirements for operating your aircraft to a place where the modifications can be done. The FAA may also decline to issue a special flight permit in particular cases if we determine you cannot move the aircraft safely. To apply for a special flight permit, follow the procedures in 14 CFR 21.199.

For Further Information Contact

Wes Ryan, Manager ACE-114, Programs & Procedures, FAA Small Airplane Directorate, 901 Locust, Kansas City, MO 64106; Phone: (816) 329-4111; Fax: (816) 329-4090; e-mail: wes.ryan@faa.gov.

(Optional) For Related Service Information Contact

AMD, LLC (**SLSA Manufacturer**)
Heart of Georgia Regional Airport
415 Airport Road,
Eastman, Georgia 31023 USA
Email: <http://www.newplane.com/>

Mailing address:
P O Box 4277 Eastman Georgia 31023 USA
TEL: 478-374-2759
FAX: 478-374-2793

Zenith Aircraft Company (**Kit Manufacturer**)
Mexico Memorial Airport, PO Box 650
Mexico, Missouri, 65265-0650 USA.

TEL: 573-581-9000
FAX: 573-581-0011
Email: <http://www.zenithair.com/>

Appendix J

Zodiac CH601XL/CH650 Airworthiness Actions Memo



Federal Aviation Administration

Memorandum

Date: November 12, 2009
To: All Manufacturing Inspection Offices, District/Satellite Offices, and Certificate Management Offices/Units
All Flight Standards Divisions
All Flight Standards District Offices
Note: Please disseminate to appropriate designees
From: *Frank P. Paskiewicz* Frank P. Paskiewicz, Manager, Production and Airworthiness Division, AIR-200
Prepared by: AIR-230
Subject: Zodiac CH601XL/CH650 Airworthiness Actions

Purpose

To suspend the issuance of new airworthiness certificates to any and all variants of Zodiac CH601XL and CH650 airplanes, all serial numbers, including special light-sport category aircraft (S-LSA), experimental light-sport aircraft (E-LSA), and experimental amateur-built aircraft.

Background

Since April 2009, the FAA has been conducting a special review of the Zodiac CH601XL and the nearly identical CH650 to evaluate design and operational details of these aircraft. This review revealed several areas of concern regarding the CH601XL/CH650 design that impacts the overall safety of the design including wing structure, structural stability, flutter, airspeed calibration and stick force characteristics.

On November 7, 2009, in order to prevent potential catastrophic structural failure, the FAA issued SAIB CE-10-08 *Wings: Zodiac CH601XL and CH650 Wing Structural Modifications*. The SAIB can be found at

[http://rgl.faa.gov/Regulatory_and_Guidance_Library/rgSAIB.nsf/\(LookupSAIBs\)/CE-10-08?OpenDocument](http://rgl.faa.gov/Regulatory_and_Guidance_Library/rgSAIB.nsf/(LookupSAIBs)/CE-10-08?OpenDocument).

In the SAIB, the FAA strongly recommends that all owners and operators of Zodiac CH601XL/CH650 comply with actions outlined in an Aircraft Manufacturing & Design, LLC (AMD) Safety Directive / Safety Alert before further flight. This AMD Safety Directive/Alert was also issued on November 7, 2009 and can be found at

http://www.newplane.com/amd_downloads/SAFETY%20ALERT%20November%207%202009.pdf

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Action

To preclude potential catastrophic in-flight structural failure, effectively immediately, no new airworthiness certificates will be issued to any and all variants of Zodiac CH601XL and CH650 airplanes, all serial numbers, including special light-sport category aircraft (S-LSA), experimental light-sport aircraft (E-LSA), and experimental amateur-built aircraft until such time that the applicant submits adequate evidence that the applicant's aircraft has been modified in a manner consistent with the above-mentioned documents.

For Further Information Contact

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Telephone: (202) 385-6346