

# Ambulance Transport Safety Summit

## Bridging the gap between what we do and what is known

EMS Subcommittee of the TRB Ambulance Transport Safety Summit  
 Nadine Levick MD, MPH

October 29<sup>th</sup>, 2009



## Goal of the Summit

“Enhancing ambulance transport safety through shared knowledge of technical data”



## Collaborative Interdisciplinary Initiatives

- Government agencies
- TRB
- SAE
- Academia
- Industry



## We should use the best safety practices demonstrated in engineering

### Development of an Effective Ambulance Patient Restraint

**Development and Application of a Dynamic Testing Procedure for Ambulance Paediatric Patient Restraint Systems**

Emergency Medicine and Safety Engineering Collaboration in Paediatric Ambulance Transport Safety

Nadine Levick  
 Johns Hopkins University, School of Medicine, Baltimore, USA

2001-01-1173

**Biomechanics of the patient compartment of ambulance vehicles under crash conditions: testing countermeasures to mitigate injury**

Nadine Levick, Guohua Li  
 Johns Hopkins University

John Yannaccone  
 ARCCA Inc

Copyright © 2009 Society of Automotive Engineers, Inc.

## ...in automotive safety engineering

**CRASHWORTHINESS ANALYSIS OF THREE PROTOTYPE AMBULANCE VEHICLES**

Nadine Levick  
 Objective Safety, LLC  
 USA

Raphael Grzybowski  
 Masah University

**DEVELOPMENT OF PROPOSED CRASH TEST PROCEDURES FOR AMBULANCE VEHICLES**

Nadine Levick

2009-01-2832

**USA AMBULANCE CRASHWORTHINESS FRONTAL IMPACT TESTING**

Nadine Levick  
 EMS Safety Foundation (1)  
 USA

Raphael Grzybowski  
 Injury Risk Management Research Centre (2)  
 University of New South Wales  
 Australia

Paper Number 09-0471

**Protection for Infants Transported in Incubators**

Marilyn J. Bull  
 Vice President for Children

**Ambulance Vehicle Crashworthiness and Passive Safety Design: A Comparative Evaluation**

Nadine Levick  
 EMS Safety Foundation

Raphael Grzybowski  
 University of NSW

**ABSTRACT**

Recent epidemiological studies have identified ambulances as high risk passenger transport vehicles.

**ABSTRACT**

Performance record for ambulances worldwide does not compare to the safety standards used for the automotive industry. Ambulances are largely exempt from crashworthiness and passive safety standards, and severely impact the research of great risk of injury.

## 2 most recent publications

### ESV July 2009

#### USA AMBULANCE CRASHWORTHINESS FRONTAL IMPACT TESTING

Nadine Levick  
 EMS Safety Foundation (1)  
 USA

Raphael Grzybowski  
 Injury Risk Management Research Centre  
 University of New South Wales  
 Australia

Paper Number 09-0471

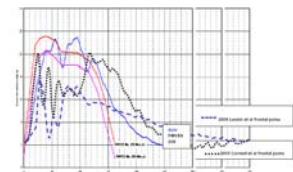


Figure 15. FMVSS 213 and NHTSA 2005 2006 Levick et al frontal crash pulse and 2003 Current et al frontal crash pulse [26]

**ABSTRACT**

Recent epidemiological studies have identified ambulances as high risk passenger transport vehicles.



## October SAE – October 2009

2009-01-2832

**Crash Protection for Infants Transported in Incubators**  
 Gary R. Whitman, David L. Gushue and Larry Sicher  
 ARCA Inc.

Marilyn J. Bull  
 Riley Hospital for Children



Figure 7. Kinematics of infant dummy restrained by five-point restraint with head forward and end of ambulance during frontal crash and testing (Test 2).



Figure 8. Kinematics of infant dummy restrained by five-point restraint with head toward rear end of ambulance during frontal crash and testing (Test 2).

