



Ambulance Safety in the Fire Service

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Division of Safety Research
Centers for Disease Control and Prevention**



Disclaimer: The findings and conclusions in this presentation have not been formally disseminated by the National Institute for Occupational Safety and Health and should not be construed to represent any agency determination or policy.



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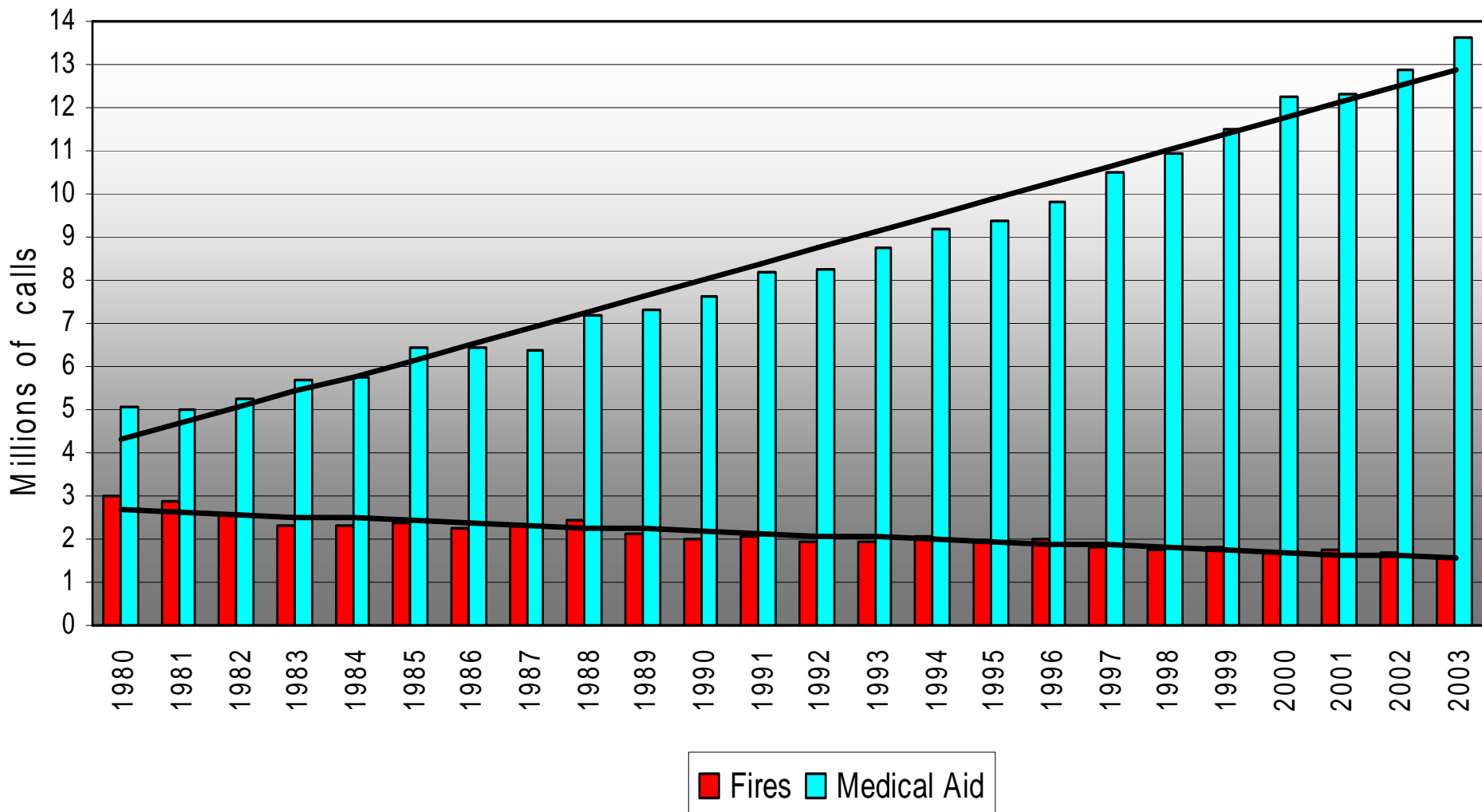
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Fire Department Calls (Fire and Medical Aid): 1980 - 2003



Source: NFPA. "Fire Department Calls". 2005.



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Fire Department Calls - 2001



- **Any fire call:** 3 per minute
- **Structure fire call:** 1 per minute
- **Medical aid call:** 23 per minute

