Auto Investigation #1

ENGINEERING REPORT

June 2006

PREPARED FOR:	**AUTO INSURANCE COMPANY #1**
ATTENTION:	**MR. RON REYNOLDS**

INSURED:	AUTO INSURANCE COMPANY #2
DATE OF LOSS:	**JULY 2004**
LOSS LOCATION:	Louisville, KY
POLICY NUMBER:	N/A
CLAIM NUMBER:	<omitted>
IC1 FILE NUMBER:	<omitted>

Introduction

On July 2003, a garage fire occurred at the residence of the claimant, Donna Smith in Louisville, Kentucky. The fire extended to the residence, which was claimed as a total loss. The fire caused damage to adjacent properties located at <omitted>.

On November 2004, Mr. Ron Reynolds of Auto Insurance Company #1 contacted Investigations Company #1, Inc. (IC1) and requested IC1's assistance in determining the origin and cause of the subject fire. Auto Insurance Company #1 provided insurance coverage for Auto Insurance Company #2 of <omitted>.

The author of this report, Scott A. Jones, P.E., C.V.F.I. and Mechanical Engineer of IC1, (812) 944-9988, was assigned to conduct the investigation.

Per the report of the claimant, Auto Insurance Company #2 installed a dual exhaust system on a 1997 Vehicle that was located in the garage at <omitted> at the time of the fire. Per a receipt produced by the claimant and forwarded to the author by Mr. Reynolds, the repair was performed on August 2000. The claimant alleged that a defective repair performed by the insured nearly 3 years before the fire caused the subject fire.

The observations and conclusions contained in this Engineering Report were obtained from inspection of the subject vehicle; review of adjuster's notes; Howard Fire Incident Report <omitted>, which described the public response to the fire; a receipt from Investigation Company #2 dated August 2003, for investigative services rendered; color photographs of the scene along with Auto Insurance Company #3 damage repair estimates, all provided by Mr. Reynolds. It is believed that Auto Insurance Company #3 provided property damage insurance coverage to the claimant.

Background

The author reviewed Howard Fire Incident Report <omitted>. The time of alarm was given as 2:27 A.M. on July 2003. The first response unit arrived at the scene at 2:31 A.M. The events preceding the fire were described in the Narrative section as follows:

> *"Command questioned the property owner and the residents at <omitted> about how the fire had started, and they stated that the 1997 Vehicle had an exhaust leak, and that they had been driving it back from Evansville, Indiana, and when they smelled something burning* [sic]. *The owner of the vehicle stated that when he removed his backpack from the passenger side rear seat his pack was hot. During his inspection of the vehicle he found and* [sic] *indentation in the seat where the pack was sitting. Upon further investigation he stated that the seat was hot and he*

went into the house for a cup of water which he poured onto the seat. When asked if the water soaked in the owner advised that it did not. He stated after he removed the water the seat was warm but not as hot as it had been and he reached up under the seat as he could which was not far to see if it was hot under the seat. The owner advised the Incident Commander that he left his windows open to air out the vehicle, closed up the garage and went into the house around 00:15 hours."

Bethany McQueen, Battalion Commander
7/20/03

Mr. Reynolds further discussed the allegation of defective maintenance in his October 2003 adjuster diary notes. The claimant alleged that the girlfriend of the insured was driving the subject Vehicle and hit something. It was alleged that the impact pushed the exhaust system upward, and since the insured installed non-flexible muffler mounts, the exhaust system remained close to the undercarriage. It was further alleged that the when the insured took his backpack from the backseat of the car, it was hot. The car was then placed into the garage.

The diary further noted that Auto Insurance Company #3 and Auto Insurance Company #4 hired Investigations Company #2 to investigate the origin and cause of the fire. Investigations Company #2 reportedly developed the fire causation hypothesis discussed above.

Observations

On November 2004, the author inspected the subject 1997 Vehicle at Storage Facility #1 in Louisville, Kentucky. The vehicle was being stored outdoors. Mr. Reynolds was present during the entire inspection.

