



NIOSH
Fire Fighter Fatality Investigation
and Prevention Program

Death in the line of duty...

A summary of a NIOSH fire fighter fatality investigation

June 3, 2005

Forest Ranger/Fire Fighter Drowned After Catastrophic Blow-out of Right Front Tire - Florida

SUMMARY

On March 3, 2004, a 40-year-old male forest ranger (the victim) died after he lost control of the brush truck he was driving to a controlled burn. The truck experienced a catastrophic blow-out of the right front tire, left the road, struck a culvert and overturned. It came to rest on its roof in a ditch filled with approximately 2 feet of water. The victim was pronounced dead at the scene.

NIOSH investigators concluded that to minimize the risk of similar occurrences, fire management agencies and fire departments should:

- *provide driver training as often as necessary to meet the requirements of NFPA 1451. Training should incorporate specifics on maintaining vehicle control when a rapid loss of tire pressure (blowout) occurs.*
- *as part of the apparatus maintenance program, ascertain the age of tires and impose time restrictions for usage according to manufacturers' specifications and guidelines*

Although it is unclear if the following contributed to this incident, fire management agencies and fire departments should consider implementing the following recommendation based on prudent safety considerations.

- *ensure that vehicles meet the requirements of NFPA 1901 and NFPA 1906 and do not exceed their load-carrying capacity*



Overtured truck

INTRODUCTION

On March 3, 2004, a 40-year-old male forest ranger (the victim) died when he lost control of the brush patrol truck he was driving and crashed after a blow-out of his right front tire. On March 12, 2004, the U.S. Fire Administration (USFA) notified the National Institute for Occupational Safety and Health (NIOSH) of this fatality. On May 19-20, 2004, two safety and occupational health specialists from the NIOSH Fire Fighter Fatality Investigation and Prevention Program investigated the incident. The NIOSH team met with the Division Safety Officer; the Chief of the Forest Protection Bureau; the victim's supervisor; the Equipment Operations/Maintenance Administrator for the District; union representatives; and the state highway patrol officer who investigated the incident. The NIOSH team interviewed several of the victim's coworkers and reviewed the division's standard operating procedures (SOPs), training records, and the death

certificate. A crash reconstructionist, contracted by NIOSH, visited, photographed and measured the incident site, incident vehicle, donor^a vehicle, and the tire in question.

Department/Training: This state agency has 900 wildland fire fighters in 15 field units. Each field unit serves 4-6 counties or work centers. The agency serves a population of about 17 million in an area of approximately 42,000 square miles. Recruits initially go through 420 hours of wildland fire fighting training and must take 60 hours of fire fighter training annually thereafter. The victim had 13 years of experience with this agency and had the requisite initial and annual training including an emergency vehicle operator course (EVOC) in 2003. There are no special requirements for driving this class of vehicle.

Weather/Road: The road is a two-lane, state-maintained, asphalt roadway with white roadway edge fog lines and narrow paved shoulders on each side. The road was dry, in good condition, and free of defects. The road is approximately 20-feet wide with a surface coefficient of friction of approximately 0.65 (as measured by the reconstructionist). Drainage ditches are located on both sides of the road. The incident occurred on a long, straight section of the road with no visual obstructions and a posted speed limit of 60 mph. This incident occurred during daylight hours. The weather was clear. The drainage ditches contained approximately 2-feet of water at the time.

Apparatus: The brush truck (incident vehicle) was a 1984 full-ton pickup. It was a federal surplus vehicle which the division had acquired in the summer of 1994. The incident vehicle was 211.8 inches long and 79.6 inches wide. It weighed 7,250 lbs dry and 9,250 lbs when the water tank was full. The gross vehicle weight listed for the vehicle was 8,800 lbs. The division had installed a steel flatbed equipped with a 270-gallon, dual-baffled water tank, pump and hose reel assembly. The division also used parts from a 1985 pick-up truck they had purchased in May 1994 from a local fire department as a donor vehicle for the incident vehicle. In February 2004 the division installed a dual-tire rear axle, a front axle, and six tires on the incident vehicle from the donor vehicle. The rear tire system upgrade reportedly was completed to improve weight distribution and to provide more loft while traveling off road. The springs, shocks, steering box, brakes, and brake hose were replaced during the latter service procedure. Over the 10-year period of ownership, the division carried out regular, routine maintenance on the incident vehicle as well as larger maintenance procedures that included replacement of the engine, axle/differential drive shaft, and steering box. *Note: Reportedly the water tank was empty after the crash. Because the victim was en route to a controlled burn, and the usual procedure was to keep the tank full at all times, the tank presumably was full at the time of the incident.*