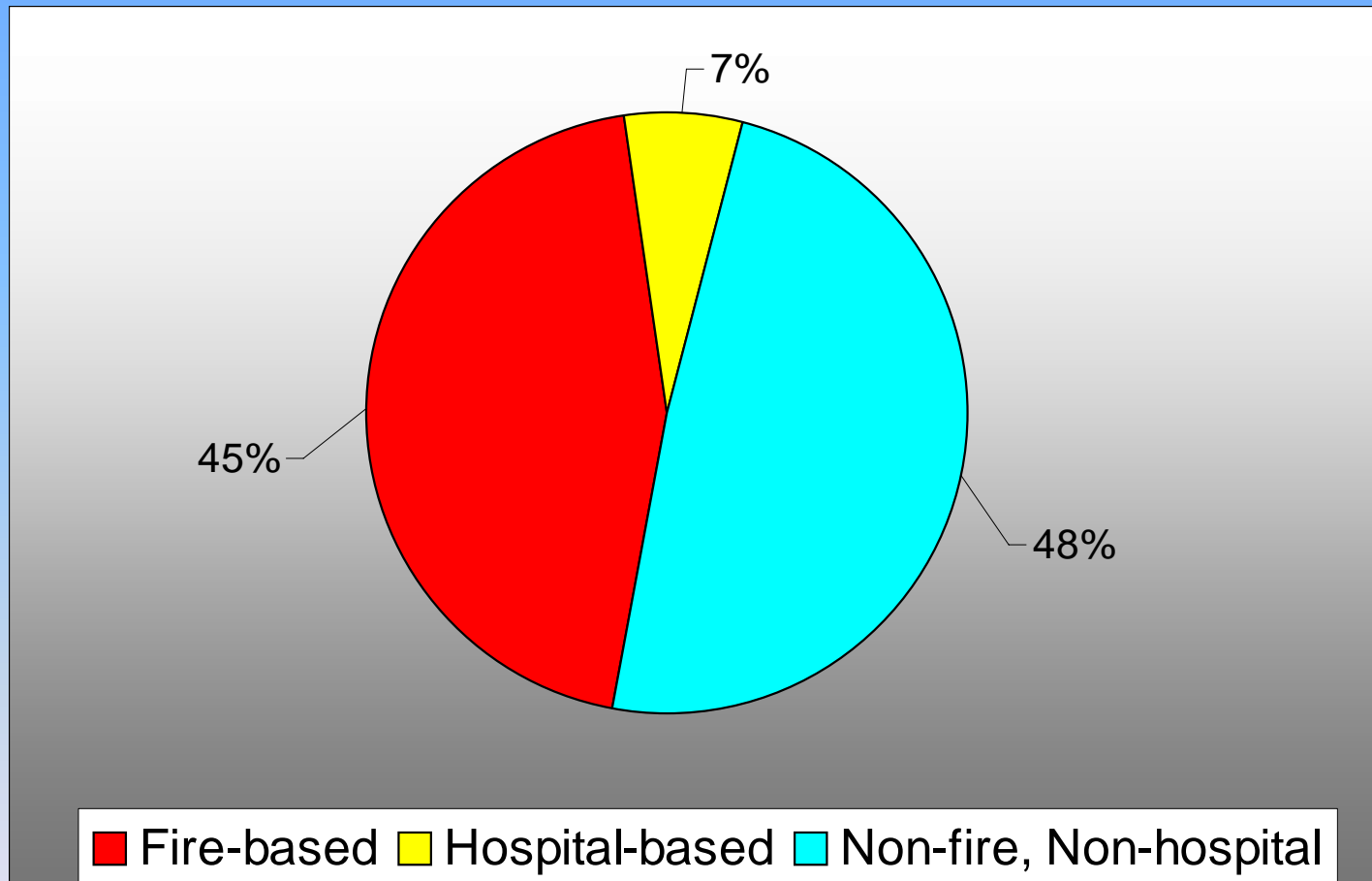
Source: NFPA. "U.S. Fire Problem Overview Report". 2003.



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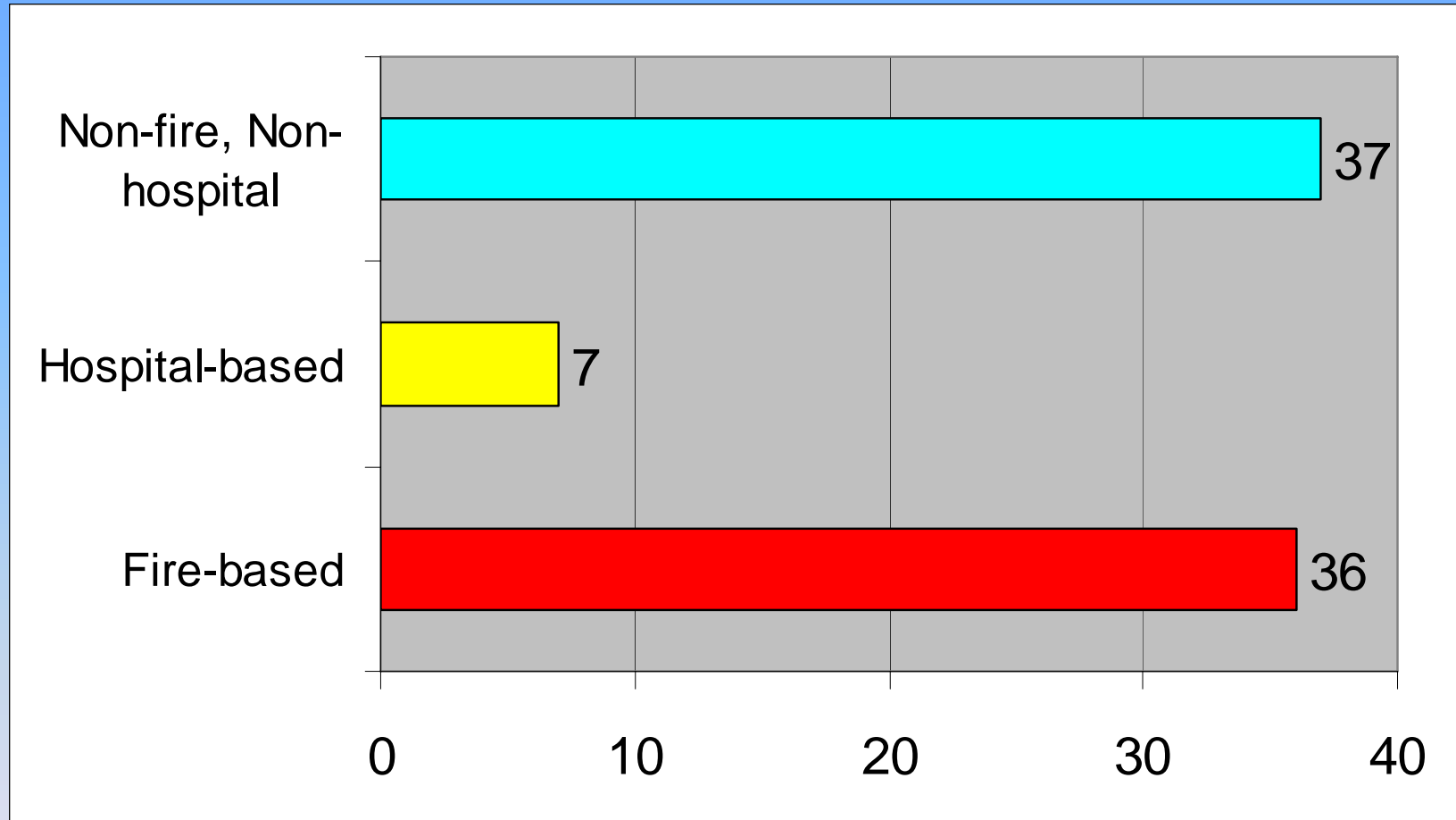


