



# Boosters & Air Bags

**Prepared/Revised by the  
National Child Passenger Safety Board  
October 2012**

# Objectives

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1. Discuss the effectiveness of belt positioning booster (BPB) seats
2. Explain the advantages of using different types of BPB seats with children of different ages and sizes
3. Identify different types and locations of air bags in vehicles
4. Identify advanced air bag systems commonly seen in family vehicles
5. Discuss the NHTSA side air bag recommendations





# Important Notice

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- Sponsoring organizations do not endorse or support products included in any modules.
- Products included in this or any other module are used only as examples.
- Examples do not represent all products on the market.
- Check manufacturer's websites for more products, explanations, and details.

# Boosters

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# Belt Positioning Booster Effectiveness



A new study, including a greater percentage of children aged 6 to 8 years than in previous studies, found that children who were 4-8 years of age and using BPB seats were 45% less likely to sustain injuries than similarly aged children who were using the vehicle seat belt\*.



\*K.B. Arbogast, J.S. Jermakian, M.J. Kallan, and D.R. Durbin. *Effectiveness of Belt Positioning Booster Seats: An Updated Assessment*. Pediatrics 2009;124;1281-1286; originally published online Oct 19, 2009.

# Types of Booster Seats: Belt Positioning Boosters



**BACKLESS**



**HIGH BACK**



# Is One Safer Than The Other?



- Both provide protection in a crash
- Both lift the child up so the adult lap-shoulder belt fits correctly.
- Taller children benefit from the head, neck and back support of a high back booster, especially if there is no head restraint (such as a low bench seat).



# Is One Safer Than The Other?

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- High back boosters must be used when vehicle seat backs are low or do not have head restraints.



# Backless Belt Positioning Booster: Benefits

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- Raises child up for good belt fit, but booster is not seen from outside the vehicle. Older children may not want to be seen using a “little kid’s seat”
- Lower cost (as low as \$20-25)
- Narrow base of some may improve access to belt buckles if three children are in restraints in the back seat. (Some are also adjustable in width)
- Compactness is convenient for carpools and travel.

# Backless Belt Positioning Booster

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- Cautions:
  - May require a belt guide for proper shoulder belt positioning.
  - Belt guides may be difficult to use or lost.

# SAMPLE: Backless BPB Shoulder Belt Guide



Source: Partners for Child Passenger Safety Educational Illustrations



# High Back BPB

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- Benefits:
  - Built-in shoulder belt guides assist with proper positioning of the belt (across the shoulder).
  - Adjustable headrests with side-wings help keep sleeping children upright with the shoulder belt positioned properly.
- Cautions:
  - More expensive than backless BPBs
  - Some guides don't allow the shoulder belt to retract freely so belt will stay snug.
    - Always check to be sure the belt moves freely through the belt adjuster's path.

# SAMPLE: High Back Shoulder Belt Guide



Source: CHOP Partners for Child Passenger Safety Educational Illustrations

# Good to Know...

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- Booster seat backs offer varying degrees of rear-impact head/neck protection
  - Several HBBs do not allow use if the child's head is above the vehicle seat back.
- With new head restraints, some high back boosters may not sit flush against the vehicle seat back.
  - Consult **both** vehicle and booster seat manuals for how to handle this situation



# Types of Booster Seats: A New Combo CR



- Kiddy is only manufacturer to distribute a child restraint with a “protection shield”.
- **It is not the same thing as the older, discontinued “shield” boosters.**
- When the upper weight limit is met, the shield is removed and the CR becomes a belt positioning booster



# Always Review the Manual and Labeling



## 2. Recommended use

The 'kiddy world plus' has been tested and certified to FMVSS 213 for use with children over one year of age, capable of sitting upright alone and who weigh between from 22 to 110 lbs (10 to 50 kg) and whose height is 57 in. (145 cm) or less.

### 2.1 Toddler Car Seat Use (WITH protection shield)

**WARNING** DEATH or SERIOUS INJURY can occur

- Children must be at least one year of age and able to sit upright unassisted to use this car seat.
- Protection shield must be used with children 22 to 40 lbs (10 to 18kg).
- Seat cushion must be used with children 22 to 30 lbs (10 to 13.6 kg).
- Discontinue use of the protection shield when child exceeds either 40 lbs (13.6 kg) or height of 43 in. (109 cm).