The vehicle was identified with Storage Facility #1 Stock Number <omitted> (*Photograph 1*). All body panels were extensively oxidized, which obscured all flame patterns. The driver's side and passenger's side of the vehicle appeared as shown in *Photographs 2 and 3*, respectively. The engine compartment hood was missing (*Photograph 4*), and the rear and top of the vehicle were extensively warped as shown in *Photograph 5*.

The 3.8 liter V-6 engine appeared as shown in *Photograph 6*. The majority of the aluminum intake manifold was not melted as shown in *Photograph 7*. The aluminum/zinc alloy alternator casing was extensively melted as shown in *Photograph 8*.

The author conducted a detailed inspection of the large gauge battery conductors contained in the engine compartment. There were no indications of conductor-to-conductor or

conductor-to-ground shorting along the length of the conductors (*Photograph 9*). The factory splice between the alternator output conductor (i.e., B+) and the positive battery harness was broken in tensile fashion (*Photograph 10*).

There were no indications of conductor-to-conductor or conductor-to-ground shorting along the length of the power and signal conductors in the engine compartment.

Passenger's Compartment Inspection

Nearly all polyurethane seat cushion materials and plastic trim components within the passengers compartment had been consumed during the fire *(Photographs 11 and 12)*. There were no upholstery materials present upon the front and back seat frame structures. Large granular charred materials lined the front seat bottoms and front and back floorboard areas (*Photograph 13*).

The author measured the distance between the top of the front seat brace for the rear bench seat down to the rear seat floorboard. As shown in *Photograph 14*, the distance was approximately 5 inches. In other words, the urethane cushion material was offset from the lower floorboard of the vehicle by 5 inches.

Photograph 15 shows the mass of extensively charred wood and chassis conductors that were situated on top of the driver's seat and the floorboard between the door and the driver's seat. The author excavated the charred wood from the floorboard region to facilitate inspection of the chassis conductors lying on the floorboards as shown in *Photograph 15*.

A group of chassis conductors spanned from forward to aft along the driver's side of the vehicle as shown in *Photograph 16*. The end of the harness terminated at the rear floorboard as shown in *Photograph 17*, looking down at the conductors.

The author removed the harness from the vehicle to facilitate detailed examination of the same (*Photographs 18 and 19*). The harness was connected to another set of bare, stranded conductors as shown in *Photograph 20*. Further examination of the opposite end of the bare, stranded conductors revealed electrical conductor-to-conductor faulting as shown in *Photograph 21* and detailed in *Photograph 22*.

The author created ***Figure 1*** from *Photograph 22* to detail the arc faulting.

Figure 1 - Arc Faulting of Conductor Harness

The author discovered the other half of the arc faulted conductor harness on the rear floorboard as shown in *Photograph 23.* The author created ***Figure 2*** from *Photograph 24* to detail the arc fault and melted termination of the harness continuation run.

Figure 2 - Arc Faulting of Conductor Harness Continuation Run

Photograph 25 details the view of the arc fault opposite the view in *Photograph 24*.

Vehicle Underside Inspection

The author request Storage Facility #1 personnel to lift the subject vehicle utilizing front loader tongs through the window frames to avoid damaging the exhaust system. The observations from the underside inspection were as follows.

In *Photograph 26*, the transition between the stock exhaust system to the exhaust pipes and mufflers installed by the insured presumably occurred approximately 18 inches aft of the dual catalytic converters. The transition butt welds to the 2 inch diameter muffler tubes were as shown. There were no observed cracks or separations between the new tubes and stock exhaust components.

The dual mufflers and clamps installed by the insured are shown in *Photograph 27* attached to the transition tubes (reference *Photograph 26*). The mufflers were tightly clamped to the transition tubes with no exhaust leakage paths evident.

The tailpipes were welded to the muffler as shown at the welded transition on the passenger's side muffler in *Photograph 28*. The butt welds showed no visible cracks or separations.

