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Workshop Proceedings on Emergency Responder Vehicles:
Risk Management Interventions to Reduce Vehicle-Related Incidents and Fatalities

FINAL PROCEEDINGS BY:

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Held: 13-14 June 2017, Prince William County Department of Fire and Rescue Station 523, Woodbridge Virginia

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Executive Summary

These are the proceedings of the Workshop on Emergency Responder Vehicles for the research project on Risk Management Interventions to Reduce Vehicle-Related Incidents and Fatalities held in Woodbridge, Virginia on 13-14 June 2017.

The purpose of this workshop was to gather feedback from a diverse group of stakeholders for the dissemination and deliverables of this project. Stakeholders that participated included representatives from the fire service, enforcers/AHJs, public educators, researchers, equipment manufacturers, standards developers, and others. The feedback gathered has helped clarify how to conclude the project research and properly disseminate the deliverables of the project in an effective manner. The agenda included a review of previous work, on-going relevant work, discussion on data gaps on this topic, and recommendations for effective dissemination and future research.

Acknowledgements

This workshop and the research project were supported by DHS/FEMA Assistance to Fire Fighter (AFG) Fire Grant:

About the Fire Protection Research Foundation
The Fire Protection Research Foundation plans, manages, and communicates research on a broad range of fire safety issues in collaboration with scientists and laboratories around the world. The Foundation is an affiliate of NFPA.

About the National Fire Protection Association (NFPA)
Founded in 1896, NFPA is a global, nonprofit organization devoted to eliminating death, injury, property and economic loss due to fire, electrical and related hazards. The association delivers information and knowledge through more than 300 consensus codes and standards, research, training, education, outreach and advocacy; and by partnering with others who share an interest in furthering the NFPA mission. All NFPA codes and standards can be viewed online for free. NFPA's membership totals more than 55,000 individuals around the world.

Keywords: Risk Management, Fire Apparatus, DHS/FEMA, NFPA 1002, NFPA 1451, NFPA 1901, NFPA 1906, NFPA 1917,

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Project Panel

Stephen Austin, Cumberland Valley Volunteer Fireman's Association (DE)

Jim Brinkley, IAFF (DC)

Wes Chestnut, Spartan Motors and FAMA (Alt to R Lackore) (MI)

Stephen Cook, Birmingham Fire & Rescue (AL)

Tom Hollenstain, State Farm, ATR - Vehicle Research Facility, (IL)

William Jenaway, VFIS Education Training and Consulting (PA)

Maurice Kemp, Metro Chiefs Representative & Miami Fire Rescue Ret. (FL)

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Paul Moore, NIOSH FFFIPP (WV)

Edward Rice, District of Columbia Fire Department (DC)

Ken Richards, Old Mystic Fire Department (CT)

1) Background and Overview

Emergency Service Vehicle Incidents (ESVIs) and being struck by vehicles are the second leading cause of U.S. firefighter fatalities, averaging approximately 20 each year. For career, combination, and volunteer fire departments, an average of approximately 16,000 fire fighter ESVIs and over 1,100 associated injuries are reported annually.

This research project is led by University of Arizona (UA) with collaborative support from the Fire Protection Research Foundation. Funding for this project is through a DHS/FEMA Assistance to Fire Fighter (AFG) Fire Grant. The supporting role of the Foundation will be conducted in accordance with section 6 of the Foundation Policies and will be guided by a Project Technical Panel who will provide input to the project, review periodic reports of progress and research results, and review the final project report. This three-year project is scheduled to be completed in July 2017.

The goal of this project is to implement and determine the effectiveness of proactive risk-management-based training, administrative, and technological interventions to improve vehicle operation and reduce emergency responder vehicle incidents in career, combination, and predominantly volunteer fire departments. This will be accomplished through the following aims:
      i. Evaluate risks and design and implement interventions to reduce ERVIs;
      ii. Measure program effectiveness and economic return; and
      iii. Develop and disseminate model guidance materials for vehicle-related program interventions.

This project will implement a proactive risk management framework to tailor vehicle-related program interventions and test their effectiveness with three fire departments. Interventions will incorporate appropriate use of information from fire apparatus vehicle data recorders (VDRs), and additional interventions will be considered, including but not limited to increasing training, revising protocols for emergency and non-emergency response, and increasing supervisor responsibility for ESVIs.

