



# The Safety Corner

## From the Marine Corps Center for Lessons Learned October 12, 2007



### Vehicle Rollovers

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This issue of the Safety Corner highlights lessons and observations about the prevention of vehicle rollovers and mishaps during operations in the War on Terror.

**From the Director:** This Marine Corps Center for Lessons Learned (MCCLL) Safety Corner was sparked by a period in August - September 2007 when 11 Coalition Force members died as a result of five vehicle rollovers. Most rollovers result from the vehicle leaving the roadway. While unfortunate and often tragic as these rollovers have been, many could have been prevented. Investigations have determined that aggressive driving, lack of situational awareness, improvised vehicle configuration, unsecured loads, and fatigue continue to be the main causes.

The rollover problem may seem difficult to eliminate entirely given the road conditions in theater and in our training areas, but our Marines and Sailors must take every precaution possible to help reduce the chance of a rollover. Remember, any vehicle will rollover under the right circumstances.

You are encouraged to pass on and post this Safety Corner for the widest dissemination. Log on to [www.mccll.usmc.mil](http://www.mccll.usmc.mil) to download previous editions of the Marine Corps Center for Lessons Learned Safety Corner as well as our Monthly Newsletters. I look forward to getting your comments and feedback so we can raise awareness, reduce risk and maintain a high level of readiness. I sincerely welcome your comments, observations, and concerns.

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- 13 Aug (OFFC/NMCB 5) During unit movement, vehicle rolled over causing severe injury.
- 15 Aug (5th Bn 11<sup>th</sup> Mar) HIMAR vehicle rolled over and landed downhill.
- 10 Sep (2CBT) 7 soldiers died of injuries from a vehicle rollover.
- 21 Sep (IIMEF/1<sup>st</sup> FAST CO) LCpl was returning from convoy training when his HMMWV rolled over.
- 20 Sep (II MEF BCT 1/3) Sgt died as a result of a M1151 HMMWV rollover.

#### Did you Know?

The height of a vehicle's center of gravity and the length of the wheelbase determine the vehicle's stability, and improperly secured loads can change a vehicle's center of gravity and its stability.

#### Vehicle Speed

This is probably the most important factor contributing to vehicle instability because it magnifies problems presented by the other three factors (vehicle center of gravity, load security, radius of curves and slope of roadways). As the vehicle's speed increases, the centrifugal, or sideways force increases. Faster speeds also result in decreased driver response times. Speed is the factor over which the driver can exercise the most control.

#### HMMWVs: They're Not Indestructible... Neither Are You

by Capt Brian Dibb  
Ground Warrior, Winter 2005

"We 'always' wear seatbelts, except when we are in a tactical training environment", one NCO stated, following a HMMWV rollover. In another HMMWV rollover, an SNCO said, "My Marines always obey the speed limit, but it doesn't really apply when training on a fire-and-movement range. " Finally, another NCO stated, "I've never seen any of my Marines driving recklessly," following yet another HMMWV rollover. (continued)



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### HMMWVs: They're Not Indestructible... Neither Are You (continued)

Many Marines are aware that motor-vehicle mishaps cause most fatalities and property damage. This fact holds true both on and off duty. In the past five years, several HMMWV rollovers have resulted in numerous deaths, dismemberment, and destruction. We will look at three of them.

In the first case, an NCO was returning from the field to garrison to return some mechanics to the motor pool. The driver seemed to believe that General Motors had built a vehicle that was "un-rollable." As he set out to prove himself correct, he destroyed a HMMWV A2, gave his A-driver an avulsion from his wrist to his elbow, and has to live with brain damage for the rest of his life. He tried to fishtail the vehicle while accelerating down a sloping dirt road. The speed of the vehicle still is unknown, but, when the driver's side rear wheel caught a ditch, the vehicle slid sideways and went airborne for more than 50 feet. As it corkscrewed through the air, both he and his A-driver were ejected. Only the two mechanics in the back seat had the sense to buckle their seatbelts. When the vehicle landed, one mechanic got out, kissed the ground, and went to his comrades to start first aid.

