AmSafe State-of-the Art Restraint System (SOARS)

for Part 23 Aircraft

System Description

AmSafe Document Number: SD7336

The AmSafe Commercial and Government Entity (CAGE) code: 35FB9

REVISION HISTORY

Rev.	Revision Summary
-	Refer to ECO02119.
A	Refer to ECO02533.

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1 INTRODUCTION

This document provides a system description of AmSafe State-of-the-Art Restraint system (SOARS) and its components and operation.

2 REFERENCES

- RTCA DO-178B: Software Considerations in Airborne Systems and Equipment Certification
- USCAR-24: USCAR Inflator Technical Requirements and Validation

3 DESCRIPTION

SOARS is intended for installation and use on various Part 23 type certified normal, utility, acrobatic, and commuter category airplanes. SOARS (Figure 1) provides supplementary occupant injury protection. SOARS utilizes an airbag packed within a cover attached to the webbing of a standard restraint system assembly. When a predetermined deceleration event registers within the electronic module assembly (EMA), an initiation signal engages the inflator assembly to release gas and fill the airbag. The airbag deploys out through a rip stitch/seam within the airbag cover. SOARS uses an airbag-equipped label and a body. SOARS contains the following parts.

- Inflatable restraint system assembly (TSO C114)
- Cable interface assembly
- LRU/inflator cable interface
- Inflator assembly
- EMA
- Installation instructions

Figure 1. SOARS

3.1 Inflatable Restraint System Assembly

The inflatable restraint system assembly has the same basic configuration as conventional, non-airbag seatbelts with the addition of a packed airbag, airbag cover and fabric hose subassembly. The inflatable restraint system assembly is TSO C114 approved. The inflatable restraint system assembly has three subassemblies: a connector half, a buckle half and a shoulder harness (Figure 2). (An extension assembly is not available.)

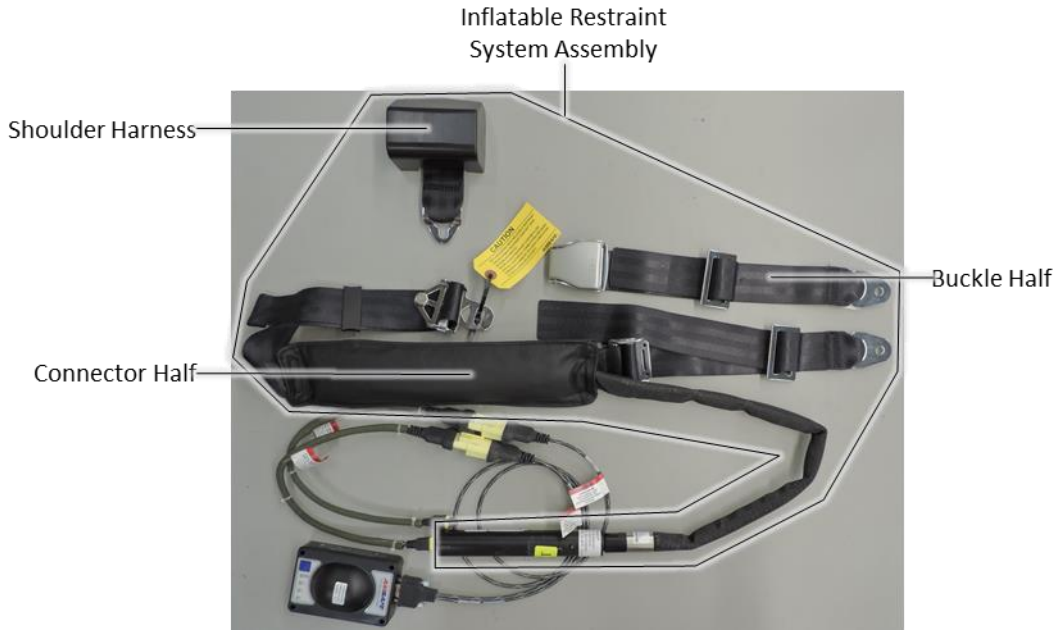

Figure 2. Subassemblies

The connector half consists of an 3-bar slide, end fitting, connector assembly, polyester webbing, airbag and a fabric hose subassembly (Figure 3). The 3-bar slide facilitates adjusting the length of the connector half and secures the airbag along the webbing. The end fitting attaches to the seat or aircraft anchor point. The airbag cover protects the packed airbag and other internal components from wear, tear and contamination. The airbag cover is made of leather or other textiles and has a tear seam that opens upon deployment. The construction of the fabric hose subassembly provides resistance to wear and tear with safeguards against in-service tampering. The fabric hose subassembly is made of 1000-denier polyester with Kevlar filler and hose lining. The fabric hose subassembly has a protective sleeve made of urethane treated 1000-denier polyester fabric. The fabric hose subassembly has a threaded aluminum fitting with a stainless steel ferrule that connects to the inflator assembly.

