U.S. Department of Transportation

National Highway Traffic Safety Administration

ODI RESUME

OFFICE OF DEFECTS INVESTIGATION

NHTSA

Authentic US Government Information
National Highway Traffic Safety Administration
uses a *digital certificate* to ensure
the content has remained unchanged

Investigation: EA 19-001
Prompted by: PE 18-003
Date Opened: 04/19/2019
Investigator: Brian Smith **Reviewer:** Scott Yon
Approver: Stephen Ridella
Subject: Air Bag ACU Electrical Overstress

MANUFACTURER & PRODUCT INFORMATION

Manufacturer: Kia Motors America, Chrysler (FCA US LLC), Mitsubishi Motors North America, Inc., Hyundai Motor America, TRW Automotive Inc, Honda (American Honda Motor Co.), Toyota Motor Corporation

Products: Various MY 2010 to 2019 vehicles w/ZF air bag control unit

Population: 12,300,000 (Estimated)

Problem Description: Certain FCA, Honda, Hyundai, Kia, Mitsubishi and Toyota vehicles are equipped with an air bag control unit produced by TRW (ZF), which could fail during a crash event resulting in non-deployment of air bags and seat belt pretensioners. These control units may suffer electrical overstress due to harmful signals (electrical transients) produced by the crash event, causing the unit to stop working during the crash.

FAILURE REPORT SUMMARY

	ODI	Manufacturer	Total
Complaints:	0	TBD	TBD
Crashes/Fires:	2	TBD	TBD
Injury Incidents:	1	TBD	TBD
Number of Injuries:	2	TBD	TBD
Fatality Incidents:	1	TBD	TBD
Number of Fatalities:	1	TBD	TBD
Other*:	1	1	TBD

***Description of Other:** One crash event was identified by ZF and one was identified by ODI through monitoring insurance salvage facility (public) web sites. Each involved Toyota vehicles, and neither was filed as a Vehicle Owner's Questionnaire.

ACTION / SUMMARY INFORMATION

Action: Upgrade PE18-003 to an Engineering Analysis and expand the scope of the investigation to include the Tier-one supplier and any manufacturers who installed this unit in production vehicles.

Summary:

The Office of Defects Investigation (ODI) is expanding the investigation to include the equipment supplier and vehicle manufacturers (OEMs) using this unit. The investigation focuses on ACUs manufactured by TRW, now ZF-TRW (ZF) , the Tier-one supplier to Hyundai and Kia and the other affected OEMs. The ACU senses a vehicle crash to determine whether air bag deployment is required, and if so, deploys the appropriate air bags and other supplemental restraints. ZF supplied subject ACUs to six OEMs: FCA, Honda, Hyundai, Kia, Mitsubishi and Toyota.

Internal to the ACU is an electronic component (an application specific integrated circuit, or ASIC) that monitors signals from crash sensors. A failure of the ASIC may prevent deployment of the required air bags and devices, or may otherwise affect the proper operation of the ACU. The ACU is located in the passenger compartment, and electrical wiring connects the ASIC to sensors located at the front of the vehicle. ODI's current understanding is that a crash event may, in and of itself, produce harmful signals on the sensor wiring capable of damaging the ASIC,

although the probability of this occurring appears to be low. While the ACU incorporates electrical circuitry intended to protect the ASIC from harmful signals, the level and effectiveness of the protective circuitry varies by OEM customer.

During PE18-003, Hyundai and Kia filed recalls (18V-137 and 18V-363 respectively) to address a defect that could result in ACU disablement and non-deployments. According to the filings, the disablement occurs in certain types of frontal crash events. Both filings discussed a condition known as electrical overstress (EOS) that affected the subject ASIC and was likely caused by electrical signals that entered the ACU via sensor wiring. The recalled vehicles used ACUs that had the lowest levels of ASIC protection while non-recalled Hyundai and Kia products using subject ACUs had higher levels of protection. ODI has not identified any EOS failures in the non-recalled Kia and Hyundai populations.

In September 2016, FCA filed recall 16V-668 for certain model year (MY) 2010 to 2014 Chrysler, Dodge and Jeep products also manufactured with the subject ACU. In that filing, FCA also discussed an EOS condition that resulted in a failure of the subject ASIC, which caused air bag non-deployment. FCA noted that the defect condition had only been observed in vehicles equipped with sensor harnessing routed across the front of the vehicle. Other FCA vehicles that also used the subject ACU, but not the cross-car harnessing, had not experienced EOS failures, despite similar time in service. The recalled FCA vehicles used a mid-level form of ASIC protection. Other FCA vehicles that did not use cross car wiring, or used higher levels of ASIC protection, have not been recalled. ODI has not identified any EOS failures in the non-recalled FCA population.

Recently, ODI has identified two substantial frontal crash events (one fatal) involving Toyota products where EOS is suspected as the likely cause of the non-deployments. The crashes involved a MY 2018 and a MY 2019 Corolla equipped with the subject ACU that incorporated higher levels of ASIC protection. Additionally, both ACUs were found to be non-communicative (meaning the ACU could not be read with an Event Data Recorder) after the crash, a condition found in other cases where EOS occurred with other OEMs. No other EOS events have been identified for other Toyota products (including Corolla models that used the subject ACU since MY 2011), or for the Honda and Mitsubishi vehicles that use the subject ACU.

ODI plans to evaluate the susceptibility of the subject ACU designs to electrical signals, as well as other vehicle factors that can either lead to, or reduce the likelihood of, an EOS event. Additionally, ODI will evaluate whether an unreasonable risk exists that requires further field action.