AmSafe Aviation Inflatable Restraint

Cirrus Transition Training

09/10/05

UND AEROSPACE
Global Excellence through Innovative People

The system information, procedures and guidelines found in this presentation are for Reference Only.

The information & procedures in this presentation have been taken from the FAA Approved Airplane Flight Manual and Pilot's Operating Handbook (POH). The Information & Procedures in this presentation DO NOT SUPERSEDE the Information & Procedures in the POH. In the event of conflict, the POH shall take precedence.

UND AEROSPACE
Global Excellence through Innovative People

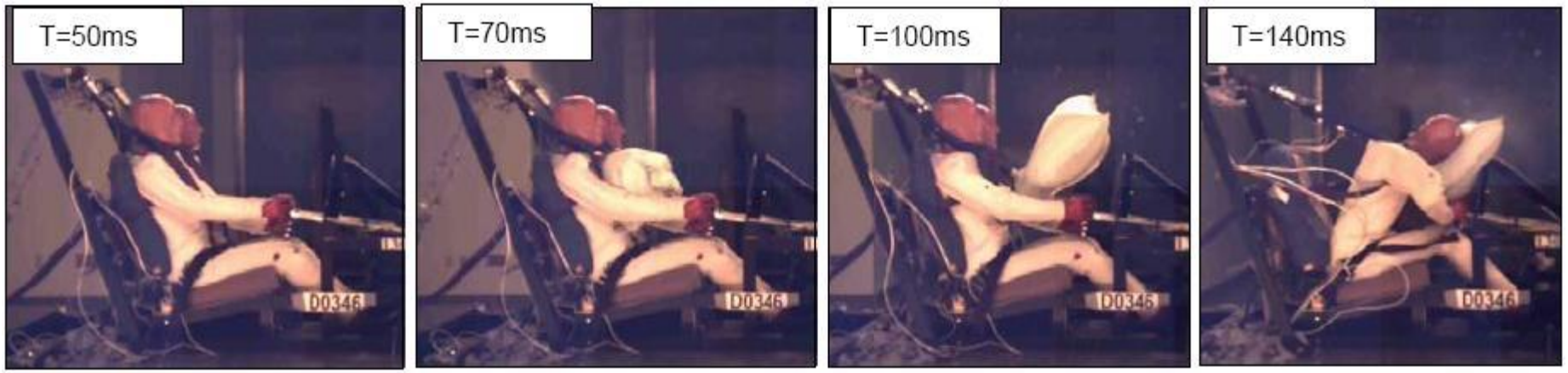
Introduction

The AmSafe Aviation Inflatable Restraint system is a self-contained modular restraint system specifically designed to improve occupant protection from serious head impact injury during an otherwise survivable aircraft accident, and enhance the occupant's ability to exit the aircraft.

Once the AAIR system's sensors detect and verify a catastrophic event, a volume of gas deploys a large airbag "pillow" up and away from the occupant's AmSafe restraint within milliseconds. This shields the occupant's head and upper torso from severe trauma caused by impact with glare shields, instrument panels, control yokes or other structures, ultimately increasing survivability.

UND AEROSPACE
Global Excellence through Innovative People

AmSafe Aviation Inflatable Restraint



Global Excellence through Innovative People

System Components

The AMSAFE Aviation Inflatable Restraint system for Cirrus aircraft is a self-contained, modular restraint system.

System components consist of four major assemblies:

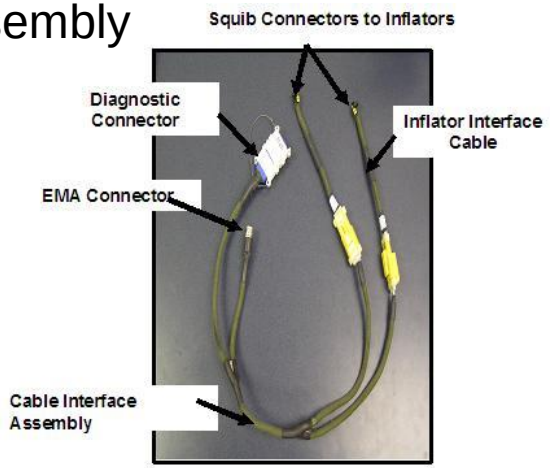
- Seatbelt Airbag Assembly
- Inflator Assembly
- Electronics Module Assembly (EMA)
- Cable Interface Assembly

A typical system with the four point restraints and the EMA controlling two seats is approximately 4.4 lbs total.