The effectiveness of the interventions will be assessed using a combination of VDR data and ESVI frequency, process evaluation measures, and economic return on investment. An advisory panel will review the study interventions, assist in evaluation and dissemination of the study results, inform applicable NFPA standards, and guide development of web-based model templates for training, evaluation and vehicle operation-related standard operating procedures (SOPs). Through these proactive risk management-based interventions, this project will seek to improve driving and reduce ESVIs and related firefighter injuries and fatalities.

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2) Workshop Agenda

The agenda for the workshop is illustrated in Table 1: Workshop Agenda. This was structured to provide an overview of previous work, on-going relevant work, data gaps, areas for future work, and recommendations on effective dissemination.

Table 1- Workshop Agenda

Time	Session	Presenters
June 13th		
Time	Session	Presenters
12:00 PM	Introductions/Lunch	All
1:00 PM	Session 1: Presentation of Research Findings • Risk Management Process and Outcomes • Pilot Training Program • Use of Telematics/VDR/Dashboards/Risk Index	Jeff Burgess Steve Crothers David Bui
2:30 PM	Session 2: Partner Reports on Risk Management Interventions	
4:00 PM	Areas/Data for Future Research & Dissemination – Part 1	Casey Grant Jeff Burgess
June 14th		
8:00 AM	Networking/Coffee	All
8:20 AM	Session 4: Systematic Review of Interventions Process	David Bui
8:30 AM	Presentation of Best Practices/Effective Interventions	Scott Egan Adrian Bevan
		Steve Crothers John Danciart
10:00 AM	Session 5: NHSTA's Heavy Vehicle Crash Avoidance Research Program	Alrik Svenson
10:30 AM	Areas/Data for Future Research & Dissemination – Part 2	Casey Grant Jeff Burgess

The baseline for this topic was established by the following presentations: first by Jeff Burgess summarizing risk management process and outcomes; second by Steve Crothers on the pilot training program for apparatus he developed and conducted; and third by a presentation on the use of VDR and telematics data. Then three fire department partners provided their reports on their department's risk management interventions, followed by Casey Grant and Jeff Burgess, facilitating discussion on areas/data for future research and dissemination. Day 2 began with an overview of a systematic review of interventions provided by David Bui, followed by two fire officers on their department's best practices and effective interventions. Next, Steve Crothers and John Danciart provided an overview on their department's training programs. Alrik Svenson on the NHSTA's Heavy Vehicle Crash Avoidance Research Program provided an overview of NHTSA's heavy vehicle crash avoidance research program. Finally, Casey Grant and Jeff Burgess facilitated a final discussion on areas/data for future research and dissemination.

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3) Presentations and Discussions

3.1) Review of Project Status, Driver Dashboards, and Systematic Overview
The project status and details were reviewed by Jeff Burgess. This was supplemented by David Bui providing an overview of telematics, driver dashboards and a systematic review of interventions to prevent ESVIs. Dr. Burgess opened the meeting with an overview of the project and project aims. He discussed the process and results from the risk management activities completed with the partner fire departments who participated in our study. Risk management (RM) is a proactive process for identifying occupational risks and reducing hazards and unwanted events through an iterative process of scoping hazards, risk assessment, and implementing controls. Dr. Burgess described the process, outputs, outcomes and lessons learned from the application of a proactive RM process to reduce ESVIs in our partner fire departments. He summarized the controls implemented at each department and data on changes to departmental crash rates after the program initiated. Below are the comments and observations of this presentation. The following comments and observations were provided during the discussions with the group:

- We didn't want this information to be used so that it was disciplinary in nature.
- This is translational research and the selected interventions varied by department.
- The Risk Management process is designed to address the unique needs of each department.
- The study only covered motorized apparatus vehicles (e.g. not personal vehicles or helicopters).
- Most crash incidents did not involve injuries.
- Data gathering and assessment of risk reduction is hard for smaller rural departments with no previous incident data.
- It was noted that Line of Duty Deaths (LODD) as a metric is limited because injuries are not effectively captured. Additionally, apparatus loss and civilian deaths are usually not captured in LODD reports.
- For changes to vehicle integrity refer to the Foundations report on powered rescue tools – high strength steel