Children must meet all of the following criteria to use the Toddler car seat WITH the protection shield:

- Age - At least one year of age and
- Able to sit upright alone (unassisted) and
- Weight - 22 to 40 lbs (10 to 13.6 kg) and
- Height 43 in. (109 cm) or less



The American Academy of Pediatrics (AAP) and Kiddy USA recommend keeping a child in a Toddler car seat as long as possible before changing to a booster car seat. Use the toddler car seat until the child's weight exceeds 40 lbs (13.6 kg) or height exceeds 43 inches (109 cm) before the booster car seat mode.

### 2.2 Booster Car Seat Use (WITHOUT protection shield)

**WARNING** DEATH or SERIOUS INJURY can occur

- Child must weigh at least 40 lbs (18 kg) and 40 in. (102 cm) to use booster car seat mode.
- Do not use protection shield with children over 40 lbs (18 kg).
- Discontinue use of car seat when
  - The child exceeds either 110 lbs (50 kg) or 57 in. (145 cm)
  - The top of the child's ears are above the top of the seat back.

Children must meet all of the following criteria to use the Booster car seat WITHOUT the protection shield:

- Weight - 40 to 110 lbs (18 to 50 kg) and
- Height - 40 to 57 in. (102 to 145 cm) and
- Top of ears must be below top of seat back.

The American Academy of Pediatrics (AAP) and Kiddy USA recommend keeping a child in a booster car seat as long as possible before changing to vehicle seat belts. Use the booster car seat until the child's weight exceeds 110 lbs (50 kg) or height exceeds 57 inches (145 cm) before using a vehicle seat belt.



# Weight Limits

- Don't graduate kids to a booster seat too early
  - Keep kids in full harness for as long as the seat allows
- Weight limits vary
  - Usually 30-100 pounds for **high back**
  - Usually 40-100 pounds for **backless**
- Look on labels for specific height and weight limits
  - Some no longer have height limits
  - Some BPBs go up to 120 pounds
- Check for proper belt path and fit



# Lots to Choose From!

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# Boosters & Side Impact Crashes

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- According to NHTSA, 42 percent of child fatalities to rear-seated children ages 0 to 8 years occur in side-impact collisions.
- Overall, side-impact crashes kill about 300 American children under age 8 each year and result in more severe injuries at lower crash severities than frontal collisions.

# Stay Updated: New to the Market...



More CR manufacturers are designing seats with added side-impact protection in the area of the head and neck.



# Boosters & Side Impact Crashes

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- Although not federally mandated, more manufacturers are responding to **side-impact** crashes by designing seats with more protection in the area of the head and neck.
- This diverts crash forces away from the head area, decreasing the severity of head trauma.





# Side Impact Protection

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- Researchers at Children's Hospital of Philadelphia's Center for Injury Research and Prevention studied more than 7,000 children ages 4 to 8 involved in real-world crashes between 1998 and 2007.
- Their 2009 study, revealed of those riding in booster seats, **children involved in side-impact crashes saw the greatest reduction in injury risk.**
- This study shows a reduction in risk of 68% in near-side crashes and 82% in far-side crashes compared to children in standard (adult) seat belts.

Source: Pediatrics, Official Journal of the American Academy of Pediatrics, 10/19/09



# Air Bags

That's a nice bag you have, but  
you need a belt to go with it.