EMS Providers by Type - 2003



Source: University of North Carolina – Chapel Hill. 2003 National EMS Survey.

Percentage of Personnel in EMS System Types - 2003



20% were not classified into system types.

Source: University of North Carolina – Chapel Hill. 2003 National EMS Survey.



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Population at Risk



- **More than 770,000 EMS personnel nation-wide**
- **Approximately 300,000 working in fire-based EMS systems**
- **In 2002, there were more than 12 million EMS responses and 7 million transports nation-wide (Approximately one-half of states reporting)**
- **If states including California, Florida, and Texas reported, the actual numbers would likely be MUCH higher.**

Source: Journal of Emergency Medical Services, 2004 Platinum Resource Guide



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TABLE. Number of persons injured in ambulance crashes, by injury severity and seating position — United States, 1991–2000

Injury severity/ seating position	No.	% within injury severity group	% of all ambulance occupants
Possible			
Front left	70	41.7%	
Front right	50	29.8%	
Other enclosed*	34	20.2%	
Other/unknown	14	8.3%	
Total	168		20.6%
Nonincapacitating			
Front left	81	36.5%	
Front right	54	24.3%	
Other enclosed*	63	28.4%	
Other/unknown	24	10.8%	
Total	222		27.2%
Incapacitating			
Front left	43	32.8%	
Front right	20	15.3%	
Other enclosed*	50	38.2%	
Other/unknown	18	13.7%	
Total	131		16.0%
Fatal			
Front left	14	17.1%	
Front right	10	12.2%	
Other enclosed*	48	58.5%	
Other/unknown	10	12.2%	
Total	82		10.0%
None†	201		24.6%
Unknown†	12		1.5%

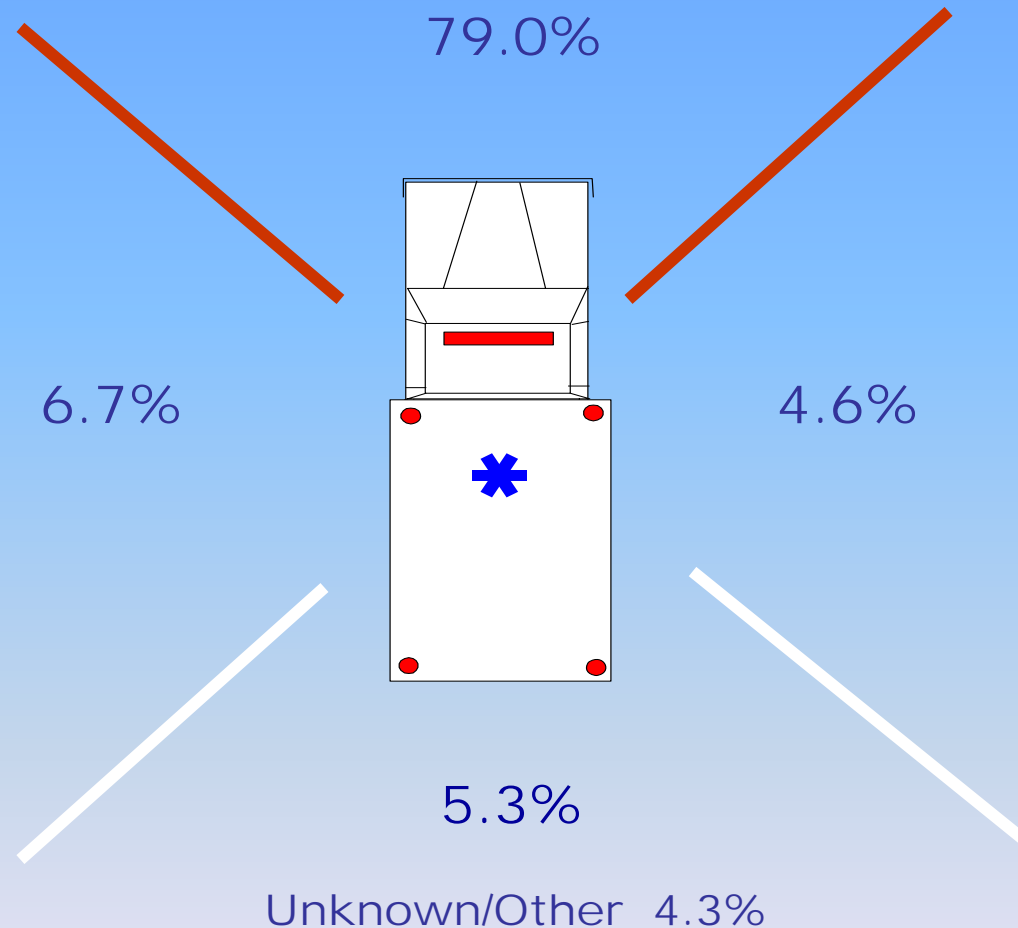
* Inside the patient compartment.