3.2) Pilot Training Program
Steve Crothers of the Seattle Fire Department presented on a Pilot Training Program. Mr. Crothers spoke on the role he played as the training consultant for this FEMA grant project Vehicle Risk Management in Fire Service. He described the training program he developed and provided to other Fire Departments to address their training needs as identified through the risk management process. The following are the comments and observations from the group:

- Go to www.TractorDrawnAerial.com for further guidance on this presentation subject matter.
- What is "driver training"? What are they looking for or at when they say "driver training"?
- Who is training apparatus drivers?
- This program aims to change the understanding for driver training and who trains their drivers.
- Biggest challenge for driver training was access to trucks and space to drive these trucks in real world scenarios.
- Training encompassed when to look in your mirror, when to turn, and how long you look in your mirror.
- Focus was to allow trainees to understand how each apparatus is different.
- The goal of this training was to try and create a culture where it is ok to make mistakes and create a constructive criticism atmosphere.

- When deciding to purchase a piece of equipment, cause and effect need to be considered. What happens when I buy a specific add-on. Does it increase safety? Does it prevent accidents?
- The pamphlets in new apparatus for training and guidance, you can influence that through FAMA's technical committees.
- The difference between trained and untrained operators can be seen in telematics driving data.

3.3) Use of telematics/VDR/Risk Index

David Bui, of the University of Arizona, presented on the use of telematics, VDR, and risk index for the project. This presentation provided an overview of the telematics data system used in the project to gather driving data from our partner departments. Mr. Bui summarized analysis results showing that harsh braking, speeding and cornering were driving behaviors that were associated with an increased risk of crash among the engines and ambulances. He presented results of a risk index we developed using the telematics data and the validation results showing moderately good sensitivity and specificity. Finally, he discussed potential strategies for translating these research findings into practice. The following comments and observations were provided during discussions with the group:
- VDR data can be difficult to access and analyze.
- Individual driving behaviors can be tracked more easily through telematics.
- Telematics can track where rules are being broken.
- There is a correlation between harsh braking and crashes.
- Harsh Braking is triggered on a g force event of 0.4Gs.
- In civilian drivers, harsh braking was also predictive variable for crashes (see: Progressive Snapshot results).
- The effect of auxiliary braking devices potentially triggering driving rules were not considered.
- We do not have data on whether aggressive downshifting could affect the telematics statistics.
- The data collected from the VDR and telematics was a data dump and not user friendly.
- A more user friendly "report card" to disseminate the data was created. These "report cards" were made available departments, but it is not yet clear as to how the departments will use them.
- The telematics data gathering did not identify individuals, however this could be done with shift logs, or proactively tracked with unique key fobs.

3.4) Partner Reports on Risk Management Interventions- Small Combination Department

A presentation was made by several partner fire departments on their risk management interventions in their departments based on the data this project was gathering. A fire officer from a small combination department discussed the department's experience with the risk management project. He discussed issues that other departments may want to consider when implementing a risk management program. Finally, he reviewed plans at his department to address ongoing emergency service vehicle issues, risks and hazards. The following comments, and observations were provided during discussions with the group:
- Small Combination Department (about 1000 calls a year).
- They used VDR data to confirm what was already known about driving behaviors at the department and to try and discover unknowns.
- The department was focused on collecting data on seatbelts, non-emergency speeding and emergency speeding.
- Use of telematics and VDR to prevent accidents is no different in a small department, and is just as important as in a large department. There is also scalability for small, medium, and large departments. The reason why larger departments have more accidents is because of frequency of activity rather than different risk.

- Reducing the response code can still be efficient in responding to emergencies but also managing risk more efficiently e.g. instead of tankers driving faster, you get more tankers.
- Volunteers can get nervous about being recorded.
- Getting smaller vehicles that still fit the need can sometimes improve the driver handling and reduce incidents.