**TRB** TRANSPORTATION RESEARCH BOARD  
 OF THE NATIONAL ACADEMIES

## and in ergonomics

**ERGONOMICS**  
 International Journal of Ergonomics 53 (2009) 307–316  
**INDUSTRIAL ERGONOMICS**  
 www.elsevier.com/locate/ergon

Ergonomics in the rescue service—Ergonomic evaluation of ambulance cots

Karsten Klatt<sup>a</sup>, Helmut Strasser<sup>b,\*</sup>

<sup>a</sup>Division of Ergonomics, Department of Psychology, University of Salzburg, Austria; <sup>b</sup>Department of Psychology, University of Salzburg, Austria

Received 19 November 2008; accepted 10 December 2008; available online 10 January 2009

ERGONOMICS

Applied Ergonomics, 0014-0139

www.elsevier.com/locate/ergon

Reviewing ambulance design for clinical efficiency and paramedic safety

Jeremy Farrugia, Sue Hignett<sup>\*</sup>

<sup>a</sup>School of Ergonomics and Human Factors, Brunel University, Uxbridge, Middlesex, UK; <sup>b</sup>School of Health, Behavior and Society, Johns Hopkins University, Baltimore, MD, USA

Received 10 October 2008; accepted 14 June 2009

Abstract

This study aimed to review the layout of the patient compartment in a UK ambulance for paramedic efficiency

Ergonomic Evaluation of the Ambulance Interior to Reduce Paramedic Discomfort and Posture Stress