† Seating positions irrelevant or unavailable.

Source: Centers for Disease Control and Prevention, Morbidity and Mortality Weekly Report (MMWR), February 28, 2003 / Vol. 52 / No. 8.



Initial Impact Location



Source: FARS 1991 - 2000



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Career Fire Fighter/Emergency Medical Technician Dies and Paramedic is Injured in a Three-Vehicle Collision - Nebraska



Career Fire Fighter/Emergency Medical Technician Dies and Paramedic is Injured in a Three-Vehicle Collision - Nebraska



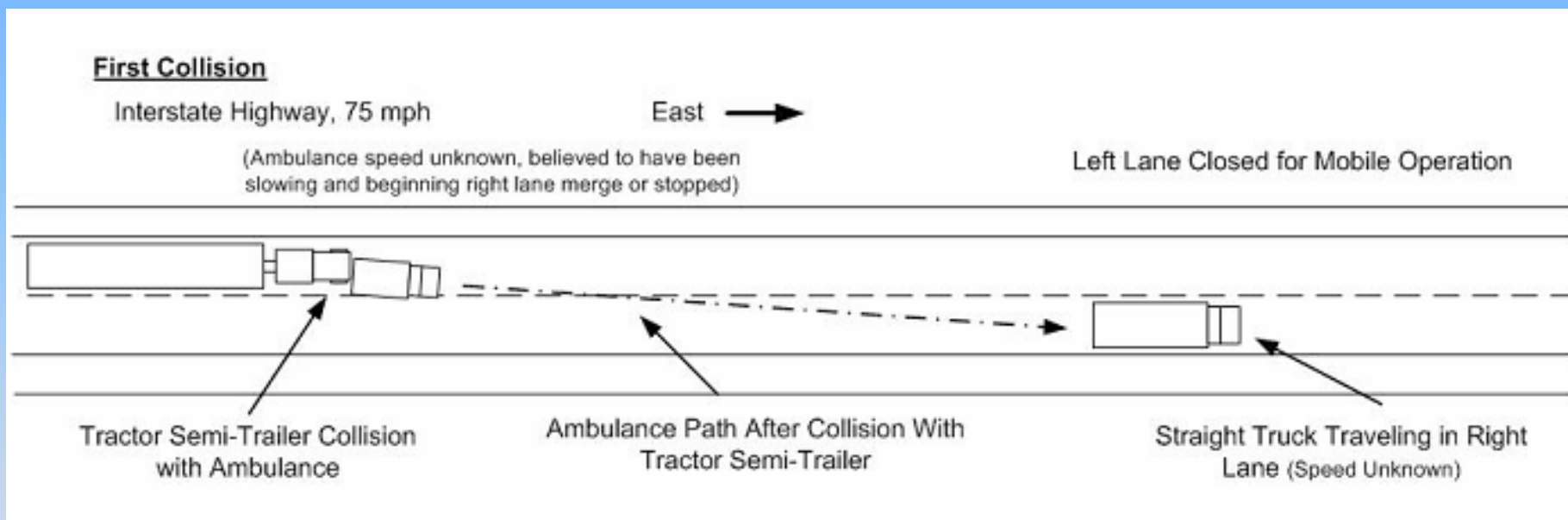
- 43-year-old career fire fighter/EMT (driver)
- Non-emergency transport between two hospitals
- Ambulance was struck from behind and pushed into a straight truck
- Victim was using the three-point lap/shoulder seatbelt; the front cab sustained such extensive damage that he was fatally injured
- Lieutenant/paramedic and patient, who had been riding in the ambulance patient compartment, were also injured during the collision

Career Fire Fighter/Emergency Medical Technician Dies and Paramedic is Injured in a Three-Vehicle Collision - Nebraska