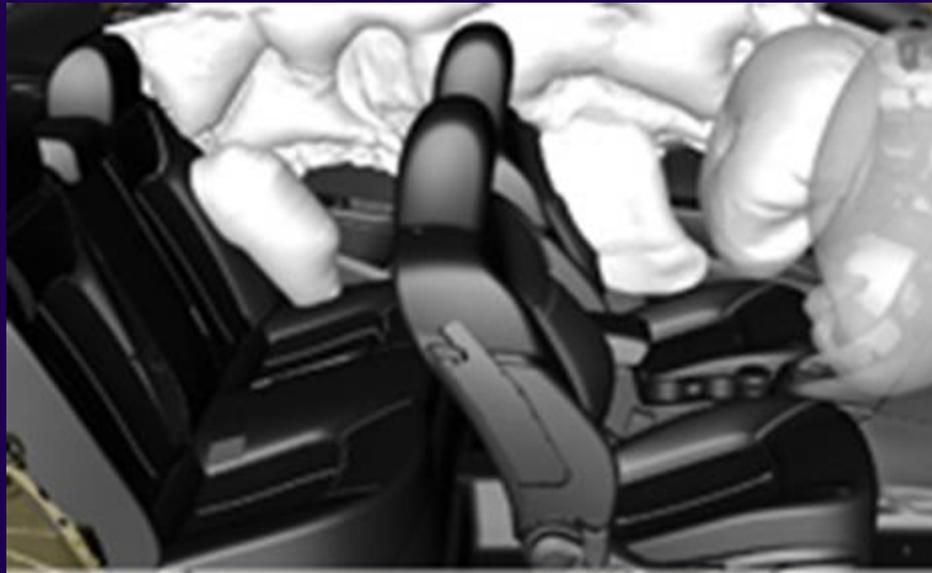
# Air Bags in Vehicles

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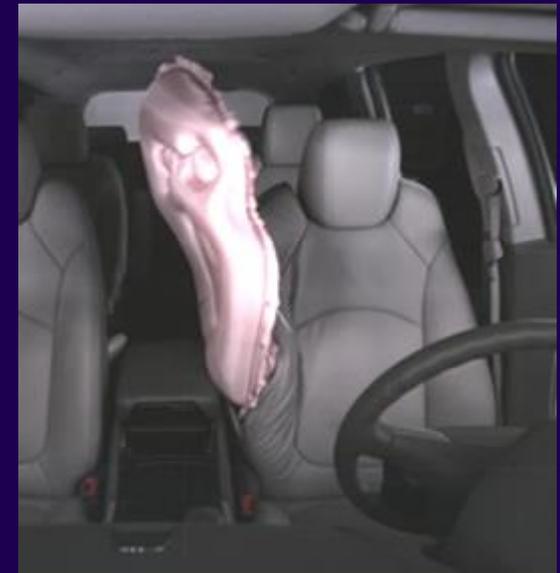
- Air Bags may be found throughout the vehicle.
- Different air bags provide protection for different types of crashes.



**Inflatable Seat Belt**



**Front and Side Air Bags**

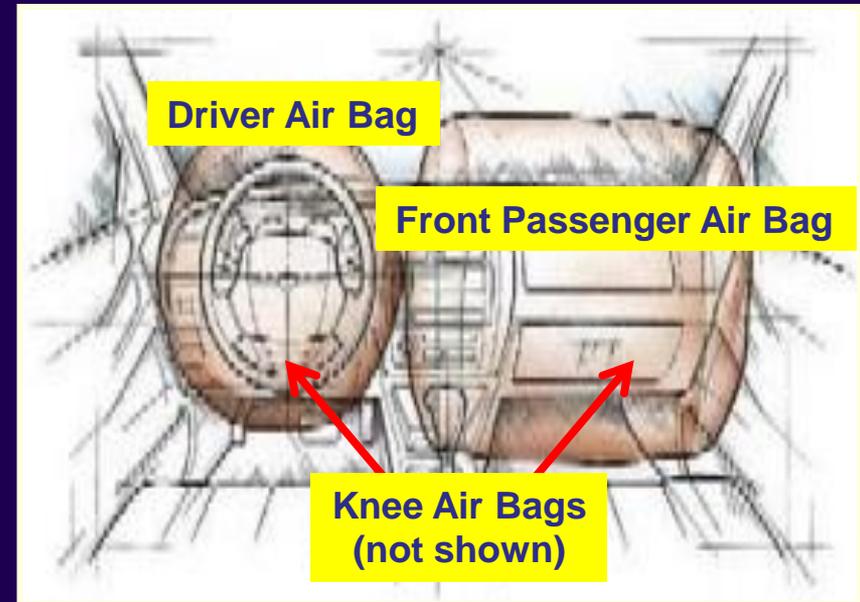


**Front Center Air Bag**

Photos Courtesy of Ford Motor Company and General Motors

# Air Bags for Front Crashes

- Air Bags for front crashes work with seat belts to protect front occupants.
- Newer vehicles may also have knee air bags to protect occupants' legs, located below the steering wheel and the glove box.
- Front air bags in the passenger seat, even in newer vehicles, still pose a risk to children.