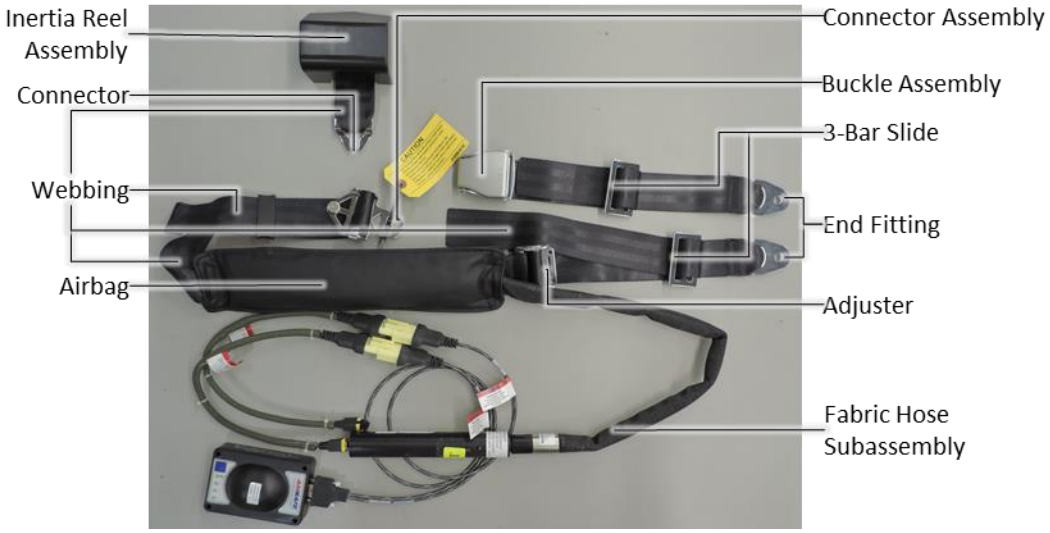

Figure 3. Subassemblies

The buckle half consists of a 3-bar slide, webbing, buckle assembly and an end fitting. The 3-bar slide facilitates adjusting the length of the buckle half and secures the airbag along the webbing. The buckle assembly attaches to

the connector assembly. The end fitting attaches to the seat or aircraft anchor point.

The shoulder harness consists of an inertia reel assembly with a cover, webbing and connector. The connector attaches to the rivet on the connector assembly. The inertia reel assembly attaches to the seat or aircraft anchor point.

3.2 Operation

SOARS is active and able to deploy as soon as all electrical connections are made. SOARS is not deactivated when it is unbuckled. SOARS is connected by buckling the connector half and buckle half and attaching the connector on the shoulder harness to the rivet on the connector half. The connector half can be adjusted to accommodate a range of stature of seat occupants. SOARS is released by lifting the latch on the buckle, disconnecting the connector half and disconnecting the connector on the shoulder harness.

3.3 Cable Interface Assembly and LRU/Inflator Cable Interface

The cable interface assembly connects the EMA to the inflator assembly through the LRU/inflator cable interface (Figure 4). These cable assemblies relay the deployment signal from the EMA to the inflator assembly.

The 15-pin connector on the cable interface assembly connects to the EMA and the 4-pin connector attaches to the 4-pin connector on the LRU/inflator cable interface. The squib connector on the LRU/inflator cable interface connects to the inflator assembly. The design of the 4-pin connector prevents improper connection and inadvertent disconnection. The 4-pin connector provides enhanced safety with a self-shorting feature that protects against electrostatic discharge when the 4-pin connector is disconnected.

The cable interface assembly and LRU/inflator cable interface are not connected to aircraft power or ground and both cables meet the applicable requirements for electromagnetic interference (EMI), electromagnetic compatibility (EMC), high-intensity radio fields (HIRF) and environmental and flammability testing.

Figure 4. Connectors

3.4 Inflator Assembly

There is one inflator assembly per seat position. The inflator assembly (Figure 1) provides the gas source to inflate the airbag upon command from the EMA. The inflator assembly consists of a compressed gas cylinder a minimal amount of pyrotechnic material and an initiator. The inflator assembly also has a thrust-neutral output diffuser that connects to a fabric hose subassembly.

The inflator assembly and its electrical connection are standard automotive components produced in high volume with extremely high reliability and safe operation. The inflator assembly contains special features for safety and

tamper resistance. All inflator assemblies used by AmSafe are USCAR-24 certified.

3.5 EMA

The EMA provides the signal to deploy SOARS and provides the method to verify SOARS' readiness. One EMA provides the deployment signal for up to three inflator assemblies. The EMA is fully qualified to environmental and flammability requirements. The EMA is a small polycarbonate box containing the activation/diagnostic circuitry, a power source and software. The EMA's components include a microcontroller with control logic, lithium batteries and an electro-mechanical crash sensor with magnetic reed sense circuitry.

The EMA is self-contained and there is no connection to the aircraft power or ground. The 15-pin connector is soldered to the PCBA and it extends through the EMA box for external connection. The 15-pin connector contains two fasteners to secure the cable interface assembly. The electrical connectors have a mistake-proof-keyed interface. Proper activation of the airbag requires the crash sensor to recognize a predetermined deceleration value and activate the deployment.

3.5.1 Lithium Batteries

The EMA is powered by three commercially available nonrechargeable lithium/iron disulfide AA batteries supplied by Energizer.

3.5.2 Software

The EMA's software satisfies the software objectives of RTCA DO-178B, Level B.

3.5.3 Diagnostics

Diagnostics are performed every 4000 flight-hours or 12 months (whichever occurs first). Diagnostics are performed via a push-to-test (PTT) function embedded in the EMA. The PTT panel has a blue PTT button and four indicator lights (Figure 5) of pass/fail conditions. Pressing the blue PTT button initiates the microcontroller to perform a diagnostic test that checks the continuity of the activation circuit, battery life and the inflator assembly resistance.

Figure 5. EMA PTT Panel

3.1 Body Block

The body block (Figure 6) is a Styrofoam block in the shape of the human pelvis. The body block is used during installation to align the packed airbag along the webbing.

Figure 6. Body Block and Packed Airbag

3.2 Airbag-Equipped Label

The airbag-equipped label (Figure 7) is placed in a conspicuous area of the cabin to provide indication that the aircraft is equipped with an airbag.

Figure 7. Airbag-Equipped Label

3.3 Service Life and Warranty

SOARS has a service life of ten years from date of manufacture and a warranty of three years.