3.5) Partner Reports on Risk Management Interventions – Medium Size Combination Department

A fire officer from a medium size combination department (50,000 calls per year) discussed the number of hours the department has put into the program, and where the department intends to go from here regarding using the data. He discussed plans for addressing speeding, addressing training issues, seatbelt issues, and adding additional units to fleet to capture more data. The following comments, and observations were provided during discussions with the group:

- Combination Department (Hybrid) – they have volunteer and county apparatus.
- VDRs are all on county owned apparatus, this means that it does not capture the habits of the volunteer firefighter drivers.
- There are no set drivers (i.e. 4-5 Drivers in one shift).
- Through telematics, the department noticed that seatbelt compliance was an issue, and the department policy has a zero-tolerance policy for non-compliance with the seatbelt policy. However just firing people based off this data would not help fix the problem so the task was to make the data be more tangible, so they shared the data with the firefighters and it went down for a little bit.
- Union and Health and Safety officers are in step and working with each other to create an effective program that increases safety and meets the needs of the Union.
- The department is fast growing with large numbers of new members with limited driving experience.
- Trying to disseminate the VDR data in a non-punitive way that is still constructive is the challenge.
- Making sure the leadership understands the whole process and knows how to constructively fix behaviors and attitudes is important.
- The Chief isn't going to fix it individually, it is up to the line leadership to help fix the problem.
- So far, they have been focused on gathering data rather than implementing interventions.

3.6) Partner Reports on Risk Management Interventions – Large Career Urban Department

A fire officer from a large career urban department provided an overview of the risk management process undertaken at his fire department. He discussed the risks and priorities identified by risk assessment and the interventions implemented to address high risk priorities. He presented some data on crashes and outline lessons learned and recommendations for other departments. The following comments, and observations were provided during discussions with the group:

- Department is focused on developing and implementing new and sustainable strategies.
- This department had a high rate of backup accidents and standard operating procedure was not working, so the department added back up cameras on different ambulances. It worked and the feedback is positive.
- The cameras don't change the standard operating procedure of the department but did change in protocol and change how accidents were classified.

- VDR data tracked seatbelts, speeding, braking, backing up, emergency, and non-emergency runs for this department.
- The plan was to provide full telematics data to the union but not to city administration. Labor was filtering and reviewing the telematics data so that data driven actions were training focused and not punitive.
- How do you prevent it from getting subpoenaed? Data could always be accessed however, now there is data collection when there is no event (e.g. accident) and this data is more easily accessed and user friendly.
- Is there a cost tradeoff for installing cameras/equipment? That's up to the department. Not only physical damage a factor in these accidents but also, but also loss of man hours, investigations, etc.
- Remedial training frequency was increased for those involved in accidents.

3.7) Partner Reports on Risk Management Interventions – Large Career Suburban Department

A fire officer from a large career suburban department presented on his department's experience with the risk management project and discusses lessons learned and best practices for other departments. He also shared experiences working with and using telematics systems and data. The following comments, and observations were provided during discussions with the group:

- Before the study, driver training wasn't a big focus at this department and a holistic driver training program was needed.
- Finding the space to conduct driver trainings was a challenge.
- VDR audible alarms were not active in their system at first, however the department recently turned on the audible alarms to see if the warnings make a difference.
- Real time audible alarms in the trucks and real time notification is a big deal and allows for immediate correction of the problem.
- Targeted solutions by handing out the assessments to the drivers.
- The department looked at non-emergency speeding vs. speeding, as those were the two highest rule exception areas.
- The exception for speeding triggers at over 5 mph over the posted speed limit and tracks for the entire time the apparatus is going over 5 mph.
- The department has a policy to not exceed the speed limit in any capacity (even in emergency).
- The biggest risk to the responders should not be on the way to the call.
- There is concern over who can access this data legally.
- In terms of risk management, the person who is suing you is not the person drowning-- it is the person who got hit by the fire apparatus on the way.
- Legal concerns need to be addressed on the department level before incidents happen so clear actions can be taken.
- How to disseminate this data is the big question as it is already in use and it can be accessed, but how are people held accountable and how can it be used in a preventable manner.
- How are these policies enforceable? How specific or how broad are they? The policies need to be realistic and relevant, and need to match with the broader vehicle code.
- The department is young and policy changes were made to change behavior.
- There are some false alarms for the VDR systems (e.g. harsh cornering would trigger upon hitting a storm drain).
- Firefighters need to train on all different types of apparatus as they might be responsible for driving different apparatuses. Each apparatus has different challenges to driving (e.g. turn radius).

- This department provides 4 hours of training per operator.