# “Advanced” Frontal Air Bag Systems



## Before 2004:

- Passenger Air Bag Systems with more powerful output force
- Higher risk to small or out-of-position occupants in the front passenger seat

## Starting in 2004:

- “Advanced” Air Bag Systems for Passenger Air Bags
- Reduced risk to small or out-of-position occupants



# Meeting FMVSS 208 Requirements For Children: “Advanced” Frontal Air Bags



- 1. PASSIVE SUPPRESSION:** The frontal air bag system is automatically disabled for the front passenger if sensors in the vehicle detect a child or child-sized person in the front passenger seat. It is enabled when larger children or small adults are in the front passenger seat.
- 2. LOW RISK DEPLOYMENT:** The frontal air bag is deployed in a way that's less likely to cause harm to an occupant (including a child in child restraint or an out-of-position small occupant).

Vehicle manufacturers may use one or both of these types of systems to certify their vehicles to FMVSS 208 requirements.

**NOTE: Our message is the same – CHILDREN 12 YEARS OLD and YOUNGER BELONG IN THE BACK SEAT.**

# ACTIVE Air Bag Suppression

The passenger air bag must be turned on/off manually  
(person must do something)

- Manual ON/OFF switch, uses the vehicle key to operate
  - Must be OFF for younger children in the front passenger seat
  - Must be ON for older kids and adults
  - Frontal passenger air bags only

**For detailed information on the switch and when to use – see the Vehicle Owner’s Manual**

**48% of all Manual ON/OFF switches are erroneously left ON even with child passengers \***



\*Source: [www.safercar.gov](http://www.safercar.gov)

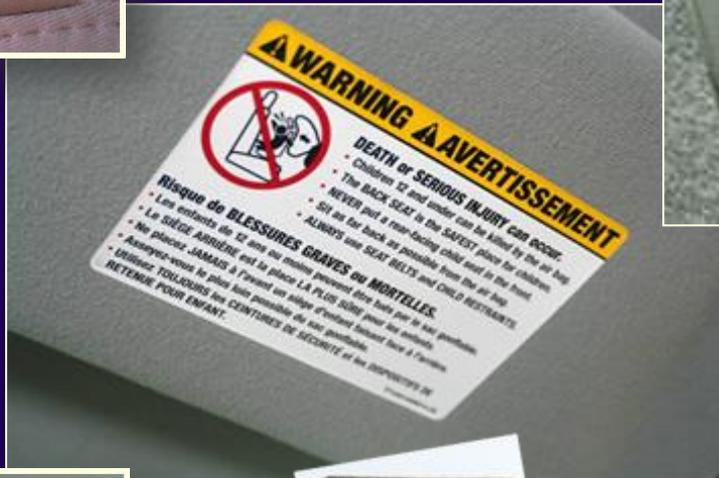
# PASSIVE (or Automatic) Air Bag Suppression



- Front passenger air bag system
- Turns off the frontal and/or side passenger air bag systems under specific conditions.
- Read the Owner's Manual to understand:
  - Is it present in the vehicle
  - How status is indicated by the light(s)
  - What size occupants turn "on" the air bag
  - Any warnings about using this system



# Air Bag Warning Labels & Markings (on visor and other locations)





# CPST's Should Know...

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- When working with caregivers, CPSTs should investigate whether the vehicle has an Advanced Air Bag System (AABS):
  - Read the visor label.
  - Check the vehicle owner's manual.
  - Advise the caregiver to follow the manufacturer's instructions and to read and understand all warnings.
  - AABS's are not all alike. The owner's manual gives the caregiver guidance about when the air bag is suppressed (or "off") and when it is active (or "on").



# CPST's Should Know...

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- Question: Why do some vehicle manuals warn that nothing should press against the back of the front passenger seat or be placed under that seat?

Short answer: Pressure on the seatback may cause a false reading by the sensors that regulate the passenger-side advanced air bag system (AABS), possibly causing either the AABS to deploy in a crash when it is not needed or to be suppressed in a crash when it is needed.

Source: Safe Ride News Jan/Feb 2010; Updated October 2012



# CPST's Should Know...

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If the vehicle owner's manual warns against a RF CR pressing against the front passenger seatback, consider these options:

- Install the CR in the driver-side position instead. (Check the owner's manual – some driver-side vehicle seats have sensors too!)
- Put the CR handle (if present) in the upright or fully lowered position, if allowed by the CR manufacturer.
- Use a CR that takes less front to backspace in the rear-facing mode.
- Install the CR in the center position as long as it does not press against the front passenger seatback.