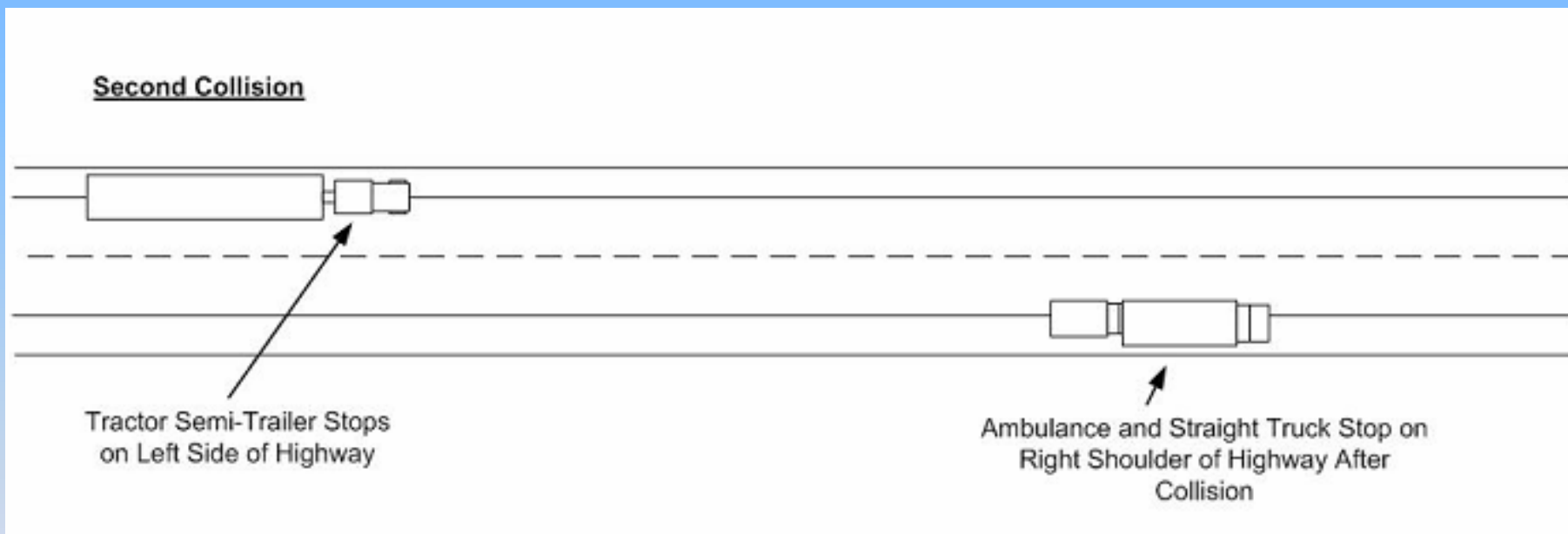


- Ambulance was traveling through a highway workzone and as the ambulance driver slowed down to move around a line painting crew
- Tractor semi-trailer struck the rear of the ambulance and pushed it into the straight truck

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Cause of Death:

- Blunt force trauma

Career Fire Fighter/Emergency Medical Technician Dies and Paramedic is Injured in a Three-Vehicle Collision - Nebraska

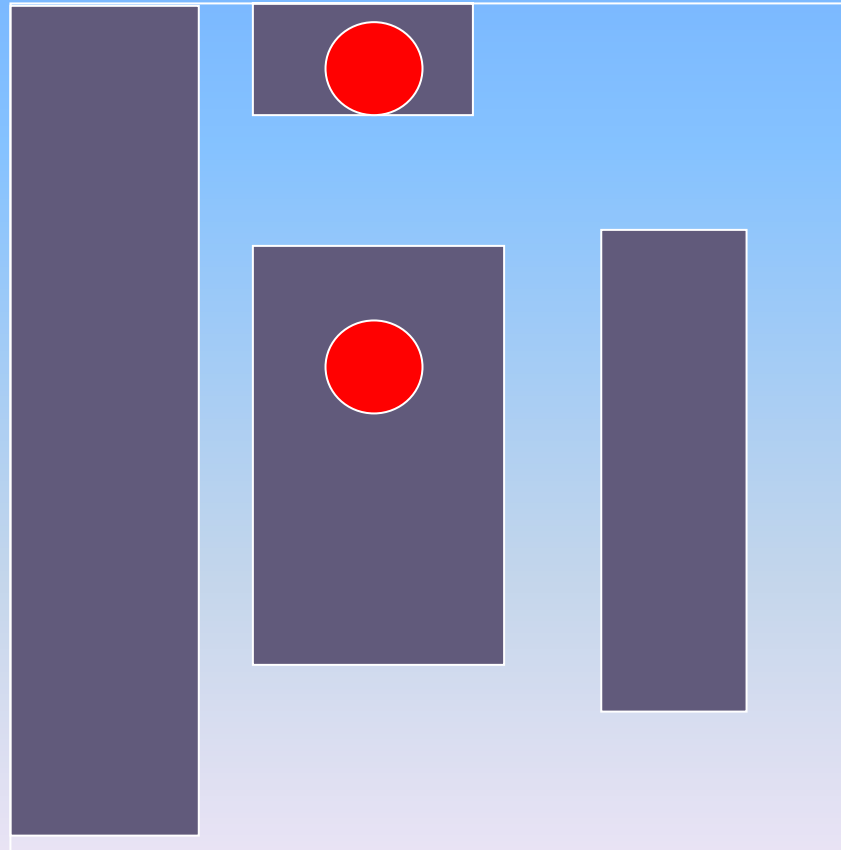


- Lieutenant/paramedic, in the process of re-seating onto the attendant's seat, slipped off the seat edge and continued moving toward the cab
- Wedged in the pass-through; lying on top of the patient, who had been ejected from the cot
- Patient told the lieutenant/paramedic that because he was laying on top of him, he could not breathe
- However, the lieutenant/paramedic could not move

Career Fire Fighter/Emergency Medical Technician Dies and Paramedic is Injured in a Three-Vehicle Collision - Nebraska



Patient compartment



Career Fire Fighter/Emergency Medical Technician Dies and Paramedic is Injured in a Three-Vehicle Collision - Nebraska



- The lieutenant/paramedic suffered several fractures and lacerations
- He spent one week in the hospital intensive care unit, and an additional five weeks in a rehabilitation facility
- The patient suffered no serious injuries

Career Fire Fighter/Emergency Medical Technician Dies and Paramedic is Injured in a Three-Vehicle Collision - Nebraska



- *Fire departments should ensure that EMS workers use the patient compartment vehicle occupant restraints whenever possible*
- *Fire departments and EMS providers should consider using shoulder straps with occupant restraints on patient cots to limit the movement of the patient from the cot during a vehicle crash*

Career Fire Fighter/Emergency Medical Technician Dies and Paramedic is Injured in a Three-Vehicle Collision - Nebraska



