



# The Limits of Compartmentalization Protection

Charlie Vits | Marketing Development Manager 

## Idaho APT 2014

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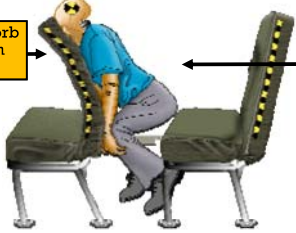
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### Compartmentalization - 1977

Passive protection for **UNBELTED** passengers

Seat backs absorb passenger crash energy



Passengers remain in compartment between seats

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### Compartmentalization

Forward and in-position



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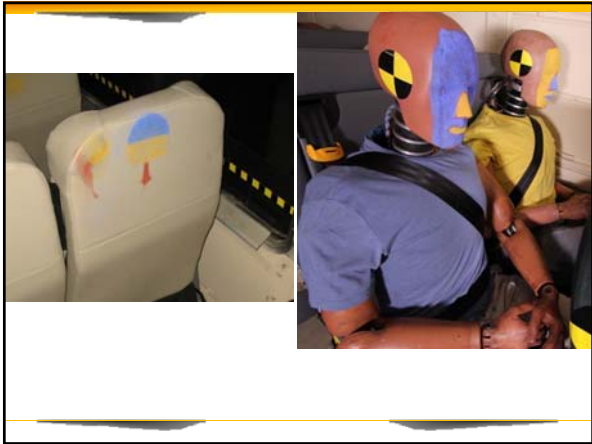
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## Compartmentalization is **NOT** enough

- Designed for low-energy, frontal crashes
- Kids must be in the “compartment”
- Kids must be properly seated, forward facing




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## Bus Crash Demonstration | August 8, 2013



- 100 guests
- 1998 Type C school bus
- 25 mph frontal crash

### Objectives:

1. Compare belted and unbelted passengers.
2. Study motions of out of position passengers.
3. Provide school transportation leaders with insights to seat belt issue.




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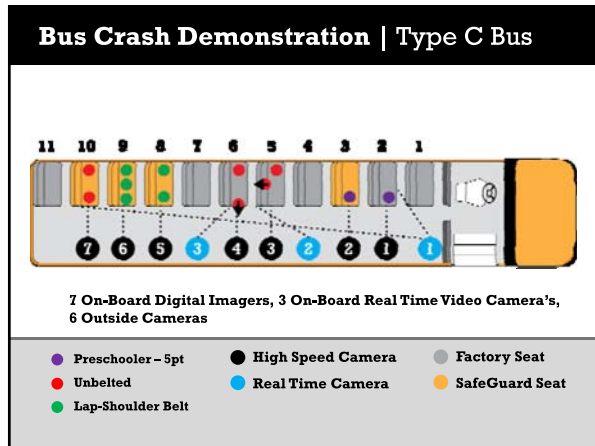
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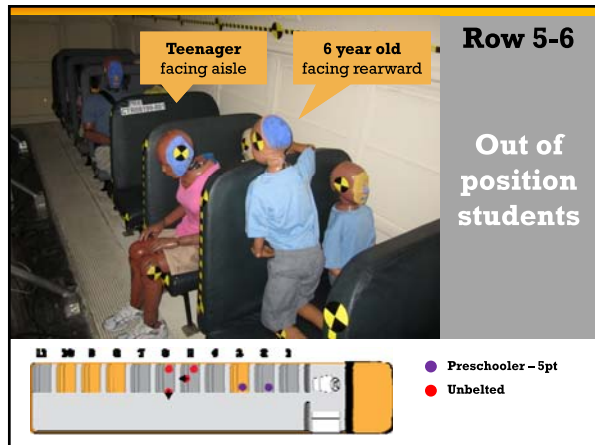
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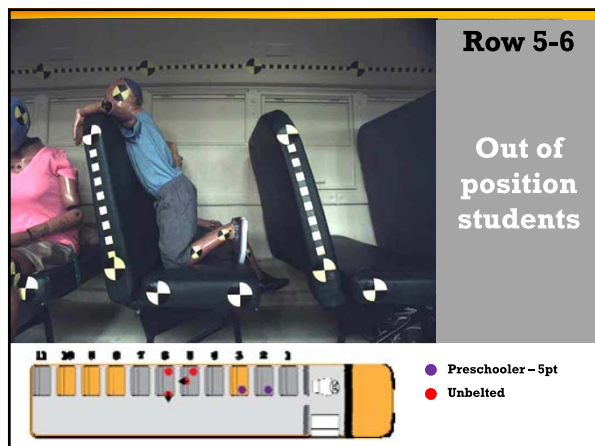
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**Row 5-6**

