

DEPARTMENT OF TRANSPORTATION**Federal Aviation Administration****14 CFR Part 23**

[Docket No. CE197; Special Conditions No. 23-138-SC]

Special Conditions: AMSAFE, Incorporated, Zenair Model CH2000, Inflatable Three-Point Self-Adjusting Restraint Safety Belt With an Integrated Inflatable Airbag Device

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Final special conditions.

SUMMARY: These special conditions are issued for the installation of an AMSAFE, Inc. Inflatable Three-Point Self-Adjusting Restraint Safety Belt with an Integrated Inflatable Airbag Device on the Zenair model CH2000. This airplane, as modified by AMSAFE, Inc. will have novel and unusual design features associated with the lap belt portion of the safety belt, which contains an integrated airbag device. The applicable airworthiness regulations do not contain adequate or appropriate safety standards for this design feature. These special conditions contain the additional safety standards that the Administrator considers necessary to establish a level of safety equivalent to that established by the existing airworthiness standards.

EFFECTIVE DATE: October 2, 2003.

FOR FURTHER INFORMATION CONTACT: Mr. Pat Mullen, Federal Aviation Administration, Aircraft Certification Service, Small Airplane Directorate, ACE-111, 901 Locust, Kansas City, Missouri, 816-329-4128, fax 816-329-4090.

SUPPLEMENTARY INFORMATION:

Background

On March 8, 2003, AMSAFE, Inc. Inflatable Restraints Division, 5456 East McDowell Road, Mesa, AZ, 85215, applied for a supplemental type certificate to install an inflatable lapbelt restraint with a standard upper torso restraint (or shoulder harness) in the Zenair model CH2000. The model CH2000 is a single-engine, two-place airplane with a stall speed in the landing configuration that is below 45 knots.

The inflatable restraint system is a three-point restraint system consisting of a shoulder harness and an inflatable airbag lap belt, and will be installed on both the pilot and co-pilot seats. In the event of an emergency landing, the airbag will inflate and provide a

protective cushion between the occupant's head and the airplane's yoke and instrument panel. This will reduce the potential for head and torso injury. The inflatable restraint behaves in a manner that is similar to an automotive airbag, but in this case, the airbags are integrated into the lapbelt. The shoulder harness is conventional and does not inflate. While airbags and inflatable restraints are standard in the automotive industry, the use of an inflatable three-point restraint is novel for general aviation operations.

The FAA has determined that this project will be accomplished on the basis of providing the same current level of safety of the model CH2000 occupant restraint design. The FAA has considered the installation of airbags as having two primary safety concerns:

- That they perform properly under foreseeable operating conditions; and
- That they do not perform in a manner or at such times as to impede the pilot's ability to maintain control of the airplane or constitute a hazard to the airplane or occupants.

The latter point has the potential to be the more rigorous of the requirements. An unexpected deployment while conducting the takeoff and landing phases of flight may result in an unsafe condition. The unexpected deployment may either startle the pilot, or generate a force sufficient to cause a sudden movement of the control yoke. Either action could result in a loss of control of the airplane, the consequences of which are magnified due to the low operating altitudes during these phases of flight. The FAA has considered this when establishing the special conditions.

The inflatable airbag is integrated into the lap belt and relies on sensors to electronically activate the inflator for deployment. These sensors could be susceptible to inadvertent activation, causing deployment in a potentially unsafe manner. The consequences of an inadvertent deployment must be considered in establishing the reliability of the system. AMSAFE, Inc. must show that the effects of an inadvertent deployment in flight are not a hazard to the airplane or that an inadvertent deployment is extremely improbable. In addition, any general aviation aircraft can generate a large amount of cumulative wear and tear on a restraint system. It is likely that the potential for inadvertent deployment increases as a result of this cumulative damage. Therefore, the impact of wear and tear on inadvertent deployment must be considered. Ultimately, because of the effects of this cumulative damage, a life limit must be established for the

appropriate system components in the restraint system design.

There are additional factors to be considered to minimize the chances of inadvertent deployment. General aviation airplanes are exposed to a unique operating environment, since the same airplane may be used by both experienced and student pilots. The effect of this environment on inadvertent deployment of the restraint must be understood. Therefore, qualification testing of the firing hardware/software must consider the following:

- The airplane vibration levels appropriate for a general aviation airplane; and
- The inertial loads that result from typical flight or ground maneuvers, including gusts and hard landings.

Any tendency for the firing mechanism to activate as a result of these loads or acceleration levels is unacceptable.

Other influences on inadvertent deployment include high intensity electromagnetic fields (HIRF) and lightning. Since the sensors that trigger deployment are electronic, they must be protected from the effects of these threats. To comply with HIRF and lightning requirements, the AMSAFE, Inc. inflatable restraint system is considered a critical system, since its inadvertent deployment could have a hazardous effect on the airplane.

Given the level of safety of the current Zenair model CH2000 lap belt and shoulder harness restraint, the inflatable restraint must show that it will offer an equivalent level of protection in the event of an emergency landing. In the event of an inadvertent deployment, the restraint must still be at least as strong as a Technical Standard Order certificated belt and shoulder harness. There is no requirement for the inflatable portion of the restraint to offer protection during multiple impacts, where more than one impact would require protection.

The inflatable seatbelt system must deploy and provide protection for each occupant under a crash condition where it is necessary to prevent serious head injury. However, the Zenair CH2000 seats are not certificated to the requirements specified in § 23.562 and it is not known if they would remain intact following exposure to the crash pulse identified in § 23.562. Therefore, the test crash pulse used to satisfy this requirement may have a peak longitudinal deceleration lower than that required by § 23.562. However, the test pulse must have an onset rate (deceleration divided by time) equal to or greater than the onset rate of the