The passenger's side and driver's side muffler hangars appeared as shown in the aft-looking-forward view of the mufflers in *Photograph 29*. The passenger's side mount was a conventional rubber doughnut vibration isolation mount as shown in *Photograph 30*. The rubber isolator was consumed in the fire. The passenger's side of the vehicle was equipped with a straight bracket mount connected to the vehicle frame (*Photograph 31* and ***Figure 3***).

As shown in ***Figure 3***, the straight bracket was undamaged, contrary to the claimant's allegation that the bracket bent during the alleged bottom side impact and held the muffler abnormally close to the floor pan.

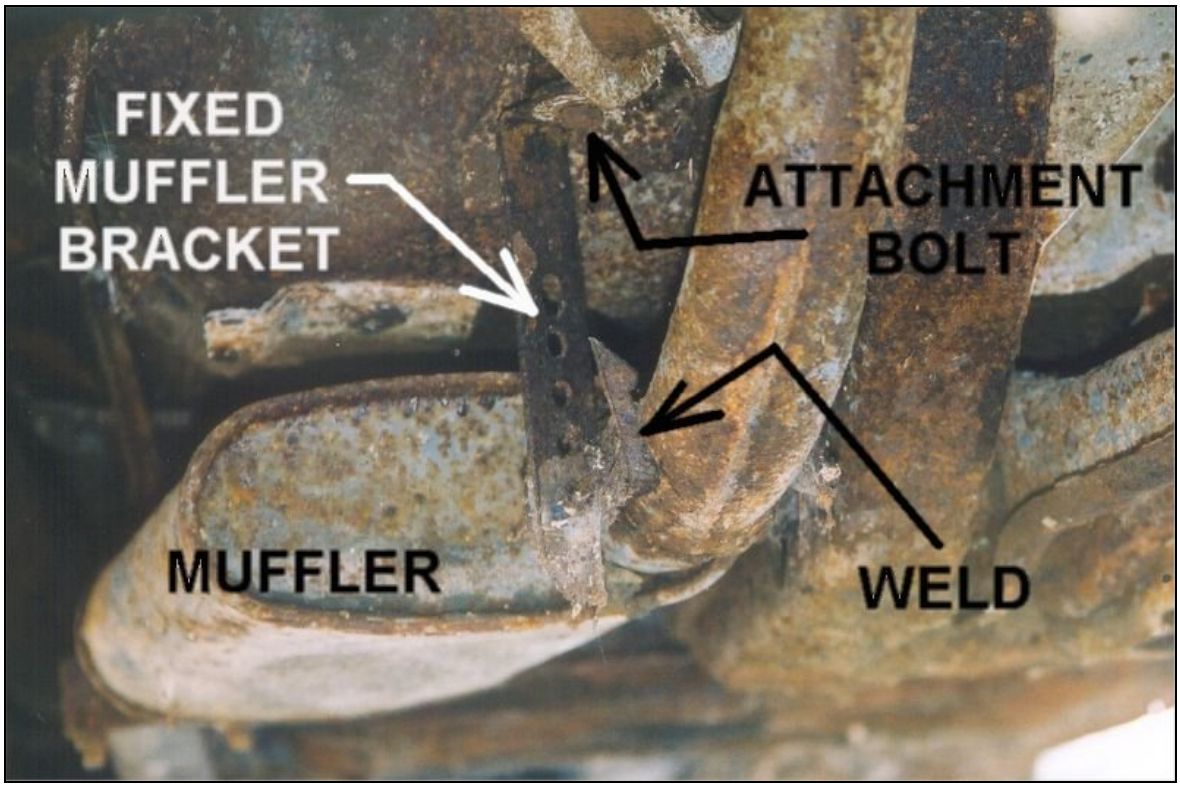

Figure 3 - Undamaged Fixed Passenger's Side Muffler Bracket

As shown in ***Figure 3***, an approximate 1 inch air gap existed between the nearest approach between the muffler and the chassis floor pan. The bracket-to-pipe weld and frame attachment points were intact as shown, and the muffler appeared to be in a nominal, manufactured position.

