MONTGOMERY COUNTY FIRE AND RESCUE SERVICE

SAFETY SECTION INJURY INVESTIGATION REPORT

Randolph Road and Middlevale Road
Silver Spring, MD

Incident #F11-001038

Tuesday, January 4, 2011

Captain Peter J. Corte, Investigator

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Executive Summary

At 0713 hours on Tuesday, January 4, 2011, units from the Fourth Battalion were dispatched to incident #11-1038, for a personal injury collision reporting persons trapped. Units arrived on the scene with no entrapment and began rescue operations, including patient care of three priority three patients. In the demobilization phase of the incident, units began to return to service and transport patients as necessary leaving RS742 on the scene with units from the Montgomery County Police (MCP), who were managing the collision investigation and traffic in the area.

Shortly thereafter, the crew from RS742 undertook the task of righting an SUV that was turned on its side as a result of the collision. As the crew was beginning the process, RS742 Officer's right hand became entrapped between the guide rollers and the hook of the winch. RS742 Officer was attempting to remove the winch hook from the main drum when RS742's Driver activated the remote winch controller causing the winch cable to retract entrapping RS742 Officer's right hand between the winch and the guide rollers. RS742 Right, who was the Captain, requested assistance via radio to include an ALS response to the scene for a Firefighter with a crush injury. RS742 Officer was able to self extricate his hand from the winch and roller assembly.

Twenty-nine minutes after dispatch of the initial incident a second dispatch was made for the injured Firefighter. RS742 Officer sustained injury to his right hand to include a partial amputation of the middle finger, and a crush injury to the index and ring fingers.

Injury Investigation and Methodology

The injury investigation was conducted at the scene and at follow-up locations, including Union Memorial Hospital, by Captain Peter J Corte, Safety 700-A, and Battalion Chief 704-A, Michael D. Hanson.

The investigators used traditional investigative techniques at the scene and then transitioned to the Human Factors Analysis and Classification System (HFACS) as a template for this report. Transition was made to HFACS when it was determined that human error and behaviors were major contributing factors to the incident.

Definitions

Human Factors Analysis and Classification System (HFACS)- The Human Factors Analysis and Classification System (HFACS) was developed as a categorization system of latent and active errors that served as causal factors that have been identified in aviation accidents. Its main purpose is to act as a framework for use in accident investigations and as a tool for assessing accident trends. HFACS was developed based on James Reason's model of latent and active failures . Generally referred to as the "Swiss cheese" model of human error, James Reason describes four levels of human failure, its active and latent errors involved and how these factors build-up towards a mishap. By strict definition, active errors are described as errors that have an immediate effect whereas a latent error would be a decision of action that has no immediate effect but lays hidden in the system until all factors come together and culminate in an accident.

Unsafe Acts- The initial point that typically triggers an HFACS investigation. There are two types of unsafe acts: errors (unintentional actions) and violations (deliberate deviation from policy or practice).

Preconditions to Unsafe Acts- Preconditions assess two categories: the substandard conditions and the substandard practices of the personnel involved. Substandard conditions include adverse mental states like being focused or distracted, adverse physiological states such as fatigue or illness and physical or mental limitations meaning the personnel were unfit for the job. Substandard practices assess crew resource management and personal readiness.

Unsafe Supervision- This category of HFACS looks to the actions of the supervisor and the role those actions played on the incident.

Organizational Influences- Looks at what role the organization played in the incident. Organizational factors evaluated include: resources and training provided and organizational culture. In this incident unsafe supervision is tied to organizational influences, as the desire to provide training is linked to a breakdown in supervision.

Apparatus and Response

Units dispatched on the initial incident, #11-1038 at 0713 were A742B, M742, RS742, E718 and BC704. Units on the initial incident had cleared or were transporting patients to the hospital, with the exception of RS742, when RS742 Officer's right hand became entrapped. RS742 Right, who was the Captain, requested assistance via radio to include an ALS response to the scene for a Firefighter with a crush injury. Montgomery dispatched the following units at 0742 hours; A724 and E718, BC704 and SA700 responded in addition. EMS702 was later assigned to assist the family at Union Memorial Hospital.