Tires/Wheels: The incident vehicle was equipped with six (two front and dual tires on rear axle/each side) tubeless radial tires with off-road, aggressive tread. The tires were obtained from the donor vehicle and were placed on the incident vehicle during the axle transference procedure in February 2004. According to the reconstructionist, the tires showed no indication of outer degradation, had not been subjected to any recall notices from the tire company, and were not recaps. Based on the Department of Transportation (DOT) number found on the tires, they were manufactured in 1998.

^a Vehicle used for spare parts.

INVESTIGATION

On March 3, 2004, at approximately 0900 hours, the victim was traveling northeast on a two-lane road to conduct a controlled burn when his right front tire experienced a catastrophic burst-type blow-out causing him to lose control. The incident occurred on a long, straight section of level road. The victim was familiar with the vehicle, the road and the area. His estimated speed at the time of the incident was 55 mph based on the reported speed of a witness traveling behind the victim. The truck left the roadway, rotated counterclockwise, hit a culvert, and overturned ½ turn coming to rest on its roof in a ditch ([Diagram](#)). The drainage ditch contained approximately 2 feet of water at the time of the incident. The victim, who was wearing his seatbelt, was suspended upside down from his seatbelt with his head submerged beneath the water. He apparently was unable to unbuckle his lap and shoulder restraint and drowned.

A post-crash examination by the crash reconstructionist determined the tire had undergone a catastrophic, burst type blow-out that compromised the casing integrity (radial casing cords), inner radial ply and liner. Tread depth of this tire was 9/32. According to the reconstructionist, the tire damage resembled similar damage documentation patterns resulting from a previous impact that may have compromised the inner tire radial ply and liner. The reconstructionist stated in his report that this type of damage is *nearly impossible to detect* because tires may still hold air and show no outward signs of deformation. He also noted that, post crash, there was *considerable tread deformation and separation along with complete cord disruption at the blow-out epicenter* ([Photo](#)).

A civilian traveling behind the victim witnessed the crash and called 911. Emergency Medical Services (EMS) arrived 3-4 minutes after the victim crashed and pulled him from the vehicle. He was pronounced dead at the scene at 0912 hours.

Cause of Death

The medical examiner listed the cause of death as drowning with no evidence of trauma-related injuries. The victim had no known pre-existing medical conditions and his post-crash blood alcohol content (BAC) and drug screening tests were negative.

RECOMMENDATIONS/DISCUSSIONS

Recommendation #1: Fire management agencies and fire departments should provide driver training as often as necessary to meet the requirements of NFPA 1451. Training should incorporate specifics on maintaining vehicle control when a rapid loss of tire pressure (blowout) occurs.

Discussion: Driver training should be documented and given in accordance with NFPA 1451, *Standard for a Fire Service Vehicle Operations Training Program*¹ and NFPA 1002 *Fire Apparatus Driver/Operator Professional Qualifications*.² These standards state that departments should establish and maintain a driver training education program and each member should be provided driver training not less than twice a year. During this training, each driver should operate the vehicle and perform tasks that the driver/operator is expected to encounter during normal operations to ensure the vehicle is safely operated in compliance with all applicable State and local laws.

NFPA 1451 §5.3¹ states that fire department personnel must be trained in and exercise “applicable principles of defensive driving techniques under both emergency and non emergency conditions.” This training should include, but not be limited to, how to maintain control of a vehicle in the event of a rapid loss of tire pressure or blowout.