**Out of position students**

● Preschooler – 5pt  
● Unbelted

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**Row 8-9**

● Preschooler – 5pt  
● Unbelted  
● Lap-Shoulder Belt

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**Row 10**

● Preschooler – 5pt  
● Unbelted  
● Lap-Shoulder Belt

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**Bus Crash Demonstration | November 13, 2013**

2001 Type D front engine  
78 Passenger  
30 mph frontal crash

**Objectives:**

1. Test at standard 30 mph crash speed.
2. Use high back seats.
3. Compare belted and unbelted passengers.
4. Study additional out of position passenger motions.



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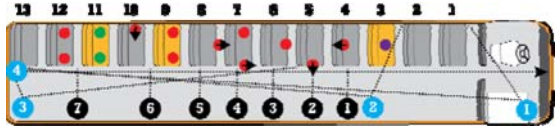
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**On-Board**  
7 High Speed Video  
4 Real Time Video

**Off-Board**  
5 High Speed Video  
5 Real Time Video



Legend:

- Preschooler - 5pt
- Unbelted
- Lap-Shoulder Belt
- High Speed Camera
- Real Time Camera
- Factory Seat
- SafeGuard Seat

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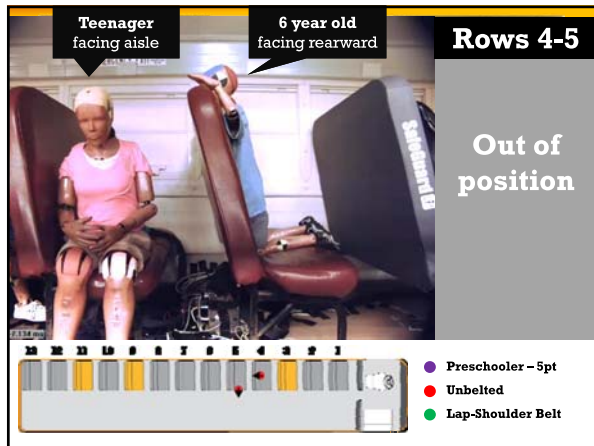
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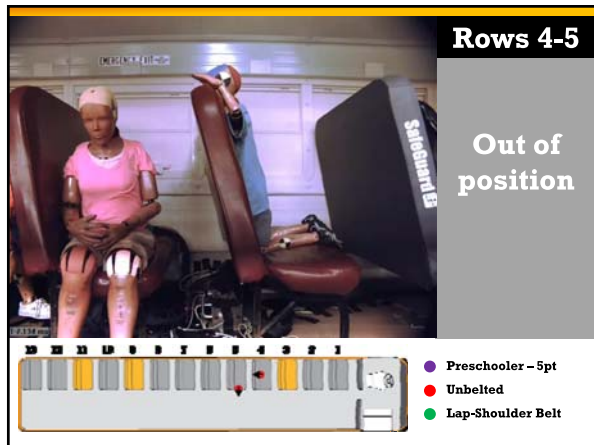
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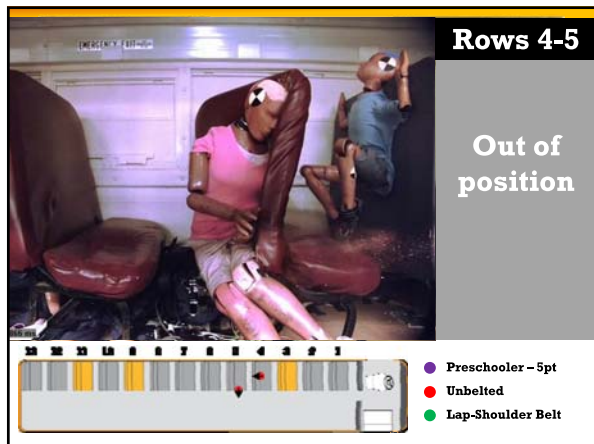
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**Rows 6**

Out of position

**6 year old**

Leaning forward  
Reaching down



- Preschooler - 5pt
- Unbelted
- Lap-Shoulder Belt

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**Rows 6**

Out of position

**6 year old**

Leaning forward  
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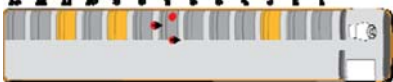


