

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 the crash conditions specified in § 23.562 where it is necessary to prevent serious head injury. The crash pulse specified in § 23.562 is viewed as a suitable threshold for system deployment. It is possible a wide range of occupants will use the inflatable restraint. Thus, the protection offered by this restraint

should be effective for occupants that range from the fifth percentile female to the ninety-fifth percentile male. Energy absorption must be performed in a consistent manner for this occupant range.

In support of this operational capability, there must be a means to verify the integrity of this system before each flight. As an option, AMSAFE, Inc. can establish inspection intervals where they have demonstrated the system to be reliable between these intervals.

It is possible that an inflatable restraint will be "armed" even though no occupant is using the seat. While there will be means to verify the integrity of the system before flight, it is also prudent to require that unoccupied seats with active restraints not constitute a hazard to any occupant. This will protect any individual performing maintenance items inside the cockpit while the aircraft is on the ground and includes protection against inadvertent deployment.

In addition, the use and operation of this restraint must be transparent to the user. Therefore, the design must prevent the inflatable seatbelt from being incorrectly buckled and/or installed such that the airbag would not properly deploy. As an alternative, AMSAFE, Inc. may show that such deployment is not hazardous to the occupant, and will still provide the required protection.

The cockpit of the model CH2000 is a confined area, and the FAA is concerned that noxious gasses may accumulate in the event of restraint deployment. When deployment does occur, either by design or inadvertently, there must not be a release of hazardous quantities of gas or particulate matter into the cockpit area.

Fire is a concern for any airplane, regardless of the size or class of the airplane. An inflatable restraint should not increase the risk already associated with fire. Therefore, the inflatable restraint should be protected from the effects of fire, so that an additional hazard is not created by, for example, a rupture of the inflator.

Finally, the inflatable restraint is likely to have a large volume displacement, where the inflated bag could impede the egress of an occupant. Since the bag deflates to absorb energy, it is likely that the inflatable restraint would be deflated at the time an occupant would attempt egress. However, it is appropriate to specify a time interval after which the inflatable restraint may not impede rapid egress. Ten seconds has been chosen as reasonable time. This time limit will offer a level of protection throughout the impact event.

Type Certification Basis

Under the provisions of § 21.101, AMSAFE, Inc. must show that the Zenair model CH2000, as changed, continues to meet the applicable provisions of the regulations incorporated by reference in Type Certificate No. TA5CH or the applicable regulations in effect on the date of application for the change. The regulations incorporated by reference in the type certificate are commonly referred to as the "original type certification basis." The regulations incorporated by reference in Type Certificate No. TA5CH are as follows:

FAR 21.29 and FAR 23 effective February 1, 1965, as amended by 23-1 through 23-42. JAR-VLA effective April 26, 1990, through Amendment VLA/92/1 effective January 1, 1992, used as a safety equivalence to FAR 23, as provided by AC 23-11. FAR 36 dated December 1, 1969, as amended by current amendment as of date of type certification.

For the model listed above, the certification basis also includes all exemptions, if any; equivalent level of safety findings, if any; and the special conditions adopted by this rulemaking action.

The Administrator has determined that the applicable airworthiness regulations (*i.e.*, part 23 as amended) do not contain adequate or appropriate safety standards for the AMSAFE, Inc. inflatable restraint as installed on Zenair model CH2000 because of a novel or unusual design feature. Therefore, special conditions are prescribed under the provisions of § 21.16.

Special conditions, as appropriate, as defined in § 11.19, are issued in accordance with § 11.38, and become part of the type certification basis in accordance with § 21.101.

Special conditions are initially applicable to the model for which they are issued. Should the applicant apply for a supplemental type certificate to modify any other model included on the same type certificate to incorporate the same novel or unusual design feature, the special conditions would also apply to that model under the provisions of § 21.101.

Novel or Unusual Design Features

The Zenair model CH2000 will incorporate the following novel or unusual design feature:

The AMSAFE, Inc. Inflatable Three-Point Self-Adjusting Restraint safety belt with an integrated inflatable airbag device. The purpose of the inflatable airbag seatbelt is to reduce the potential for injury in the event of an accident. In a severe impact, an airbag will deploy from the lapbelt portion of the restraint,