PPE

Appropriate PPE was in use and properly worn at the time of the injury and RS742 Officer's extrication glove, worn on the injured hand, was left in the equipment when RS742 Officer's hand was extricated from the winch.

Site Information

The location of this incident was a roadway maintained by the State of Maryland and had no specific role in the injury.

Weather

The weather at the time of the incident was overcast and cold with an outside air temperature of 28 to 32 degrees Fahrenheit.

Incident Description

At 0713 hours on Tuesday, January 4, 2011 units from the Fourth Battalion were dispatched for a personal injury collision with person's trapped, incident #11-1038. A742-B, M742, RS742, E718 and BC704 responded. Units arrived on the scene with no entrapment and began rescue operations, including patient care of three priority three patients. In the demobilization phase of the incident, units began to return to service and transport patients as necessary leaving RS742 on the scene with units from the Montgomery County Police (MCP), who were managing the collision investigation and traffic in the area.

Shortly thereafter the crew from RS742 undertook the task of righting an SUV that was turned on its side as a result of the collision. As the crew was beginning the process RS742 Officer's right hand became entrapped between the guide rollers and the hook of the winch. RS742- Officer was attempting to remove the winch hook from the main drum when RS742's Driver activated the remote winch controller causing the winch cable to retract entrapping RS742 Officer's right hand between the winch and the guide rollers. RS742 Right, who was the Captain, requested assistance via radio to include an ALS response to the scene

for a Firefighter with a crush injury. RS742 Officer was able to self extricate his hand from the winch and roller assembly.

RS742 Staffing and Experience Level

Position	**Rank**	**Years Experience**
RS742 Driver	FFIII	9 year's career
RS742 Officer	FFIII	13 year's career
RS742 Right	Captain	23 year's career

RS742 was the unit normally assigned to Rescue Company 2

Recommendations:

- At no time should an operator have the winch controller in hand when the crew is not in his line of sight.
- Crews must maintain communications at times when critical tasks are being undertaken.
- A method must be found to secure the winch hook outside of the roller area so that the device does not become jammed in the future.
- Anytime a repair to the winch needs to be made the PTO must be disengaged until the problem is resolved.
- Do not use incident scenes as training grounds for proficiency operations, as even perceived routine incidents contain unforeseen risks.
- The Department should consider development of a cohesive officer/candidate preceptor program that allows a senior officer to remain at the side of a promotional candidate throughout decision making and operating periods.
- The Department should develop a training program that focuses on maintaining situational awareness not only in the face of high stress events, but also while performing more routine tasks.
- Replace Kevlar winch rope due to tendency to "back lash" if not properly rewound on drum. This tendency was included in the service report as "normal".

Findings:

The findings section includes four components for each contributing action identified by the investigation: The HFACS level and action; a background statement that provides a narrative of the action; and Impact statement that describes what influence the action had on the incident and Corrective Measures; recommendations to prevent the action from happening again.

1. Unsafe Action:

Incident scenes should not be used to conduct training evolutions.

Background:

RS742's crew began the demobilization process and attempted to right the vehicle as a winch training evolution. Part of their thought process was to speed the removal of a damaged car and open the roadway at rush hour allowing traffic congestion to ease. The crew indicated that there were no discussions in regard to performing the evolution and that it was a standard practice to perform this type of activity as a method of maintaining proficiency with the winch equipment.

Impact:
While performing this operation RS742's Officer was seriously injured when RS742 Officer's right hand fingers were entrapped between the winch rollers and hook equipment causing the partial amputation of the middle finger and a crush injury to the index and ring finger.

Corrective Measure:

Do not use incident scenes as training grounds for proficiency operations because even perceived routine incidents contain unforeseen risks. If proficiency exercises are required they should be scheduled at an appropriate training area and should be supervised with the proper number of instructors.

2. Unsafe Action:

The hook on RS742's winch pulls through the rollers.