Day 2:

3.9) Systematic review of interventions process

David Bui provided an overview of the process and results from a mixed-methods systematic review to collate and synthesize the recent research literature on interventions and controls used in the emergency services to prevent and reduce emergency service vehicle crashes. The review process included a literature search and key informant interviews with fire department representatives. The following comments, questions, and observations were provided during discussions with the group:
- The idea was to get a menu of interventions and back them up with literature/research.
- The review focused on three intervention categories: Education/Training, Engineering, and Enforcement/Policy.
- We also conducted key-informant interviews following an interview protocol and then asked for outcome data.
- Does DriveCam reduce crashes or the cost of the crash (e.g. cost of legal defense, liability)?
- The use of DriveCam was associated with a reduction in large liability claims at Orange County Fire Rescue.
- The training programs by Seattle Fire Department and Sacramento Fire Department were shown to be effective by reducing preventable crashes.
- A risk management program at London Fire Brigade was found to be effective in reducing crashes.

3.10) Risk Management Programs – Large Urban International Department

The Director of Health and Safety from a large urban department located outside of the US provided an overview of risk management processes commonly adopted in their country, in the identification and management of all hazards that present a risk to the health or safety of staff. Primary focus was on interventions used to prevent emergency vehicle crashes in their department. The following comments, and observations were provided during discussions with the group:
- This department has 5,500 Staff, 3000 emergency response drivers, and 150 appliances.
- The risk management data included home fires safety visits (non-emergency journeys but still in apparatus).
- In this department, the driver of the vehicle is responsible for driving actions taken and the driver must be able to prove the employer was negligent (e.g., inadequate training provided).
- This department wanted to collect data and manage risk in three areas: 1) reversing maneuvers, 2) blue light journeys, and 3) on-station events.
- Every firefighter is an emergency responder driver for this department and thus every firefighter should be a trained driver.
- Every reversing maneuver incident is now reviewed and action taken.
- This department runs an emergency response driver training, an 8-day course of just driving. This course also includes an assessed blue light journey in the city and on a training course.
- Support vehicles for this department are not allowed to exceed speed limits on emergency response.
- A driver license database is also maintained for this department to ensure firefighters held valid licenses to drive (to monitor civilian infractions as well).
- Implemented a road traffic safety management system according to ISO 39001.

3.11) DriveCam Program – Large Suburban Department

A fire officer from a large suburban department presented an overview of their DriveCam program from both the viewpoint of Labor and Management. From management's perspective, he discussed the results of the program over the last nine years. From labor's perspective, he discussed the lessons learned, the pros and cons of DriveCam, and offered suggestions to facilitate a successful implementation and sustaining of a department wide DriveCam program. The following comments, and observations were provided during discussions with the group:

- 41 Fire stations, 1246 employees, and 286 vehicles with 261 DriveCam units.
- An event triggers the camera, and it captures it. Cannot remote in (i.e. through wireless) and doesn't capture all the time.
- The DriveCam info sent to DriveCam (company), then they send it to you if it meets your department's criteria for a driving event to be monitored.
- This department started immediately issuing disciplinary violations based on the information from DriveCam.
- Originally the violations were driving related (e.g due regard, stop signs, right turns, siren use), then citations started being issued for wrong uniform, not clean shaven, women not having their hair up.
- The DriveCam system save money as it reduces large claims, however accident rate did not go down.
- The department now gets money for accidents it would not have pursed previously and does not have to pay out as much money before as DriveCams provide the evidence that they did not have before.
- Union buy-in needs to happen early and must support the implementation for all. Implementation must start for the top and there must be training on the official use of the cameras before installation.
- Determination of the exact parameters for how the system will be used and its intended use as well as its limitations.
- Cameras only show one limited view point and does not exactly tell the whole story.
- For subscription based services who owns the video data and who can release it?
- DriveCam data is public record now.

3.12) Seattle Driver Training Program
Steve Crothers discussed the hands-on driver training program used by the Seattle Fire Department. He founded the tiller operator training program for the Seattle Fire Department, and he has served in the department's Training Division as the Driver Training Officer. He was the lead on developing the "Raleigh/Seattle Accident Prevention" video. He created TractorDrawnAerial.com to share his passion for and knowledge of aerial apparatus. Mr. Crothers' expertise has been sought out by tractor drawn aerial manufacturers which has resulted in major design changes. Mr. Crothers has extensive professional knowledge in the field of design, development, and delivery of training curricula and has been providing training for many years around the U.S. and Canada. The following comments, and observations were provided during discussions with the group:

- This department provides 16 hours of classroom and driving course training.
- Before implementing driver training, training must be defined and goals and objectives must be set.
- The department created a standard operating procedure and set of instructions for the backing officer to help reduce backing incidents.
- The department's training program took the drivers out, driving first and teaching, then drive again to test it.