The National Safety Council³ and the National Highway Traffic Safety Administration (NHTSA)⁴ suggest the following if a blowout occurs on the highway:

- Grip steering wheel firmly at the first sign of tire trouble; correct steering as necessary to stabilize vehicle and regain control.
- Gradually release the accelerator. Do **not** abruptly release your foot from the accelerator and do **not** slam on the brakes. The latter cause the vehicle to transfer more of its weight from the rear tires to the front tires which, with a flat tire, can lead to loss of control.
- Work vehicle toward breakdown lane or toward exit.
- Once the vehicle is well off the roadway, brake lightly and carefully until stopped. Turn on emergency flashers and call for help.
- Stand away from the vehicle and wait for help to arrive; do not stand behind or next to your vehicle.

Recommendation #2: Fire management agencies and fire departments should, as part of the apparatus maintenance program, ascertain the age of tires and impose time restrictions for usage according to manufacturers’ specifications and guidelines.

Discussion: Tires should be checked for signs of wear, for drying or cracking, for cuts, proper pressure inflation, adequate tread depth, and condition of the valve stems. As with any rubber product; however, degradation of tires occurs with age, regardless of tread depth and use.^{5, 6} States with high average ambient temperatures have higher tire failure rates.⁶ Thus, imposing time restrictions is important. The tires in this incident were six years old and, according to the reconstructionist, showed no signs of degradation or excessive tread wear. However, neither the division nor the fire department from which the division bought the donor vehicle could document the age of the tires.

Although it is unclear if the following contributed to this incident, fire management agencies and fire departments should consider

implementing the following recommendation on the basis of prudent safety considerations.

Recommendation #3: Fire management agencies and fire departments should ensure that fire apparatus meet the requirements of NFPA 1901 and NFPA 1906 and do not exceed their load-carrying capacity.

Discussion: NFPA 1901 Standard for Automotive Fire Apparatus⁷ and NFPA 1906 Standard for Wildland Fire Apparatus⁸ describe chassis and vehicle requirements including carrying capacity. With a full tank of water, the gross vehicle weight rating for the vehicle in this incident was exceeded by 450 lbs. Although it is unknown if this contributed to the crash, some cautionary comments are in order. According to NHTSA: “It is very dangerous to drive any vehicle whose load carrying capacity has been exceeded. Too much weight in a vehicle can cause difficulty steering and braking. It can also compromise a vehicle’s safety by causing the tires to wear more quickly and unevenly and suspension parts and axles to wear more quickly. In extreme cases, overloading may cause catastrophic failure of any of these components.”⁹

REFERENCES

1. NFPA [2002]. NFPA 1451, Standard for a Fire Service Vehicle Operations Training Program. Quincy, MA: National Fire Protection Association.
2. NFPA [2003]. NFPA 1002, Standard on fire apparatus driver/operator professional qualifications. Quincy, MA: National Fire Protection Association.
3. National Safety Council [2005]. What to do if you have a blowout on the highway. <http://www.nsc.org/library/facts/Blowout.htm>. Date accessed: May 19, 2005.
4. National Highway Traffic Safety Administration (NHTSA) [2005]. Frequently Asked Questions (FAQs). <http://www.nhtsa.dot.gov/cars/testing/ncap/Tires/pages/TirePressureFAQ.htm>. Date accessed: May 9, 2005.
5. Safety Research & Strategies, Inc. [2004]. Tire Safety. <http://www.safetyresearch.net/tires.htm>. Date accessed: May 10, 2005.
6. MacIsaac JD [2004]. Interim update - NHTSA tire aging development project. http://www-nrd.nhtsa.dot.gov/pdf/nrd-01/SAE/SAE2004/TireAging_MacIsaac.pdf. Date accessed: May 9, 2005.
7. NFPA [2003]. NFPA 1901, Standard for automotive fire apparatus. Quincy, MA: National Fire Protection Association.
8. NFPA [2001]. NFPA 1906, Standard for wildland fire apparatus. Quincy, MA: National Fire Protection Association.
9. National Highway Traffic Safety Administration [2005]. Frequently asked questions on the exemptions to the make inoperative prohibition. Issues pertaining to load carrying capacity. [http://www.nhtsa.dot.gov/cars/rules/adaptive/Inoper/Fre_ask_Ques.htm]. Date accessed: May 9, 2005.

INVESTIGATOR INFORMATION

This investigation was conducted by Linda Frederick and Virginia Lutz, Safety and Occupational Health Specialists, Fire Fighter Fatality Investigation and Prevention Program, Division of Safety Research, Surveillance and Field Investigations Branch, NIOSH. The report was written by Linda Frederick.