- *Ambulance manufacturers, EMS providers, and researchers should develop and evaluate occupant protection systems designed to provide crash protection for EMS workers and the mobility necessary to access patients and equipment within ambulance patient compartments*

EMT Dies in Ambulance Crash – New York



EMT Dies in Ambulance Crash – New York



- 27-year-old female EMT
- Riding unrestrained in patient compartment
- Attending to patient
- Non-emergency transport
- Ambulance struck support column for elevated train

EMT Dies in Ambulance Crash – New York



- Transporting a patient from hospital to residence
- Patient had been placed on the patient cot, secured with lap-belt type leg and hip restraints
- Traveling southbound and without lights and sirens on a two-lane city street
- Ambulance drifted through the northbound lane toward oncoming traffic, and struck the elevated train track support column at an estimated speed of 26 mph

EMT Dies in Ambulance Crash – New York



- During the collision, the victim was thrown forward, contacted and broke a hand rail located at the forward end of the squad bench, and struck the cabinet at the front of the patient compartment
- The patient was partially ejected from the cot restraints and struck the attendant seat before coming to rest partially off the cot
- The cot's shoulder straps were tied underneath the cot and had never been used

EMT Dies in Ambulance Crash – New York



- During the crash, the ambulance was traveling forward, and the patient was lying on the cot. The cot was not secured, and the patient was not restrained.
- The patient was not restrained, and the cot was not secured.
- The patient was not restrained, and the cot was not secured.



EMT Dies in Ambulance Crash – New York



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EMT Dies in Ambulance Crash – New York

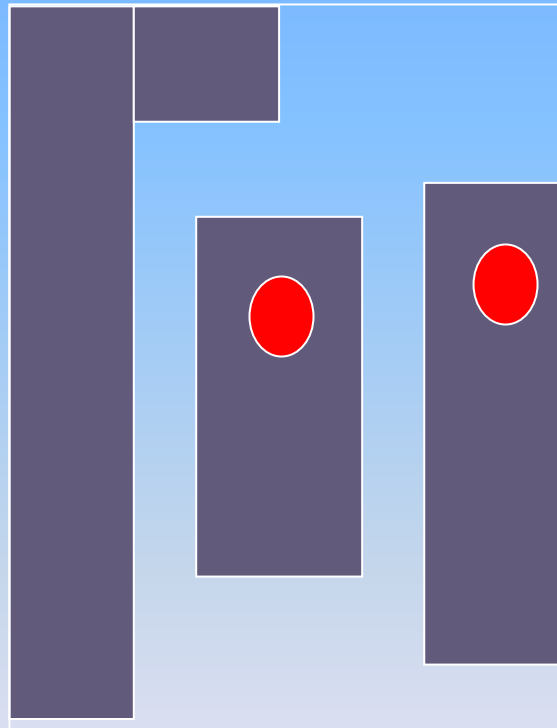


- Forward, the patient was positioned on the gurney.
- The patient was not secured to the gurney.
- The patient was not secured to the cot.

EMT Dies in Ambulance Crash – New York



Patient compartment



EMT Dies in Ambulance Crash – New York



Cause of Death:

- Thoracic spine cord laceration; complete cord syndrome with dislocation;
- Lung contusion bilateral with or without hemo-pneumothorax;
- Cerebellum subarachnoid hemorrhage

EMT Dies in Ambulance Crash – New York



NIOSH investigators concluded that, to help prevent similar occurrences, employers should:

- ensure that emergency service workers use the patient compartment vehicle occupant restraints whenever possible*
- ensure that patient cots are equipped with upper body safety restraints for use during emergency and non-emergency transports*
- ensure that drivers and front-seat passengers of emergency service vehicles use the vehicle occupant restraints that are provided*