- To try and increase the number of trained drivers, previously trained drivers where used to try and convince their coworkers to take these training courses.
- Plans to study the use of VDR data: recruit 10 drivers and track them in 3 phases: 1) track their normal habits, 2) then give them specific driver training, then 3) track them after training. The goal was then to try and give the drivers the ability to track themselves and to see their data for the day, in real time and try to improve.
- Current technology does not do this 3rd phase well but the goal is to connect with a manufacturer to try and meet this need.

3.13) Sacramento EVOC Program
John Danciart showed a brief history of his department's training program and how it started. He discussed how they start their employees' driver training, starting from their time as a recruit through the completion of probation, and then discussed what they do as an organization to combat the loss of perishable driving skills. He discussed the collision frequency rate statistics and how their department reviews our collisions. The following comments, and observations were provided during discussions with the group:
- This department has 60 apparatus and 25 stations.
- The facility they use conducts joint training with the police.
- The cost of the facility to operate is 1.7 Million through the county's risk management department, and in part works through cost sharing and salary augmentation.
- Full time Crew - POST Training police training course.
- 52 hours total (24 hours of training as a recruit, 28 hours of trainings on probation)
- 24 hours of total training time is one-on-one training.
- Training is focused on understanding vehicle dynamic.
- It was noted response time goes up if you slow down and proper vehicle handling is followed.
- 8-hour medical ride along.
- Commentary Drive is used as part of training (trainee commentates during 4 hour drive)
- All driving skills are perishable and renewing is necessary.
- The department's driver trainers respond to every collision and hold all new equipment orientations, etc.

3.14) NHTSA's Heavy Vehicle Crash Avoidance Research Program
Alrik Svenson is a Research Engineer and Program Manager in the Office of Vehicle Crash Avoidance & Electronic Controls Research at the National Highway Traffic Safety Administration (NHTSA). Mr. Svenson manages research programs in support of agency rulemaking initiatives in the areas of crash avoidance and tires for both passenger vehicles and heavy trucks. He leads all heavy vehicle research programs at NHTSA including the Commercial Vehicle V2V Communications for Safety Program. This presentation covered an overview of crash avoidance research on heavy vehicles (vehicles with a GVWR of 10,000 lbs. or greater) being conducted by NHTSA. It includes current research on collision avoidance systems such as automatic emergency braking (AEB), lane departure warning (LDW), and Vehicle-to-Vehicle communications (V2V) for safety. Also, research on human factors and cybersecurity issues were covered. The following comments and observations were provided during discussions with the group:
- Mr. Svenson leads Heavy-Vehicle Crash Avoidance Research at NHTSA. The research includes:
  o Forward collision warning and automatic emergency braking.
  o V2V commercial vehicle side.
  o 150 class 8 tractor trailers.

- - - Impact Alerts.
- - - Stopped Object Alert etc.
- Connected Vehicles Program can improve fire apparatus safety.
- 80% of accidents can be addressed/prevented by V2V communications.
- Dedicated short range communication (DSRC) is used in V2V technology.
- These devices are an aid to drivers and not a nuisance.
- To see existing programs visit: www.nhtsa.gov and www.regulations.gov.
- FAMA has a member who does Emergency Vehicle to device/traffic notification.
- Intelgen connected vehicles, ITS project.
- There is a critical threshold at which V2V gains critical effectiveness; Mr. Svenson suggested this threshold was very low and current test sites show that limited implementation of V2V technology on a subset of heavy vehicles was effective in reducing incidents.