Journal of Human Factors and Ergonomics in Health and Safety, 19(1), 2009

© 2009 Sage Publications

10.1177/1033019X09345555

http://jhe.sagepub.com

DOI: 10.1177/1033019X09345555

http://online.sagepub.com

http://online.sagepub.com

http://online.sagepub.com

http://online.sagepub.com

http://online.sagepub.com

http://online.sagepub.com

http://online.sagepub.com

http://online.sagepub.com

http://online.sagepub.com

http://online.sagepub.com

http://online.sagepub.com

http://online.sagepub.com

http://online.sagepub.com

http://online.sagepub.com

http://online.sagepub.com

http://online.sagepub.com

http://online.sagepub.com

http://online.sagepub.com

http://online.sagepub.com

http://online.sagepub.com

http://online.sagepub.com

http://online.sagepub.com

http://online.sagepub.com

http://online.sagepub.com

http://online.sagepub.com

http://online.sagepub.com

http://online.sagepub.com

http://online.sagepub.com

http://online.sagepub.com

http://online.sagepub.com

http://online.sagepub.com

http://online.sagepub.com

http://online.sagepub.com

http://online.sagepub.com

http://online.sagepub.com

http://online.sagepub.com

http://online.sagepub.com

http://online.sagepub.com

http://online.sagepub.com

http://online.sagepub.com

http://online.sagepub.com

http://online.sagepub.com

http://online.sagepub.com

http://online.sagepub.com

http://online.sagepub.com

http://online.sagepub.com

http://online.sagepub.com

http://online.sagepub.com

http://online.sagepub.com

http://online.sagepub.com

http://online.sagepub.com

http://online.sagepub.com

http://online.sagepub.com

http://online.sagepub.com

http://online.sagepub.com

http://online.sagepub.com

http://online.sagepub.com

http://online.sagepub.com

http://online.sagepub.com

http://online.sagepub.com

http://online.sagepub.com

http://online.sagepub.com

http://online.sagepub.com

http://online.sagepub.com

http://online.sagepub.com

http://online.sagepub.com

http://online.sagepub.com

http://online.sagepub.com

http://online.sagepub.com

http://online.sagepub.com

http://online.sagepub.com

http://online.sagepub.com

http://online.sagepub.com

http://online.sagepub.com

http://online.sagepub.com

http://online.sagepub.com

http://online.sagepub.com

http://online.sagepub.com

http://online.sagepub.com

http://online.sagepub.com

http://online.sagepub.com

http://online.sagepub.com

http://online.sagepub.com

http://online.sagepub.com

http://online.sagepub.com

http://online.sagepub.com

http://online.sagepub.com

http://online.sagepub.com

http://online.sagepub.com

http://online.sagepub.com

http://online.sagepub.com

http://online.sagepub.com

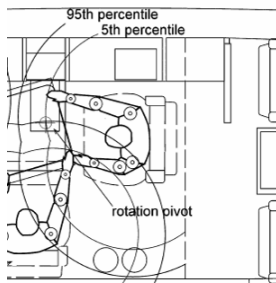
http://online.sagepub.com

http://online.sagepub.com

http://online.sagepub.com

**TRB** TRANSPORTATION RESEARCH BOARD  
 OF THE NATIONAL ACADEMIES

## Range of reach.. This is a well defined technical science



**TRB** TRANSPORTATION RESEARCH BOARD  
 OF THE NATIONAL ACADEMIES

## Research papers in the past 30 years

- EMS Safety
  - 40 papers - on ambulance safety
  - 2 papers- on ambulance ergonomics
  - 1 paper – on stretcher ergonomics
- Computer Workstations
  - 30,000 papers – on ergonomics of computer work stations

**TRB** TRANSPORTATION RESEARCH BOARD  
 OF THE NATIONAL ACADEMIES

## October 2008 JEMS Article “Rig Safety – 911”

**Rig Safety 9-1-1**  
 What you need to know about ambulance safety & standards

— BY NANCY LEVICK, MD, MPH

What is it or that we need to know about ambulance safety? How do we digest the information that's put forward by manufacturers? Does R.E.C.A. A-1822 compliance mean the ambulance can reduce a crash? What's safe and what isn't? What works and what doesn't? And where do we go to find out?

**ABSTRACT**  
 Since the 1980s, when we left the cab and went into the "back" we've searched for the safety strength of the ambulance industry. What has been the result? A lot of confusion and disagreement. Ambulance safety is a complex issue. It's not just about the ambulance itself, but also about the people who use it. This article discusses the importance of ambulance safety and the role of the National Highway Traffic Safety Administration (NHTSA) in setting standards for ambulance safety.

**ARCH BOARD**

## August 2009 – Visibility review

**Emergency Vehicle Visibility and Conspicuity Study**  
 8A-1217/August 2009

FEMA

**ARCH BOARD**

## John Killeen – Technical Expert Panel

- Lead operational expert in visibility and conspicuity ambulance operations focus
- Intensive Care paramedic
- Canberra Australia



## FEMA - Emergency Vehicle Visibility and Conspicuity Report Comments on the Study - John Killeen

1. **Vital first step toward developing informed guidelines**
2. A generalised report with an underlying awareness of numerous political & multi-agency sensitivities
3. Embraces operational diversity [Fire, Police, EMS]
4. Recognises US & selected international research
5. **Key Findings /Opportunities** are basic sound practise BUT...
6. ! Generalisation can lead to misinterpretation of detail
7. ! Many photos in the report display real-life examples of *poor design & practise*



## FEMA - Emergency Vehicle Visibility and Conspicuity Report Key Points within the Study - John Killeen

**Succeeds in focusing the future direction of conspicuity research and practise for all US states + other countries**

1. **Importance of contour markings** – especially the difference between research in USA & Canada + benefits of solid colors
2. Battenburg and chevrons – *effectiveness is unproven* due to lack of research and possible cross-cultural misinterpretation
3. Need for national standardisation of colors for rear chevrons
4. A balanced approach in the use of fluorescent and retro-reflective markings + the possibility of visual overload
5. Lowering some markings on larger vehicles to waistline height to cater for sharp light cut-off on new headlamps



## Muskoka EMS - Canada

Old design



New design



## Muskoka EMS - Canada



## Muskoka EMS - Canada



## Questions??

- Please raise your hand
- or type in the message box
- or send your questions via this link
  - <http://www.emssafetyfoundation.org/TRB2009SummitQuestions.htm>

