

## **BLM Non-Serious Accident Investigation**

### **Drive Shaft Failure on BLM Southern Nevada District Engine 5442**

**Date of Accident: July 10, 2011**

**Date of Report: August 13, 2011**

**Chief Investigator: Brent Higbee, BLM FA Division of Fire Operations**

#### **Executive Summary**

At approximately 1100 hours on July 10, 2011, the front drive shaft on Bureau of Land Management Southern Nevada District Fire Engine 5442 broke and separated from the vehicle. The vehicle was travelling at approximately 60 miles per hour on US 95 near Las Vegas, Nevada. This failure caused severe damage to the engine, totaled one and moderately damaged three other privately owned vehicles that were travelling in the vicinity of the accident. No injuries occurred. Engine 5442 is a 2002 class 667 (Type 4) International 4800 4X4 with 76,928 miles and approximately 3200 hours of use at the time of the accident.

#### **Narrative**

On July 10, 2011 at approximately 1100 hours BLM engine 5442 was driving on highway US 95 to Logandale Fire Station. The crew felt a strong vibration followed by a pop, and then witnessed an array of parts exiting from under the vehicle. The driver pulled the vehicle over to the left shoulder, and the crew inspected the engine for damage. The crew then noticed a blue POV with apparent damage had pulled over in front of them on the right shoulder, and later another POV (gold) parked behind the blue car. Upon inspection of the Engine 5442 the crew, noted transmission leaks, large dents in the fuel tank, and the majority of the front drive shaft was missing and/or broken (See figure 3 thru 7). After surveying the area, the driver saw several pieces of the drive shaft approximately 100 yards behind them in the highway. Due to the speed and volume of traffic, it was deemed unsafe to retrieve the pieces of broken drive shaft. The driver tried to move the engine further off the road but it would not move under its own power. Approximately ten minutes later a Nevada State Police officer arrived on scene and talked to the driver of the engine and POV owners. Ten minutes later a second Nevada State Police officer arrived on scene with a broken piece of drive shaft retrieved from the road (See figure 2). The second officer gathered the engine driver's license and insurance information and proceeded up to the first's officer's location. Later, the first Police officer returned and stated that there were possibly four vehicles damaged in the accident. A tow truck from Quality Towing arrived and towed the damaged engine to McCandless International Truck, 3780 Losee Road N., Las Vegas, NV, 89030. There were no injuries so no medical actions were taken.

#### **Investigation Methodology**

BLM FA Division of Fire Operations Equipment Specialist Brent Higbee was assigned to investigate this accident according to established non-serious accident investigation standards. He arrived in Las Vegas at 1600 July 14<sup>th</sup>, 2011. This investigation included the following:

- Visually inspected BLM engine 5442
- Interviewed engine 5442 captain and crewmembers
- Collected and reviewed written statements from the captain and crewmembers
- Reviewed engine 5442 maintenance records

- Considered environmental, equipment, material, procedural, and human factors as they related to the incident
- Collected information not specific to this incident, but pertaining to similar failures from other entities in support of the development of findings and recommendations for this report

## **Findings, Discussion, Recommendations**

**Finding 1:** The drive shaft on E-5442 failed during operation of the vehicle. This caused the accident.

**Discussion:** BLM engine 5442 had the original drive shaft replaced in a safety recall issued by International in the May 2005 Safety Recall G-05501-R2 (See attachment # 1). The drive shaft installed has a non-serviceable part. The centering ball and seat assembly section inside the coupling yoke of the drive shaft is non-serviceable at the field level (Figure 1). This was identified as the major contributing factor to the failure.

When the joint wears out due to lack of grease (Figures 2a and 3) it will limit the normal flexibility of the joint on the drive shaft, which causes wear and heat until one of the parts fails. The McCandless International Truck service manager and his lead technician stated that the centering ball and seat assembly had failed due to lack of grease. They stated that the multiple cardan joint design on this style of drive shaft will allow for service of the u-joints but not the centering ball and seat assembly in between the u-joints.

**Recommendation 1:** The BLM National Fire Equipment Program Manager should identify all BLM engines affected by International's May 2005 Safety Recall G-05501-R2 and issue guidance requiring the following actions:

- All identified engines must be taken to International or Dana/Spicer dealers for removal and thorough inspection of the drive shaft/joints.
- Substandard drive shafts must be ordered and replaced.
- On an interim basis, engines awaiting replacement drive shaft may remove the existing substandard drive shafts and operate in two wheel drive mode. Firefighting tactics and safety considerations must be adjusted accordingly.
- International will be providing front hubs manufactured by Fabco as they become available (see attachment #3).
- Until replacement hubs are installed, remove the front drive shaft for any long distance travel over 40 MPH (Follow International drive shaft installation recommendations).