4) Future Research and Dissemination

4.1) Areas/data for future research & dissemination

Casey Grant and Jeff Burgess led a discussion on areas for future research, research needs, and plans for dissemination. Dissemination plans include posting the Workshop Proceedings and making them openly available, presenting this information to the relevant NFPA Technical Committees and membership sections; and facilitating presentations on this work at fire service events. Comments, questions and observations from this discussion are below:

- For the Opticom System only the first truck has the control of the light which can be hazardous when two apparatus are approaching the same light.
- Vehicle to Vehicle (V2V) communication in civilian vehicles is coming very soon.
- Now that a lawyer can pull the last 6 months of an operators driving data and look at his driving history, does it become policy to destroy the data? Can this data be used to legally show a bad driving record not related to an incident? Is that legal? How do we get ahead of the curve?
- How do autonomous vehicles interact with fire apparatus, and how will we determine their interaction for the future?
- How will autonomous vehicles understand non-written rules of the road and general courtesies (i.e. Pittsburg Left)?
- The NFPA standards do not have to be prescriptive and could be suggestive for the usage of VDR (e.g., include as annex material, which in NFPA standards are advisory in nature rather than mandatory requirements).
- Use of these data needs to be corrective and instructional in nature rather than disciplinary to develop people and protect the operator.
- NFPA 1451 can take this information and run it through the committee to determine the best way to make this corrective and instructional.
- Statistics on training crashes in the community (e.g. during training rides) is also needed.
- Big Data can be used to convince the departments and the government to fund some of this study and training.
- If a risk management approach is taken, what are the formula, case studies, and methodology that are needed?
- The more hands off the data collection is the better it is (easier to collect the data as there are less intermediate steps).
- Can a national data base be created to determine who gets struck by apparatus, to determine who gets struck and how often?
- Which parameters should be transmitted from the VDR to get more useful data? Lateral G force is needed.
- Data accessibility and seamless wireless data access that the community can use is huge.
- Reporting back through dashboards is needed to help operators evaluate their driving.
- Can GPS positions be used to narrow down what you are searching for and why you are searching?
- How do you send out a consistent message about the importance of this safe driving to change behavior and culture?
- Leadership needs to communicate and help keep driver training current and sustainable and consistent at all levels.
- Will there be creation of a risk management concepts tree?
- There needs to be a data use agreement between administration and union.

- Economic analysis also needs to be conducted to identify cost-effective interventions.
- Executive officer development training and training at all levels are necessary to create safe drivers.
- Operator professional qualifications need to be clarified and there also needs to be a certificate or authentication for trained drivers.
- There are generational issues when it comes to cultural development and evolution.
- What are the challenges for operators reacting to distracted drivers and other drivers in general?

Annex A: Workshop Attendees

The following were the workshop attendees Workshop on Emergency Responder Vehicles for the research project on Risk Management Interventions to Reduce Vehicle-Related Incidents and Fatalities, held at the Prince William County Department of Fire and Rescue Station 523, Woodbridge, Virginia on the 13th and 14th of June.

Stephen Austin, Cumberland Valley Volunteer Fireman's Association (DE)
Adrian Bevan, London Fire Brigade (UK)
Omar Blanco, Miami-Dade Fire Rescue (FL)
David Bui, University of Arizona (AZ)
Jeff Burgess, University of Arizona (AZ)
Jack Carriger, Stayton Fire District (OR)
Pat Cleary, Chicago Fire Department (IL)
Stephen Cook, Birmingham Fire & Rescue (AL)
Steve Crothers, Seattle Fire Department (WA)
John Danciart, Sacramento Fire (CA)
George Dowling, Chicago Fire (IL)
Scott Egan, Orange County Fire (FL)
David Gates, Miami-Dade Fire Rescue (FL)
Casey Grant, Fire Protection Research Foundation (MA)
Alex Ing, Fire Protection Research Foundation (MA)
Maurice Kemp, Miami Fire Rescue, Metro Chiefs Representative (FL)
Walter Koch, Prince William County Fire & Rescue (VA)
Wesley LeBron, Miami-Dad Fire Rescue (FL)
Sam Massa, FAMA & HiViz LED Lighting (NC)
Scott McLean, Prince William County Fire & Rescue (VA)
Mitch Nason. Prince William County Fire & Rescue (VA)
Frank Orefice, Prince William County Fire & Rescue (VA)
Ed Rice, District of Columbia Fire Department (DC)
Ken Richards Jr., Old Mystic Fire Department (CT)
Alrik Svenson, NHSTA (DC)