Photograph AND Diagram



Photo. Right front tire after blow-out.

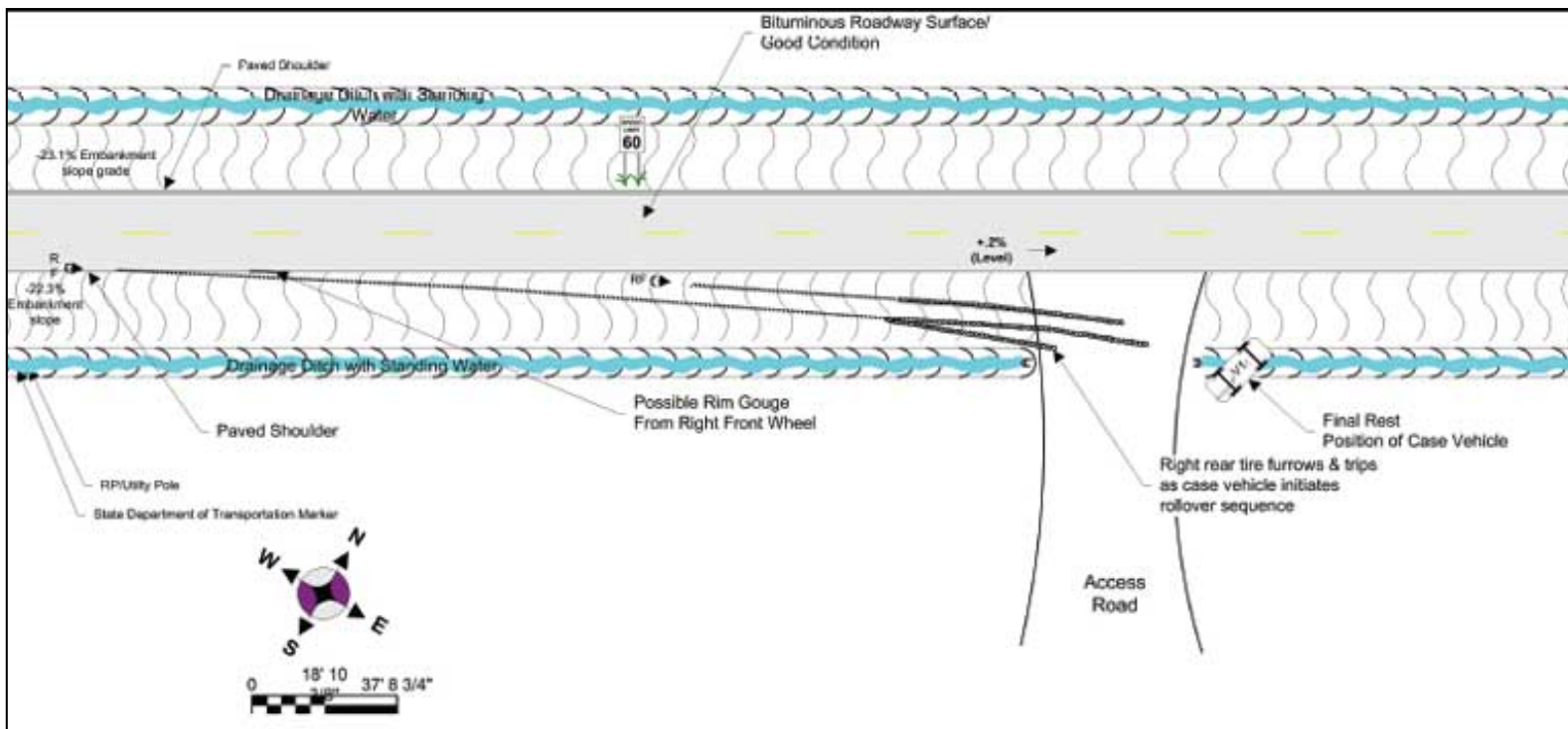


Diagram. Aerial view of incident scene.



[Return to Fire Fighter Homepage](#)



[NIOSH Homepage](#)

This page was last updated on 06/03/05.