Source: Safe Ride News Jan/Feb 2010; Updated October 2012



# CPST's Should Know...

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- For vehicles that have an AABS and warn against contact with the front passenger seatback, also avoid pressure to the front passenger seat that may be applied by:
  - a tightened (or over-tightened) RF tether
  - the legs of forward-facing children who are stretching or pushing.

Source: Safe Ride News Jan/Feb 2010; Updated October 2012

# Low Risk Deployment (LRD) AABs

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- Some vehicles have low risk deployment (LRD) advanced air bags that are never suppressed (turned off)
  - The passenger air bag is always “on” and will deploy in frontal crashes, even with a rear-facing infant in the front seat.
  - These vehicles do not have a lamp for the passenger air bag
- Some vehicles may suppress the LRD air bag for rear facing infants, but not for larger children.
  - These vehicles will have a lamp for the passenger air bag.
  - Check the owner’s manual to understand what size occupants will suppress the air bag.
- Some vehicles may have a manual on/off switch (pickup trucks or small rear seats) to turn off the LRD air bag
  - See prior slide regarding the proper use of a manual on/off switch.



# CPST's Should Know...

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- Never place a rear-facing CR in the front passenger seat with an advanced air bag that is not turned off.
  - If there is no rear seat, it is not safe to transport a rear-facing infant in the vehicle.
  - Even if the AABS is suppressed, a rear-facing infant should ride in the back seat.
- If a child in a Forward-Facing CR must sit in the front passenger seat, move the seat as far rearward as possible.

# Air Bags for Side Crashes

- Air bags for side crashes can be found in the door, the sides of the seat and along the edge of the roof.
- Some side air bags may deploy in certain types of roll overs.
- Most side air bags are tested to industry standards to minimize the risk of injury to small occupants.
- The vehicle owner's manual does not usually state when it is OK to use a CR near a side air bag, but will warn if it isn't allowed. The CR owner's manual must also allow use near a side air bag.
- No warning against = OK to use.



Front Center Air Bag Photo Courtesy of General Motors

# Front Center Air Bag

- Located in the driver's seat, on the inboard side. When present, a label is sewn on the inboard side of the seat.
- Restrains drivers in side impact crashes to the passenger side of the vehicle
- Provides cushioning between front seat occupants in side impacts and rollovers
- There are no vehicle restrictions on CR placement with a front center air bag.
- If a rear facing CR is installed in the 2nd row center seat, move the 2nd row seat rearward whenever possible to avoid interaction with the air bag.



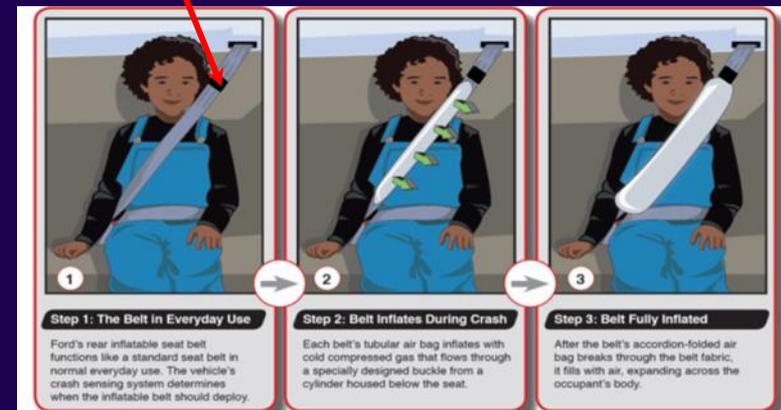
Photos Courtesy of General Motors

# Inflatable Seat Belts

- Generally deploy in front, side and roll over crashes
- Separate lap belt and shoulder belt with a sewn-on latch plate.
- Lap belt is a switchable retractor, shoulder belt is ELR
- The air bag is inside the shoulder belt webbing, which is thicker than the lap belt webbing.
- Check CR Instructions or the SafeKids website to verify if a specific CR can be used with the inflatable seat belt.