**Rows 7-8**

Out of position

**Row 7:**  
**Teenager**  
Half on/half off seat  
**10 year old unbelted**

**Row 8:**  
**Adult**  
Standing and leaning over seat



- Preschooler - 5pt
- Unbelted
- Lap-Shoulder Belt

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### Rows 7-8

**Out of position**

**Row 7:**  
**Teenager**  
Half on/half off seat  
**10 year old unbelted**

**Row 8:**  
**Adult**  
Standing and leaning over seat



- Preschooler - 5pt
- Unbelted
- Lap-Shoulder Belt

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### Rows 9-10

**Out of position**

**Row 9:** Unbelted adults

**Row 10:** Unbelted adult  
Back against wall  
Feet sideways



- Preschooler - 5pt
- Unbelted
- Lap-Shoulder Belt

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### Rows 9-10

**Out of position**

**Row 9:** Unbelted adults

**Row 10:** Unbelted adult  
Back against wall  
Feet sideways



- Preschooler - 5pt
- Unbelted
- Lap-Shoulder Belt

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### Rows 11-12

**Row 11:**  
Belted  
Adult + 6 year old

**Row 12:**  
Unbelted  
Adult + 6 year old



● Preschooler - 5pt

● Unbelted

● Lap-Shoulder Belt

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### Rows 11-12

**Row 11:**  
Belted  
Adult + 6 year old

**Row 12:**  
Unbelted  
Adult + 6 year old



● Preschooler - 5pt

● Unbelted

● Lap-Shoulder Belt

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**Bus Crash Demonstration | February 27, 2014**

- 1999 Thomas Type C - SWB Bus
- 22-passenger + 2 wheelchair
- 30 mph Full Frontal

**Objectives:**

1. Study motions of out of position passengers with backpack.
2. Study compartmentalization protection of passengers with backpacks.
3. Study unsecured objects



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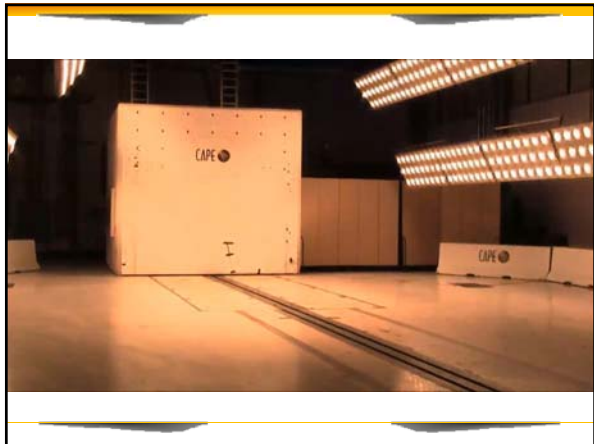
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**Bus Crash Demonstration | Type C Bus**

- Factory FMVSS 222 seats
- Lap belts removed
- One side of seats removed for cameras & lighting
- No driver occupant

● Unbelted  
● Unsecured Objects  
● High Speed Video  
● Real Time Video

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**Row 3**  
**Out of position**  
**6 year old**  
**Wearing backpack**

● Unbelted  
● Lap-Shoulder Belt

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**Row 5**

Out of position

6 year old

Wearing backpack



● Unbelted

● Lap-Shoulder Belt

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**Row 4**

Out of position

Cooler and backpack

Unrestrained



● Unbelted

● Lap-Shoulder Belt

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**What have we learned?**

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### Compartmentalization is incomplete

Injury protection is limited by:

**Idaho APT 2014**


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### Compartmentalization Limitations





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Type of crash

Interior Surroundings

Proper Seating Position

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MISINFORMATION	THE FACTS
Compartmentalization is enough	Compartmentalization is <b>NOT</b> enough
Seat belts reduce capacity	Seat belts <b>DO NOT</b> reduce capacity
Seat belts will be used as weapons	Seat belts are <b>NOT</b> used as weapons
Seat belts are too expensive	Purchase depends on <b>PRIORITIES</b>
NHTSA hasn't approved seat belts	NHTSA <b>SET STANDARD</b> for belts on buses
Seat belts slow evacuation	Seat belts <b>AID</b> evacuation
Students won't wear them	Students will wear them <b>WITH STRONG USAGE POLICY</b>

**Idaho APT 2014**


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### Compartmentalization Protection Requires:



1. Students sit properly facing forward in compartment.
2. Backpacks must be removed and placed on the floor.

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### If this were YOUR child in a crash

Compartmentalization



Lap-Shoulder Belts



Which protection would YOU choose?

TGBTG

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### The Limits of Compartmentalization

#### MORE INFO

[safeguardseat.com](http://safeguardseat.com)

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[cvits@imminet.com](mailto:cvits@imminet.com)



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