Background:

The investigation revealed that the hook would periodically slip from the outside of the rollers to the inside and actually drop to and drag on the pavement. This was not reported in any maintenance records or reports and occurred on a frequent basis. It was also noted that users of the winch were aware of this and would periodically correct the issue but never took action to make a permanent repair.

Impact:

Every time the hook becomes dislodged, it requires the operator to place it back through the rollers by hand. This requires significant manipulation of the hook to place it through the rollers.

Corrective Measure:

Install a positive stopping mechanism to stop the hook from fully retracting to the drum assembly.

PTO must be disengaged when a maintenance process is underway.

2. Unsafe Action:

RS742's Driver was operating, or in position to operate, the winch remote control device while not in view of RS742's Officer.

Background:

RS742's Driver was holding the winch controller when RS742's Driver activated the retract switch. RS742's Officer was still attempting to recover the hook from the rollers when the winch retracted, causing the winch to activate and entrap RS742 Officer's hand between the upper rollers and hook. Fabric from the employee's extrication glove was found on the upper roller, of the winch, where the fingers had been trapped.

Impact:

As the hook retracted, RS742 Officer's hand was pulled into the rollers and entrapped RS742 Officer's fingers. This caused the subsequent partial amputation of the employee's middle finger of the right hand.

Corrective Measures:

At no time should any winch operator have the winch remote control in hand when another crew member is attempting to recover the hook or cable. Operators must not activate the remote control device when not in direct view of the crew.

Preconditions to Unsafe Acts:

Preconditions to unsafe acts look at the condition of the crew and the injured as it affects performance. The investigation determined substandard conditions of the affected personnel to include channelized attention, distraction and loss of situational awareness contributed to the event.

Substandard Conditions of Affected individual(s)

Adverse Mental State

1. Channelized Attention:

Background: There are indications that RS742's crew channelized there attention to individual tasks and lost situational awareness as they each perceived their task as a priority.

A. **RS742 Officer:** The officer had his attention focused on the task of freeing the hook that had become jammed in the rollers of the winch unit while at the same time the driver was setting up and ultimately activated the winch control while RS742 officer's hand was holding the hook.

B. **RS742 Driver:** RS742's driver attention was channelized toward initially relocating the unit at the scene and then deploying the winch operating controller for use while not in view of the officer.

C. **RS742 Right:** RS742 right had his back to the rest of the crew and was looking at the overturned vehicle to locate a cable attachment point and was not in visual contact with the crew.

- **Impact:** Each member of RS742's crew was focused on their assigned task**,** and when RS742's Officer discovered the hook needed to be fed back through the rollers, the crew was not notified to stop all activities in order to solve the mechanical issue.

- **Corrective Action:** Once an equipment deficiency is found, the crew should communicate the problem with each other so that the problem can be evaluated as a team to insure that the initial action plan can be implemented.

2. Distraction

Background: RS742's driver stated that he thought they were getting ready to clear the scene and that was why they were repositioning the rescue squad. Once the rescue squad was repositioned the driver realized that they were going to perform a winch exercise.

- **Impact:** Independent, remote tasks caused the driver and crew to remain distracted from each other and this was one factor that led to the injury of the firefighter.
- **Corrective Measure(s):** Unit officers should insure that all the members of the crew are informed of the plan prior to the execution of the plan and all segments of the plan that may have begun must cease until all team members are ready to execute.

3. Loss of Situational Awareness

Background: Once the crew began to execute the plan to right the overturned vehicle the crew lost situational awareness of each other and the

actions each were individually engaged in. Had the driver and officer been in good communication with each other the driver would have been aware that there was a malfunction of the equipment and would not have had the winch controller in his hand, preventing the winch from engaging.

Corrective Measure(s): The department should develop a training program that focuses on maintaining situational awareness not only in the face of high stress events, but in while performing more routine tasks. Current training does not adequately address identifying when personnel lose situational awareness.

Unsafe Supervision:

RS742 Right was the senior person, as well as the ranking officer. RS742 Officer is on a promotional list and was being allowed to function as the unit officer for training purposes.