Inflatable belts are identified with a permanent label on the shoulder belt



Photos Courtesy of Ford Motor Company

# NHTSA Side Air Bag (SAB) Recommendations

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All air bags (frontal or side) are supplemental safety devices and are intended to work best in combination with seat belts. Therefore, even with SABs that meet TWG\* testing procedures, make sure that:

- ALL children use a safety restraint appropriate for their age and size (this could be a safety seat, booster seat or adult seat belt).
- NEVER place a rear-facing infant seat in the front seat of a vehicle with a front passenger air bag.
- To minimize injury risks, NHTSA recommends that children not lean or rest against chest-only or head/chest combination SABs.
- NHTSA has not seen any indication of risks to children from current [inflatable curtains].

\*TWG = Technical Working Group: the industry group that established test procedures to confirm a low risk of injury to out-of-position small occupants from deploying side air bags (SABs).

Source: NHTSA: Frequently Asked Questions About Side-Impact Air Bags (SABs), April 15, 2005. *National Child Passenger Safety Certification Training Student Manual, April 2007 (R01/08)*, pp 253-256.

# Don't Forget!

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Children under the age of 13 are safest sitting in the rear seat properly restrained.



# FYI



- Pregnant women should always wear their seat belts.
- They should sit as far back as possible from the air bag with the lap portion of the belt correctly positioned over the hips (not the stomach) and the shoulder portion across the chest.

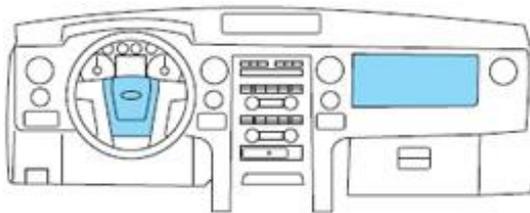


# When In Doubt, Check It Out! Read The Manual.



## Seating and Safety Restraints

### AIRBAG SUPPLEMENTAL RESTRAINT SYSTEM (SRS)



The airbag supplemental restraint system is designed to work in conjunction with the safety belts to help protect the driver and front outboard passenger from certain upper body injuries. The term "supplemental restraint" means the airbags are intended as a supplement to the safety belts. Airbags alone cannot protect as well as airbags plus safety belts in impacts for which the airbags are designed to deploy, and airbags do not offer any protection in crashes for which they do not deploy.

The airbag supplemental restraint system consists of:

- driver and passenger dual stage airbag modules (which include the inflators and airbags).
- side airbags and Safety Canopy®. Refer to *Seat-mounted side airbag system* and *Safety Canopy® system* later in this chapter.
- one or more impact and safing sensors.
- the same indicator light, RCM (restraints control module) and diagnostic unit used for the Personal safety system.
- Front passenger sensing system
- Passenger airbag off indicator light.

The airbag supplemental restraints are an integral part of the Personal Safety System. They are designed to be deployed in cases where the Personal Safety System has determined the occupant conditions and crash severity are appropriate to activate these devices. Refer to the *Personal Safety System™* section in this chapter.

200

## Seating and Safety Restraints

### Important SRS precautions

The SRS is designed to work with the safety belt to help protect the driver and right front passenger from certain upper body injuries. Airbags DO NOT inflate slowly; there is a risk of injury from a deploying airbag.



**⚠ WARNING:** All occupants of the vehicle, including the driver, should always properly wear their safety belts, even when an air bag supplemental restraint system (SRS) is provided.

**⚠ WARNING:** When possible, all children 12 years old and under should be properly restrained in a rear seating position.

**⚠ WARNING:** The National Highway Traffic Safety Administration (NHTSA) recommends a minimum distance of at least 10 inches (25 cm) between an occupant's chest and the driver airbag module.

**⚠ WARNING:** Never place your arm over the airbag module as a deploying airbag can result in serious arm fractures or other injuries.

To properly position yourself away from the airbag:

- Move your seat to the rear as far as you can while still reaching the pedals comfortably.
- Recline the seat slightly one or two degrees from the upright position.

**⚠ WARNING:** Do not put anything on or over the airbag module. Placing objects on or over the airbag inflation area may cause those objects to be propelled by the airbag into your face and torso causing serious injury.

201

Source: 2012 Ford F150 Owner's Manual.

Take the Quiz:

<http://cpsboard.org/quiz-test-2/>