UND AEROSPACE
Global Excellence through Innovative People

System Components

Cable Interface Assembly



Electronics Module Assembly

Inflator Assembly

Seat Belt Airbag Assembly

UND AEROSPACE
Global Excellence through Innovative People

Seat Belt Airbag Assembly

The four point restraint consists of the airbag unit and the gas hose attached to one side of the shoulder harness of restraint system. The opposite shoulder harness is padded for comfort and to match the airbag side.

The shoulder harness is tightened by an dual inertia reel; the lap belts are manually adjustable.

Seat Belt Airbag Assembly

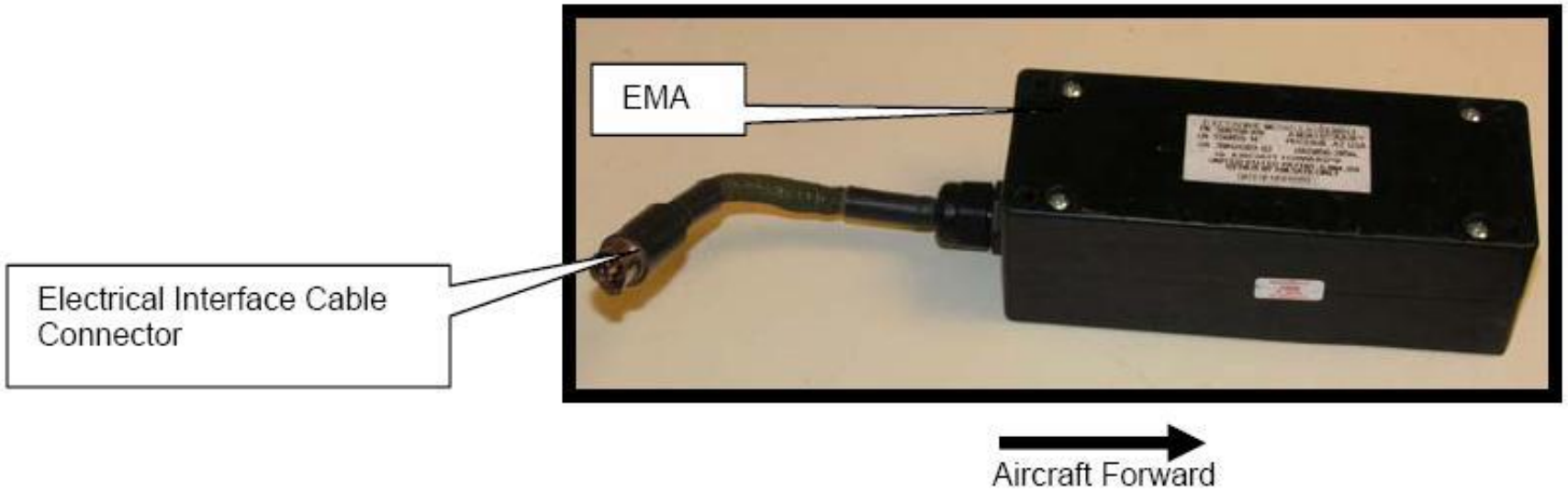
Buckling Assembly Pieces

Airbag attached to shoulder harness, covered with leather shroud.

Dual Inertia Reels

Inert Gas Hose

Electronics Module Assembly



Electronics Module Assembly

The Electronics Module Assembly (EMA) is located underneath the cabin floor along the longitudinal direction of the aircraft.

The Electronics Module Assembly (EMA) is a small black box containing the system electronics, crash sensors, and battery.

When the crash pulse signal from the crash sensor is determined to be within predetermined activation thresholds, the EMA sends an actuation current to the Inflator Assembly.

Electronics Module Assembly

The primary components of the EMA are as follows:

- The EMA battery is an advanced lithium battery with improved safety features and short circuit protection circuitry. During normal conditions, the EMA does not draw any power from the battery. Therefore, the battery service life is essentially defined by the storage life of the battery. Under typical operating and environmental conditions, the battery service life is seven years. The EMA battery is not user replaceable.
- The sensor and electronics module is used to detect and analyze decelerations. The system electronics receive a signal from the crash sensor, evaluates the signal, and provides control of system operation.