Discussion/Observations

The Scientific Method of fire cause determination is taught in National Fire Protection Association (NFPA) 921-2004, *Guide for Fire and Explosion Investigations*, Chapter 4. Once a hypothesis on fire causation is developed, the hypothesis must be tested against all facts known in the case.

Specifically, per NFPA 921, Paragraph 4.3.6:

> "*Testing of the hypothesis is done by the principle of deductive reasoning, in which the investigator compares his or her hypothesis to* ***all known facts*** *[emphasis added by author]. This testing of the hypothesis may either be cognitive or*

experimental. If the hypothesis cannot withstand an examination by deductive reasoning, ***it should be discarded as not provable****…*"

The driver's side muffler mount was a conventional hooked bracket mount (reference *Photograph 30*) upon a rubber sound isolator. The passenger's side muffler mount was a straight bracket connected between the tailpipe and the chassis (reference ***Figure 3***).

By examination of the straight bracket in ***Figure 3***, the bracket was not bent as discussed in the insureds allegations and consequently, the muffler was held away from the underside of the chassis floor pan by at least 1 inch at closest approach.

Investigations Company #2 allegedly opined that the heat from the muffler served as the ignition source for the subject fire. The nearby combustibles would have been the polyurethane carpet pad, the polyethylene carpet, and/or the polyurethane rear seat cushion. Examination of the auto ignition (i.e., the temperature of combustion with no spark or flame present) as taught in NFPA 921-2004, Table 5.3.5:

Material	***Auto Ignition Temperature***
Polyurethane	852-1074ºF
Polyethylene	910ºF

From the author's instrumented testing of vehicular exhaust systems in non-related investigations, the surface temperature of a vehicular exhaust system rarely exceeds 700ºF. *Therefore, with a reasonable degree of thermodynamic certainty, it is believed that the surface temperature of the exhaust system was less than the auto ignition temperature of the common interior upholstery materials utilized within the subject vehicle*. The exhaust system could not have served as the competent ignition source for the subject fire even if the upholstery materials had been in *direct contact* with the exhaust system.

Furthermore, 49 CFR 571.302, (i.e., Federal Motor Vehicle Safety Standards (FMVSS 302)), requires that all materials used in the passenger compartment of a motor vehicle: 1) not burn when exposed to an open flame or 2) self–extinguish under limited conditions of fire propagation.

It is therefore believed with a reasonable degree of thermodynamic certainty that the opined ignition source (i.e., exhaust system contact with the underside of the vehicle) has no credible basis in thermodynamics and therefore, per the requirements of NFPA 921, be discarded.

It is believed with a reasonable degree of engineering certainty that the actions of the insured, during the reported installation of the dual exhaust system on August 2000, created no deleterious conditions that might have been causal to the subject fire. It is

therefore believed that the insured had no responsibility for the conditions leading to the subject fire loss.

From the author's inspection of the subject vehicle, a substantial conductor-to-conductor arcing fault was discovered on a conductor harness discovered behind the driver's seat at the rear floorboard (reference ***Figure 1*** and ***Figure 2***). It is believed that the subject conductors were energized at the time of the faulting. There were no other conductors in the passenger's compartment or engine compartment that showed indications of arc faulting.

It is believed with a reasonable degree of engineering certainty that the ignition source for the fire was the heat generated by inadvertent conductor-to-conductor faulting of the subject chassis harness. It is believed that the first fuel to the fire was the electrical insulation surrounding the same. As the author was not able to access the complete maintenance history of the vehicle, assignment of responsibility to the vehicle manufacturer or subsequent repair entity could not be made.

The analysis and conclusions are based upon information reviewed to date, plus general engineering knowledge and experience. Information reviewed at a later date may warrant modifying or augmenting the conclusions.

We appreciate the opportunity to work with you on this evaluation. Pending further direction, this file is considered closed. Please let us know whether we can be of further assistance to you.

Sincerely,

Investigations Company #1

Scott A. Jones, P.E., C.V.F.I.
P.E. & Mechanical Engineer
P.E Electrical Engineering