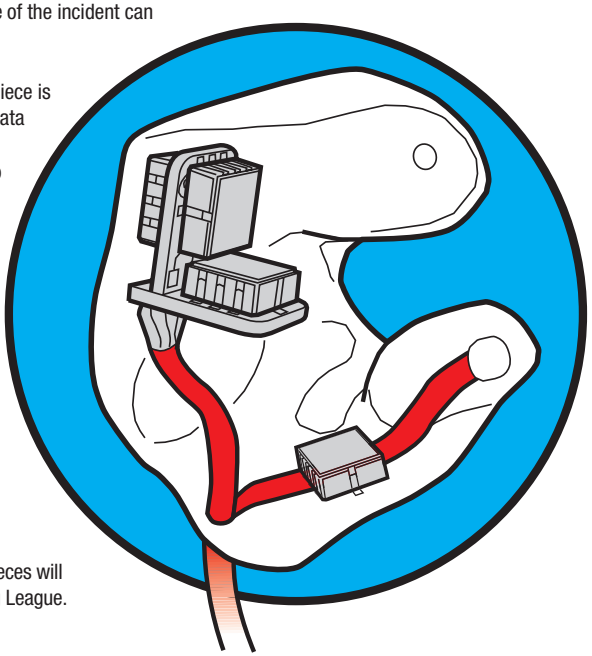
Earpiece

The Delphi Earpiece Sensor System is designed to measure dynamic forces applied to a driver's head during an impact.

The system utilizes accelerometers, small sensors integrated into the earpiece that measure changes in linear force. Each earpiece is fitted with three accelerometers to sense and measure vertical, lateral and longitudinal G-forces on the driver's head at the moment of impact. With vibration or movement, the accelerometer puts out voltage, and the earpiece sensor system interprets the changes in voltage as changes in the car's direction or velocity. By measuring the amplitude of the voltage, G load at the time of the incident can be measured.



Following a crash, information from the earpiece is downloaded through wires to the Accident Data Recorder, also known as the black box. After an accident, the information is transferred to a laptop and analyzed. This data gathered from the earpiece is utilized to evaluate how safety improvements like shoulder harnesses, seat belts and head and neck restraints help prevent head and neck injuries.

The Delphi Earpiece Sensor System has been worn by all IndyCar Series drivers since 2003 and the Indy Pro Series drivers since 2004. Not only is the earpiece used to record crash data, it blocks exterior sound and wind from the driver's ears and allows teams to conduct pit-to-car audio communication. Beginning in 2007, the earpieces will be manufactured in-house by the Indy Racing League.

INDYCAR SERIES & AIR FORCE RESEARCH LABORATORY

The IndyCar Series teamed with Air Force Research Laboratory engineers at Wright Patterson Air Force base in Ohio to share crash impact and injury data gathered from the Delphi Earpiece Sensor System.

Air Force engineers are collecting the data to develop safer helmets, harnesses and ejection seats for military pilots during all phases of flight. Researchers at Wright-Patterson Air Force Base use human subjects in their labs, but can't duplicate the gravitational forces that IndyCar Series drivers endure. Researchers are trying to develop an ejection seat and harness for the Joint Strike Fighter, the Pentagon's next-generation, all-purpose fighter jet. Pilots who eject from such a plane can be buffeted by a 700 mph blast of wind and then get jolted when their parachute opens. The battering can injure their heads, necks and upper bodies. Military researchers have been amazed at how drivers endure such great gravitational forces without suffering serious head injuries.

Research is also shared with the commercial automotive industry through conferences and universities, which can lead to safety policy changes for auto manufacturers.