Inflator Assembly

Inflator Assembly

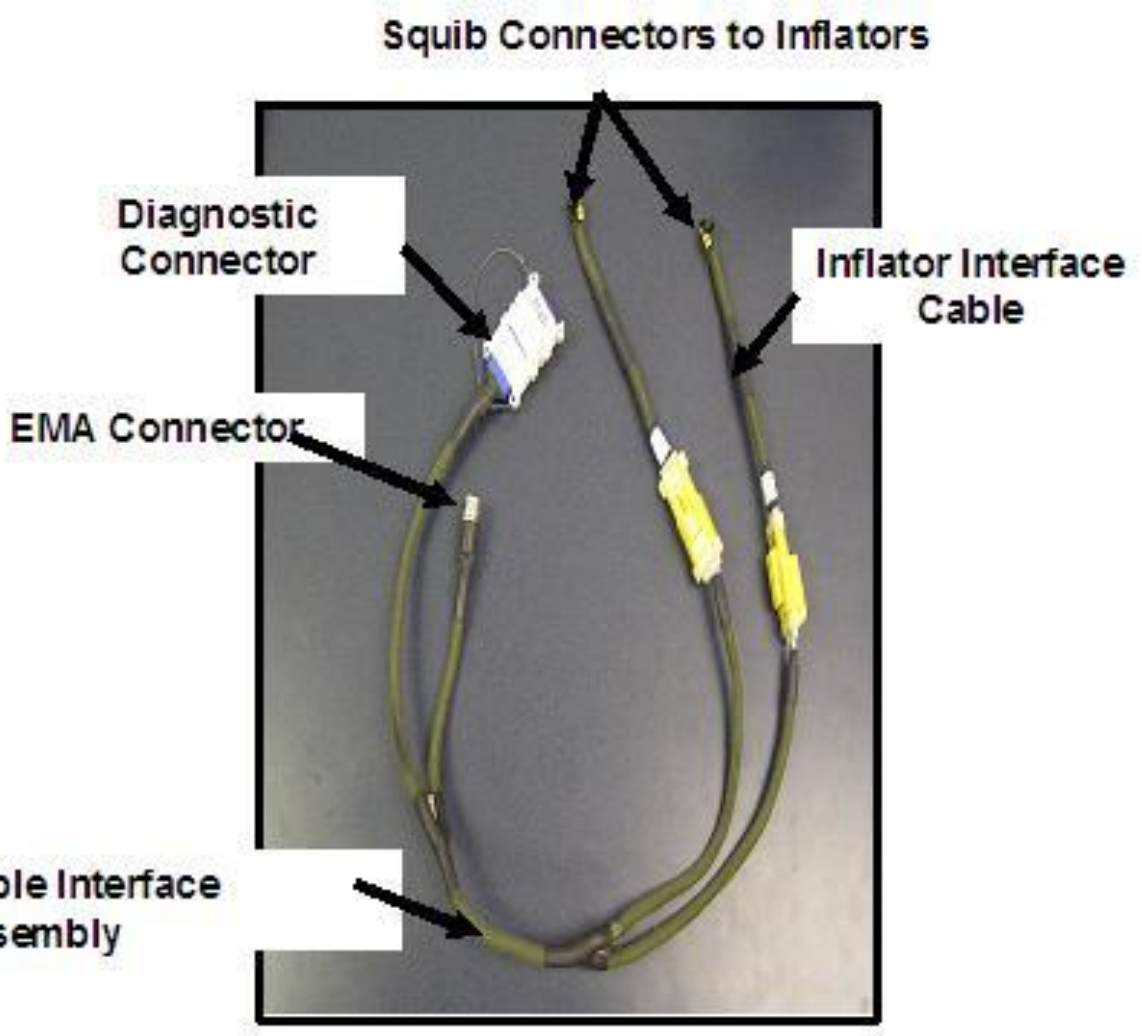
The Inflator Assembly consists of a 6,250 PSI compressed gas cylinder and gas nozzle. Gas travels through the gas hose into the airbag via a tamper-proof connector at the Inflator. The inert gas contained in the Inflator is non-toxic and expands at an ambient temperature.

The Inflator is mounted under the seat with installation-specific brackets. One Inflator is required for each seat position.

A female squib connector is located at the end of the Inflator. The male squib connector is on the squib cable for four point restraints.