This anomaly stems from a Department practice where company officers allow employee's on a promotional list to ride in the position of the officer in charge. Unfortunately, the process is undefined and does not have a set of measured dimensions that allow constructive feedback, nor does it have set bench marks and allows for unsafe operations since the supervisor is part of the crew and will often, depending on the staffing, be forced to be away from the candidate.

Organizational Influences:

Lack of deficiency reporting and normalized deviancy regarding hook stowage and "back lashing" of the winch rope was a factor in this injury. There was knowledge among personnel at Rescue 2 that these issues were recurring, but the issues were not reported and were never corrected. There appears to be system wide knowledge of the problem with the winch and the winch rope was prone to "back lashing" causing sudden reversal of direction.

Normalization of deviancy was an overriding factor in this incident. Several people indicated, when interviewed, that the hook would frequently pull through the rollers and have to be repositioned prior to use but nothing was ever done to permanently correct this problem. Several of those interviewed at Rescue Company 2 stated that the hook would pull through and then be found to be dragging on the pavement and then have to be placed back through the rollers.

Lastly, it was common for the day crews at Rescue Company 2 to return vehicles to the up right position using the winch at the scene of collisions. This practice of utilizing the incident scene for this purpose should cease.

Injuries, Care and Treatment:

RS742's officer was treated at the scene by A724 with the AFRA provider from E718 and transported to the Curtis Hand Center at Union Memorial Hospital in Baltimore, MD via ground transport. RS742's officer sustained a partial amputation to the right middle finger and other associated orthopedic injuries to his right hand.

Apparatus Impoundment and Inspection:

RS742 was not impounded following this incident; however, the winch unit was placed out of service until it could be inspected by a certified inspector. FESCO provided the following report (attached).

FESCO Emergency Sales
6401 Macaw Court
Elkridge, Maryland 21075
Phone: 410.379.5353
Fax: 410.379.0261
www.fescosales.com

INVOICE

COPY

Invoice W11-01192
Invoice Date: 01/13/2011
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Amount Due: $ 190.00

Bill To:
Wheaton Volunteer Rescue Squad, Inc. 11435 Grandview Ave Wheaton, MD 20902 301-949-9673

Vehicle Information			
Customer	Wheaton Volunteer Rescue Squad, Inc.		
Prod. #	21302	Current Mileage:	62,863 miles
VIN #	4S7AU2F964C045926		
Manufacturer:	Marion	Type: Rescue Squad	
Description:	Unknown		

Payment Terms	Sales Rep ID	Order Date	Date Completed
Net 30	MSCHLICHTING	1/6/2011	01/06/2011

Description of Work Performed	Amount
Check winch operations to verify that it is working correctly. Steve found the following: The winch is an electrically controlled hydraulic unit with an air operated free-spool control. It has a synthetic rope attached to a hook. Upon initial inspection, the hook had been drawn through the fairlead roller assembly and was resting between the spool and the back side of the roller fairlead assembly. Unit was run 'out' and pulled the hook back through the roller assembly and at that point it noted the rope thimble was distorted. The unit was run 'out' and inspected the synthetic rope for damage and condition. The rope was flattened in several spots but did not show any signs of fraying or any slices or cuts. After running approximately 20feet of rope out , the rope began to be drawn back into the spool. Further inspection showed that the rope was caught against the end of the spool by the next remaining layer of rope still on the spool. A quick tug released it and there was no other issues running it completely 'out' or 'in'. Was able to change directions several times and the speed and direction changes were always correct and predictable. The air operated free-spool switch and air valve worked smoothly as did the hydraulic motor. The fairlead roller assembly was also in complete working order and all 4 rollers turned freely and smoothly. The Synthetic rope's thimble should be replaced and something should be done to prevent the hook from being drawn through the fairlead assembly, which is most likely how the thimble was damaged. A visual inspection of the winch housing, mounting hardware and support structure did not reveal anything abnormal.	$190.00