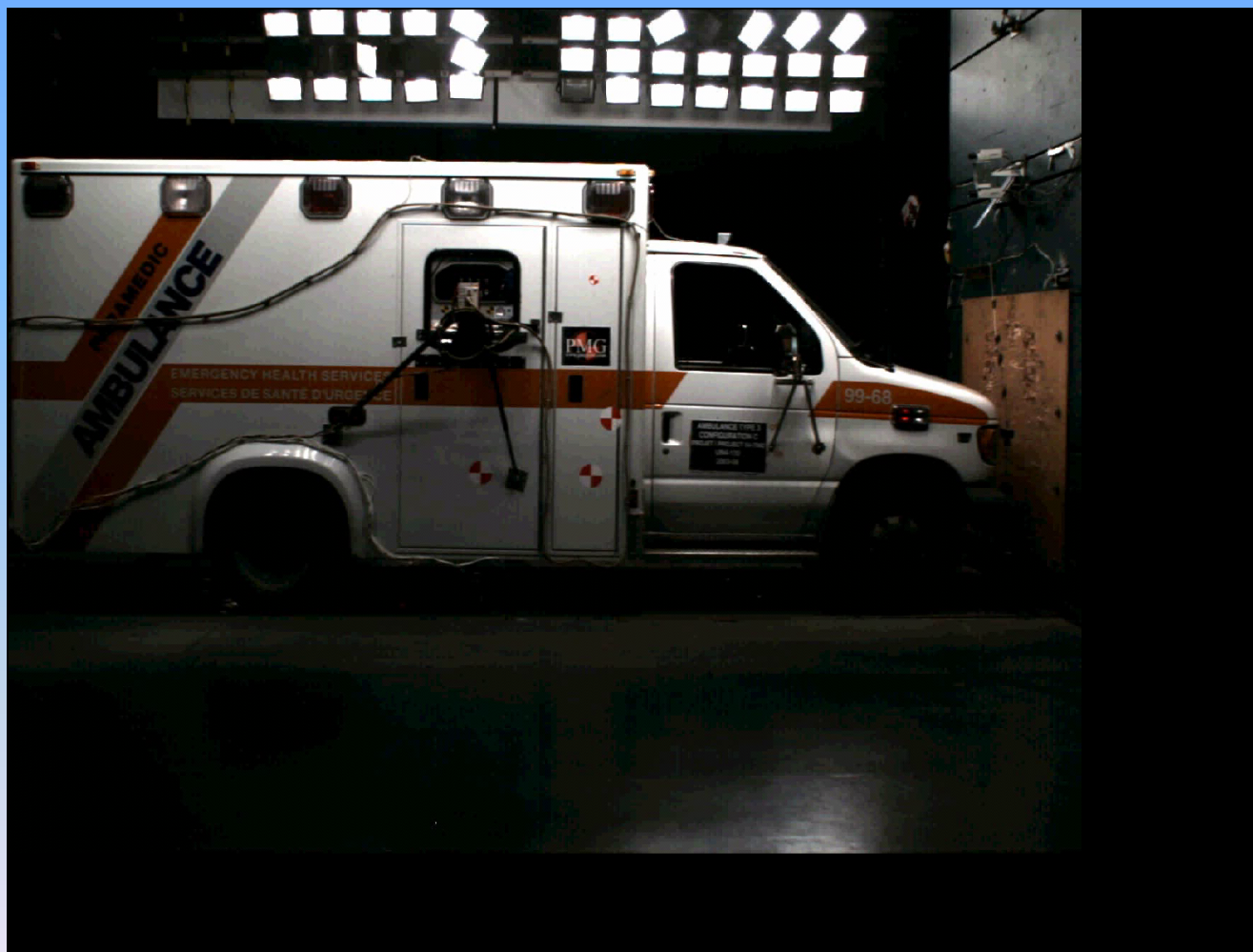
EMT Dies in Ambulance Crash – New York



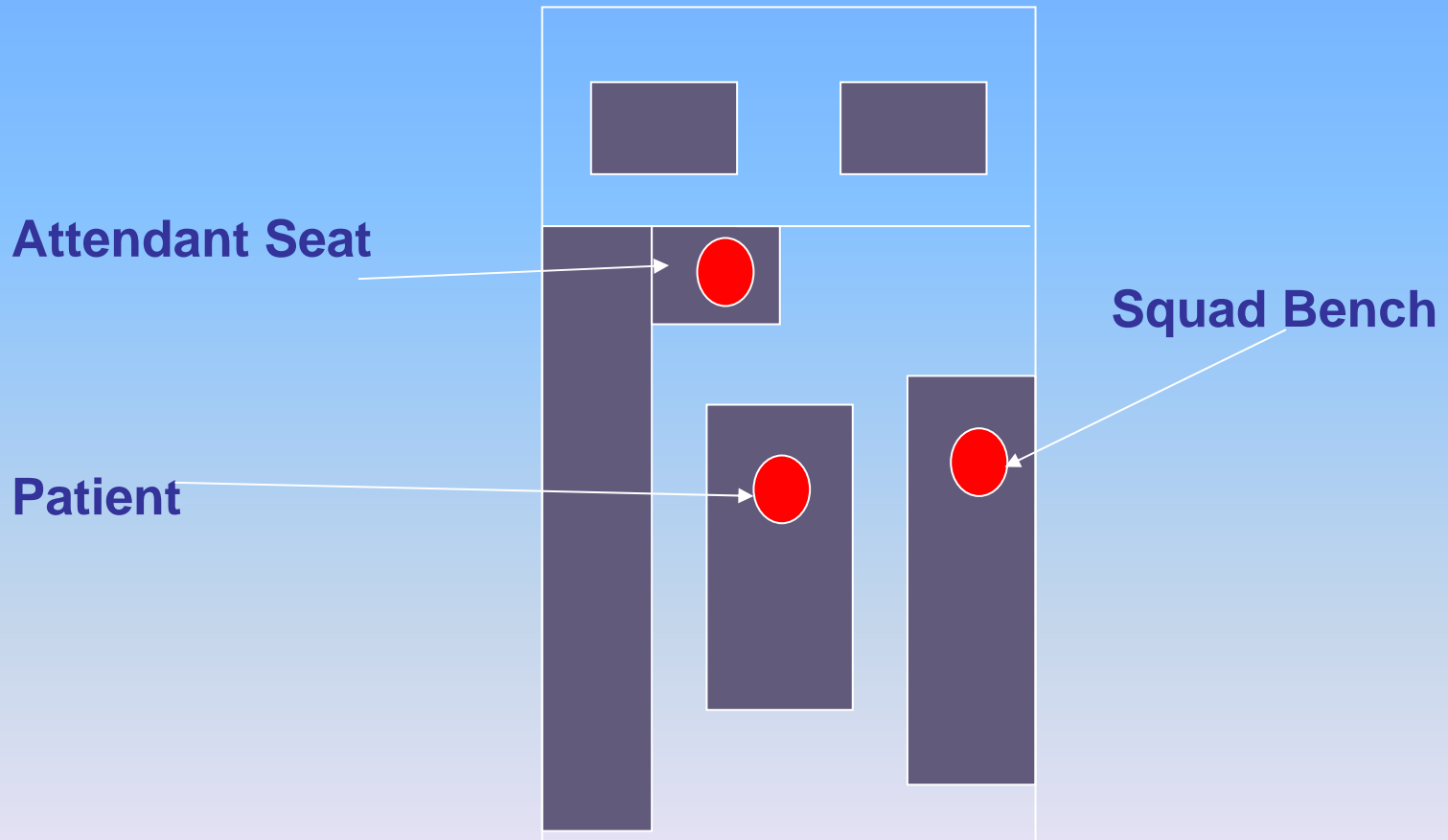
Ambulance manufacturers and emergency services should:

- *evaluate and develop occupant protection systems designed to increase the crash survivability of EMS workers in ambulance patient compartments while still providing the necessary mobility to provide patient care during transport*

NIOSH Project



Occupant Locations



Occupant Locations



Attendant seat

Squad bench

Cot location



Sled and Crash Test Speeds

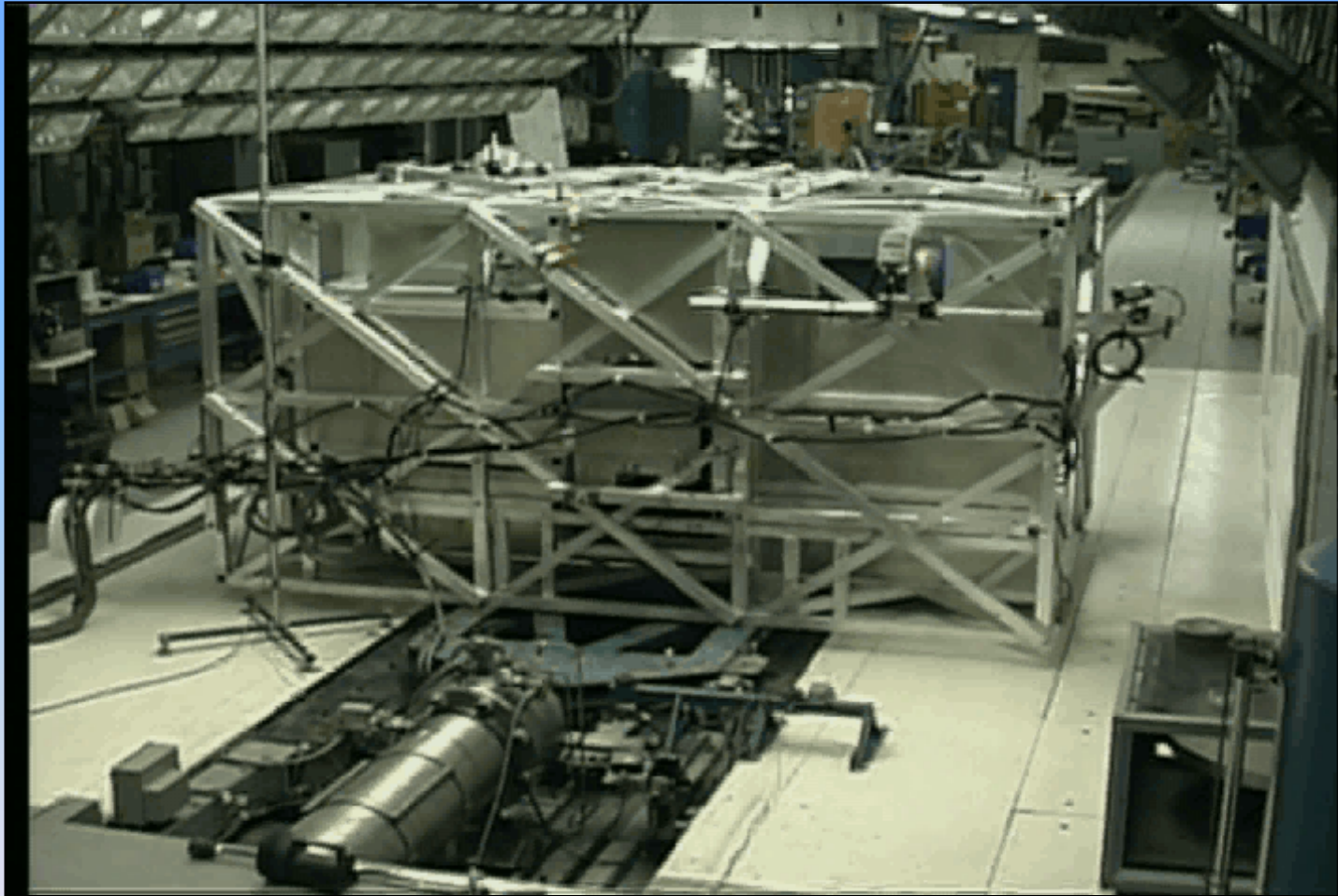


Front Impact – 30 mph and 25 mph
30 mph matches federal standard
for front seat occupant protection

Side Impact – 17 mph
similar to federal side impact
standard

Rear Impact – 18 mph
similar to federal rear impact
standard

Sled Test



Unrestrained and Lap Belt-Restrained Bench Seat Occupants



**** Lap belts should always be used in conjunction with net as recommended by the net manufacturer ****

Attendant's Seat Occupant



Patient Excursion into Attendant's Seat Occupant



Dissemination and Research-to-Practice Efforts



- Industry:
 - Front-line EMTs
 - Ambulance Service Providers
 - Restraint System Manufacturers
 - Cot Manufacturers

Dissemination and Research-to-Practice Efforts



- Standard-setting bodies:
 - General Services Administration – “Federal Specification for the Star-of-Life Ambulance”

Preliminary Project Findings



- All the mobile restraint systems tested provided protection even when the occupant is not seated against the seat back.

Questions?



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