**Finding 2:** Recommended service interval and estimated 50,000 mile life cycle information (See attachment # 2) for the drive shaft was not available to the field. This contributed to the accident.

**Discussion:** The Engine Captain was aware of drive shaft issues on this model of BLM trucks and the previous recall issued from International. The crew performed a thorough inspection on the morning of the incident.

The Southern Nevada District had a similar drive shaft failure on 8/22/10 on Engine 5441, which was the same year, make, and model as engine 5442. Due to the previous failure, the Engine Captain and crew of 5442 were diligent in daily inspections and did thorough weekly inspections

every Friday. The Engine Captain and investigator were unaware of the recommended service interval and estimated 50,000 mile life cycle that Dana/Spicer had established after the recall had taken place. This was provided to the investigator on July 15<sup>th</sup> 2011 from the Navistar regional service manager. To the investigator's knowledge, no information ever made it to the field; this information remained at International and their service centers. Cal Fire had experienced two similar failures with less damage. Cal Fire has been working with Navistar for a long term repair.

**Recommendation 2:** The BLM National Fire Equipment Program Manager should continue to work with Navistar and subcomponent manufacturers to ensure that maintenance requirements are effectively communicated to BLM fire personnel through established channels.

**Finding 3:** The engine crew did not utilize the Fire Equipment Maintenance and Procedure Record (FEMPR). This may have contributed to the accident.

**Discussion:** The engine crew performed daily Preventive Maintenance (PM) Checks that were documented. The investigator did not find any records of greasing the drive shaft as described and recommended in the vehicle owner's manual. Last recorded service was on 10/01/2010 when BLM engine 5442 had its yearly preventive maintenance done at Silver State Truck and Trailer, 3701 Freightliner drive, N Las Vegas, NV, 89081. When needed repairs were identified, there was no tracking as to when the repairs were completed and who performed the repairs (6/29/2010 daily checklist identified small Transfer Case leak but no record of any corrective actions taken or the repair had been performed). International had performed the 2005 safety recall number G-05501-R2 (see attachment # 1) on the front drive shaft. This was verified by the style of drive shaft that failed on the engine, which was different than the original drive shaft. However, no records were found to support this. The engine's FEMPR could have documented this had it been utilized.

**Recommendation 3:** The Southern Nevada District Fire Management Officer should ensure that the BLM Fire Equipment Maintenance and Procedure Record (FEMPR) are used as required by the *Interagency Standards for Fire and Fire Aviation Operations* (chapter 2, page 37).

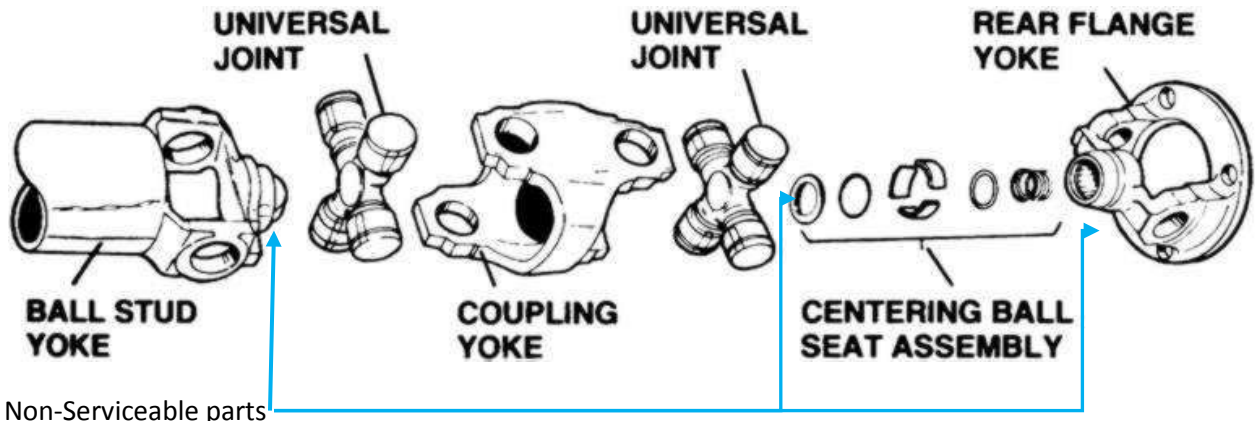
**Finding 4:** Operational and environmental conditions may have decreased the service life of the drive shaft. This may have contributed to the accident.

**Discussion:** Prolonged periods of high drive shaft speeds associated with highway travel, high ambient temperatures and dusty conditions contributed to the equipment failure by causing the drive shaft to overheat and wear out. To date, Navistar International has not developed a replacement part for these drive shafts; therefore, the potential for the same failure still exists.