Quantity	Part #	Part Description	Unit Price	Amount
		PAID 2-11-11 $ 190.00 2458		

Tech	Hours	Rate	Amount
Steve N.	2.00	$95.00	$190.00

Parts Total	0.00
Labor Total	$190.00
Sub-Total	$190.00
Sales Tax	$0.00
Shipping & Handling	$0.00
TOTAL	$190.00

SUMMARY

This incident serves as a reminder that crews must maintain good communication with each other at all times. Crews should recognize that if a task begins to seem, or has become, routine a process review should be undertaken to insure that safety practices and best practices are adhered to. It is critical for all operational teams to learn skills that will allow them to recognize when crew integrity and situational awareness are beginning to become compromised. This incident is an example of what can happen when members of a crew lose sight of each other, and is an example of why direct supervision needs to be in place when critical tasks are being performed. This would also apply anytime an unusual event occurs while executing an actual operation or an evolution in training.

In the event that a candidate is operating in the capacity of a unit officer the senior officer must still act affirmatively as the supervisor. At no time should the candidate be alone, with the exception of the actual riding position, and the supervisor must be in a location that allows him to closely monitor the candidate's behaviors and actions. The Department must address the long-time and unofficial practice of candidates on promotional lists working as acting officers. This program is a great tool but is in need of defined parameters, benchmarks and a quantitative feedback process.

Lastly, it is incumbent upon employee's to recognize and aggressively follow up on deficiencies to apparatus or equipment. Proper documentation must be completed and utilization of the chain-of-command must be employed when unusual deficiencies are noted. Once the employee notes deficiencies, the problem must be corrected. The day to day work load must no prevent the repair of damaged or broken equipment.

- **Photographs**

RS742 position looking west on Randolph Rd.

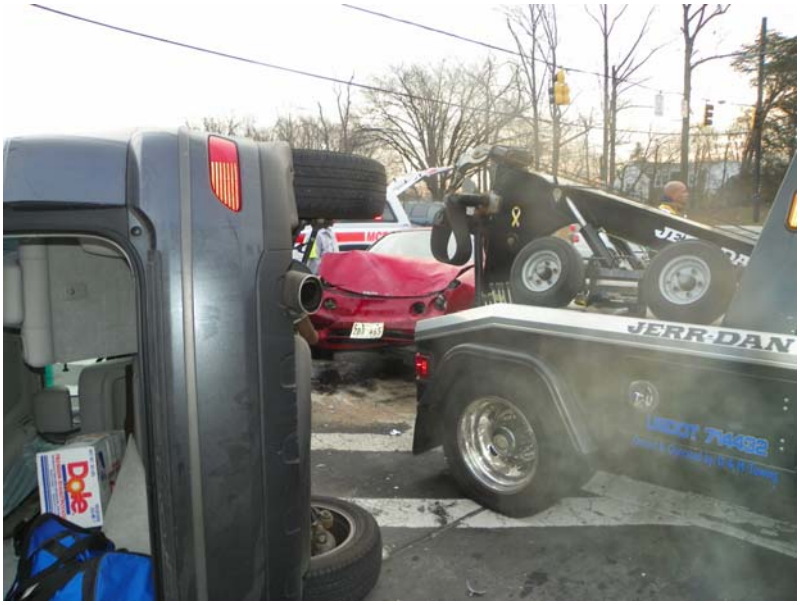

Position of vehicles at scene looking west toward Layhill Road.

RS742

Scene overview looking east on Randolph Rd.

Scene overview looking east on Middlevale Road.


SUV that RS742 was attempting to right.



SUV looking east on Randolph Rd.

Compartment where RS742 Driver was positioned at time of injury.

Relationship of compartment to winch location where RS742 Officer was injured.

Final position of hook after winch was stopped and RS742 Officer had been extricated. The winch continued to run in the retract mode for some time after RS742 Officer was extricated.

Spot where green fabric material was located after RS742 Officer's hand was freed.

Hooked returned to initial position.

Photo mock up of position of RS742 Officer's hand just prior to being pinned.

Previous damage to hook that was found during investigation. Previous damage and historical difficulty reported by crew of RS742 in regard to the hook jamming behind rollers. No reports of deficiencies were noted by RC742.