UND AEROSPACE
Global Excellence through Innovative People

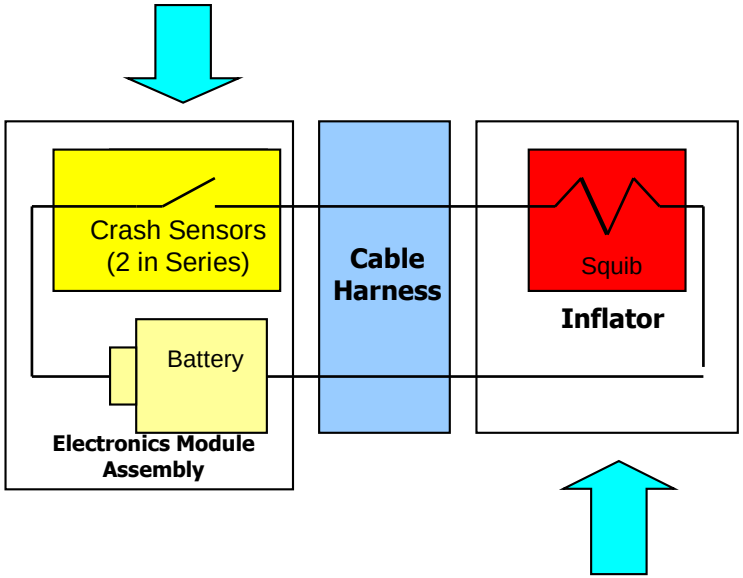
Cable Interface Assembly



Activation Circuit
Four-Point Restraint

1. Crash sensor activation closes the circuit and . .

2. Allows power to the circuit from the battery. . .



3. Which activates the squib, releasing the gas from the Inflator to deploy the airbag!

UND AEROSPACE
Global Excellence through Innovative People

Maintenance

AAIR System functional diagnostics are performed at a maximum of 1000 flight hour intervals or annually, whichever comes first (annual check is at the discretion of the aircraft manufacturer).

System checks can be performed by an A&P using a specialized diagnostic tool available from AMSAFE Aviation. The diagnostic tool activates the diagnostic functions in the system to verify proper operation. Evaluation of the system by the diagnostic tool takes only a few moments.

14 year service life; 7 year refurbishment for the EMA and Inflator Assembly

Questions & Answers

The Following Slides are a few questions and answers from AmSafe Aviation in regards to the AmSafe Aviation Inflatable Restraint system for General aviation.

The following information is from the General FAQ's PDF file located on AmSafe Aviation's website.

www.amsafeaviation.com

UND AEROSPACE
Global Excellence through Innovative People

Questions & Answers

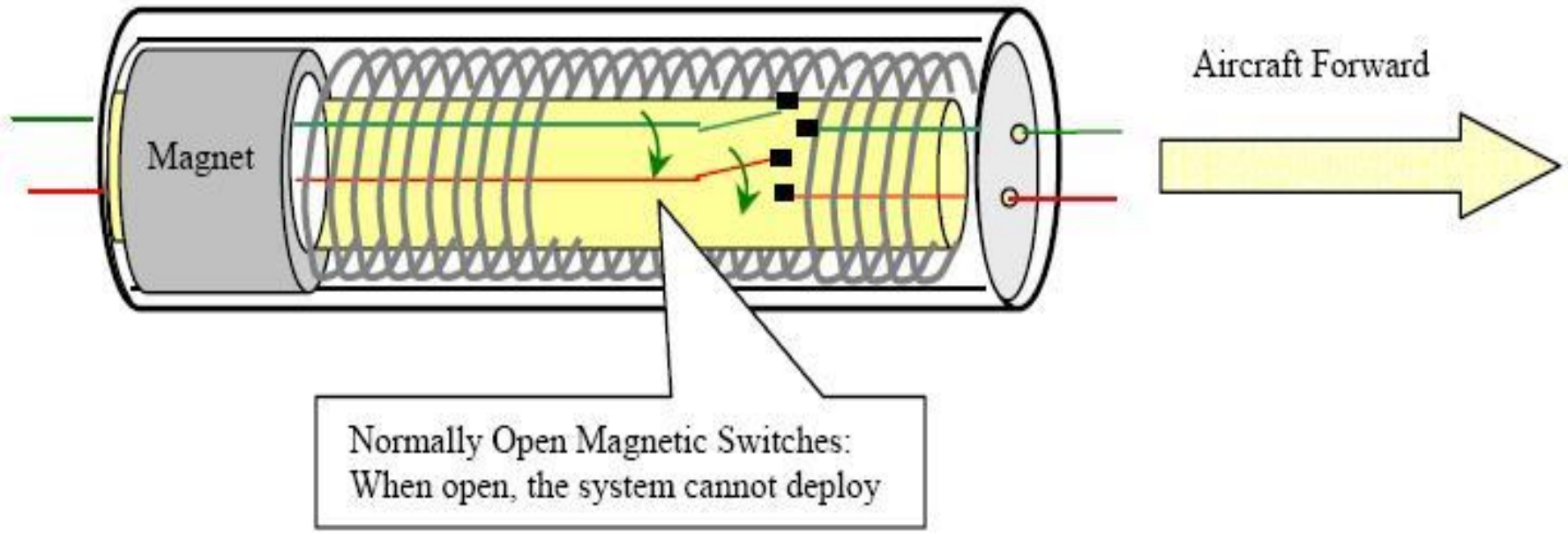
Question:

Can AmSafe provide a description of the sensor function and an understanding of the trigger mechanism internal to the Electronics Module Assembly (EMA)?

Response:

A simplified schematic of the crash sensor is shown below. Two crash sensors, in series, are used in the sensing circuit. In order for deployment to occur, the magnet has to push forward against a spring with enough force to close two open magnetic switches; a severe longitudinal deceleration sustained over a period of 40-50 ms along the length of the aircraft is required to do this. The crash sensor design eliminates inadvertent deployments due to operational conditions such as in-flight turbulence (up and down motion doesn't move the magnet), hard landings (up and down motion doesn't move the magnet), hard brake application (typical hard braking deceleration is less than 1 G), or hitting small runway objects (up and down motion doesn't move the magnet).

Questions & Answers



Questions & Answers

The effects of external environments such as electromagnetic interference, lightning, vibration, temperature and humidity, and internal components such as the spring and magnet, etc. were evaluated and tested extensively during the development and certification of the AAIR system. The system is tested and certified to the highest required levels for aircraft airbag systems.

The AmSafe crash sensor design has been in use in the automotive industry for many years and is installed in approximately 7 million cars. There has never been a reported inadvertent deployment caused by the crash sensor, or any reported spring or magnet failure. The AAIR system is flying in hundreds of aircraft with over several million flight hours, all without a single inadvertent deployment.

UND AEROSPACE
Global Excellence through Innovative People

Questions & Answers

Question:

What assurance can be given that hard landings or turbulence won't deploy the airbag?

Response:

The crash sensor in the EMA will only respond to a forward impact motion at a high g-force sustained for a defined time interval. The sensor is mechanically prevented from deploying the system from forces in any direction except towards the rear of the aircraft (i.e. significant longitudinal deceleration). Hard landings (students' hard landings included) consist of two elements: down motion at a potentially high g-force, and longitudinal deceleration with relatively low g-force.

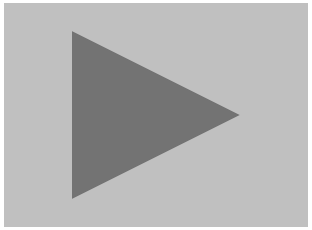
UND AEROSPACE
Global Excellence through Innovative People

Questions & Answers

The down motion does not affect the crash sensor, no matter how high the g-force. Landing longitudinal deceleration (hard braking) is a relatively low g-force. If the longitudinal deceleration exceeds the deployment criteria (high g-force and sustained time interval), then it is a crash event and the airbag will deploy to prevent occupant injury. Turbulence from side-to-side and up-and-down motion is also ignored by the crash sensor. Only deceleration in the longitudinal direction of the aircraft is evaluated by the crash sensor. Extensive testing to D0-160D Section 7 (Operational Shock) and Section 8 (Vibration) substantiate the EMA's lack of vulnerability to hard landing and turbulent conditions.

Each EMA has two crash sensors in series to make it impossible that a single point of failure would cause sensor triggering. Crash sensors are tested at the manufacturer 100% to perform within AmSafe's specification to only fire during the appropriate conditions. Once the crash sensors have been accepted by our quality department and assembled within an EMA, the firing time is again tested to perform within the stated criteria.

AAIR Movie



Press to Play

Global Excellence through Innovative People