**Recommendation 4:** The BLM National Fire Equipment Program Manager should continue to work with Navistar International and sub-manufacturers to formulate a long term solution. One possible remedy is installation of Fabco front hubs for the front axle (See attachment # 3).

**Maps/Photos/Illustrations**

**Figure 1** Typical Double Cardan Joint Exploded View



**Figure 2** Driveshaft recovered at scene



**Figure 2a** (Note close up of bluing of ball due to lack of grease)

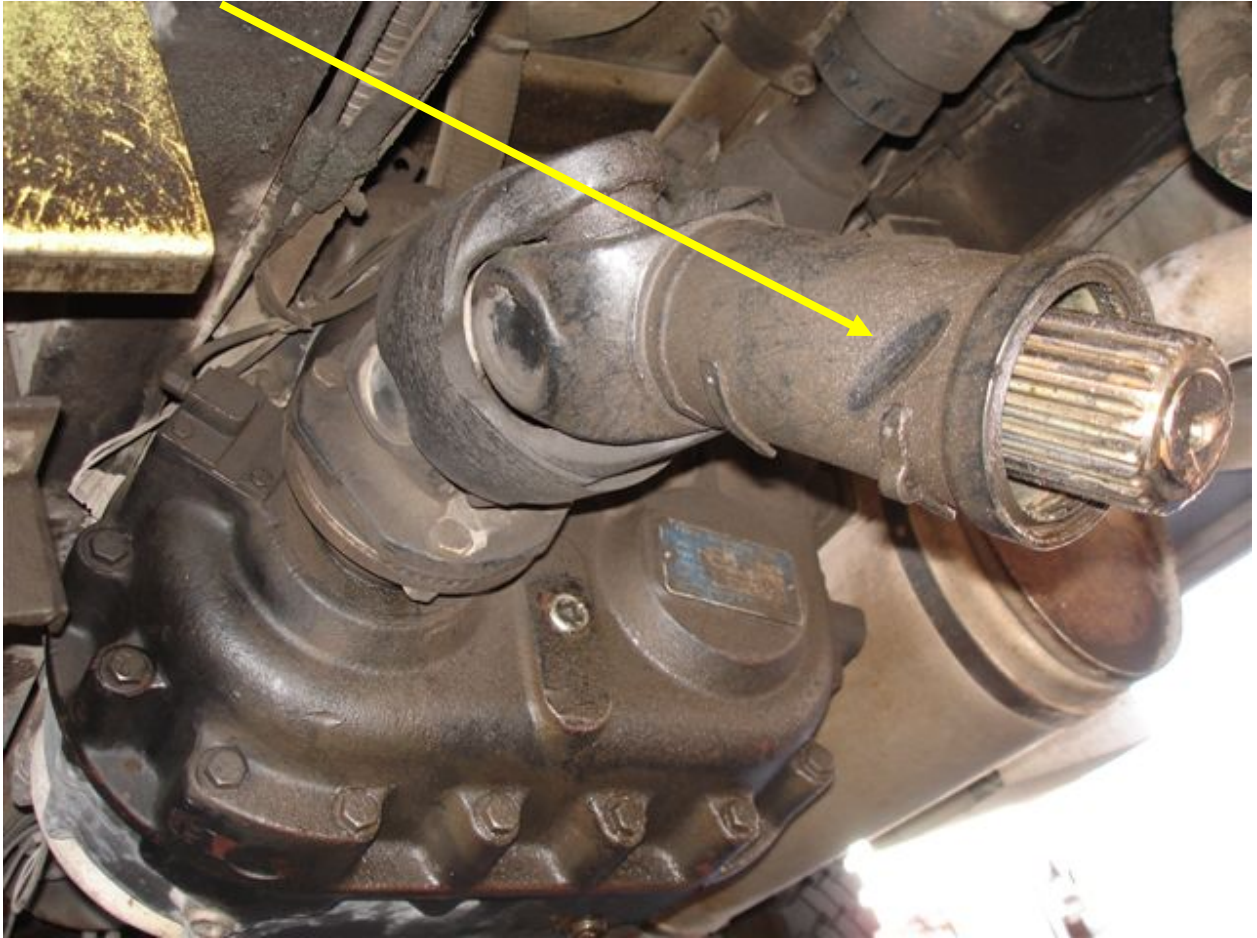


**Figure 3** Front Axle Yoke (Note rust color and signs of lack of grease in the seat)





**Figure 4** Transfer Case Section of driveshaft. (Note big dent next to splines that part of the drive shaft hit the frame of the truck)



**Figure 5** Fuel tank dented and leaking.





**figure 6** Transmission Cracked and Leaking from driveline hitting the case of the transmission.



**Figure 7** View from transfer case (note damage to transmission, exhaust, and fuel tank)