In the second case, a CAAT platoon was conducting a rehearsal for a fire-and-movement exercise on a range. One of the SNCOs was not happy with the slow pace and directed the Marines to pick up their pace. While retrograding from a forward firing position to a rear one, the HMMWV attempted a 110-degree turn into the position. The driver lost control in the turn, and the vehicle slid. At one point, it was sliding almost broadside down the road. When the vehicle left the road, the tires dug into soft sand and "bit," resulting in a slow roll. It came to rest on its roof, killing the .50-caliber gunner who was in the turret. The driver was exceeding the speed limit for a gravel road. He was relatively new, with limited experience on unimproved roads.

Finally, a corporal of the guard decided to drive the duty HMMWV while making rounds. This mishap also occurred on a dirt/gravel road. An investigation found he was driving well over the speed limit, he wasn't licensed, and no one in the vehicle had worn seatbelts. The HMMWV was destroyed, one Marine killed, and the rest injured after they were ejected.

These three mishaps have several commonalities; the first is that they all involve HMMWVs. Despite the fact these vehicles have a relatively low center of gravity, they can and do rollover. Second, all of the vehicles were on unimproved roads. Drivers must understand that tires grip sand and gravel about half as well as asphalt or concrete. Marines from the north know what snow does to their brakes, and those of us from the south know what hitting a puddle and hydroplaning is like. Sand and loose gravel are nearly the same. Directly related to this point is the third factor: less space speed. All the drivers were well above both the established speed limit and safe speed of the road or training area. It's clear that, in two of these mishaps, the drivers were hot-dogging, horse playing, or whatever you want to call it. Tactical vehicles are not your personal recreational vehicles.

The speed limit in training areas on Marine Corps bases is 25mph. Vehicle commanders need to brief vehicle speeds and other safety-control measures whenever conducting movements, whether in combat or administrative moves along base hard-ball roads. When a driver exceeds the speed limit, he or she places the occupants, vehicle and careers on the line. Fourth, seatbelts played a part in who walked away and who didn't. If a vehicle rolls and an occupant is not restrained, he or she most likely will be ejected. We had one driver nearly killed, and an occupant walked away unscathed from the same mishap. In the case of HMMWVs with turrets, leaders carefully must plan and brief safety considerations. Drivers absolutely must obey the speed limit and take extra precautions to prevent collisions or rollovers. A gunner in a turret doesn't have a chance when the vehicle lands on top of him. Finally, two of the drivers in these mishaps were incidental drivers; one was not licensed at all. Leaders must account for lack of experience of drivers when planning and executing training.

### Risk Management Control Measures

Every driver can take eight basic steps to prevent or reduce the potential for rollovers.

1. Adjust the vehicle speed to allow a "Speed Cushion" for maneuvering (at least 10 MPH below the posted speed limit is recommended when approaching a curve).
2. Slow down and brake or downshift early. Do not shift in the curve.
3. Observe speed limit and check speedometer to ensure your vehicle is below the posted speed.
4. Do not rely on a "seat of the pants" sense to judge speed and vehicle maneuverability. New suspensions and chassis set-ups give a false sense of control. (continued)



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### Risk Management Control Measures (continued)

5. Slowly accelerate out of the curve.
6. Maintain a "Space Cushion" (distance between your vehicle and other traffic) so there is a safe maneuvering speed to compensate for errors in judgment, weather, road conditions, and poor driving by other motorists.
7. Avoid the temptation to brake hard if the rear of the vehicle or trailer "slides out". Instead, if there is clearance, attempt to apply steady throttle, allowing the vehicle to straighten itself. Braking will accelerate the skid, contributing to loss of control and rollover.
8. Risk Management Procedures. Personnel are required to wear seatbelts. All Marines should follow unit standard operating procedures/tactical standard operating procedures and be in proper uniform when operating or riding as a passenger in military vehicles. All personnel must wear the Kevlar helmet and flak jacket while riding/driving in a tactical vehicle.

### Rollover Actions

- The driver and passengers MUST wear seat belts (if equipped). The operator is responsible for ensuring all personnel, riding in or on a vehicle, wear seatbelts (if equipped) and all required equipment inside the vehicle is properly stowed and secured.
- The operator must ensure all personnel are checked for injuries and injured personnel are given emergency first aid as needed if a rollover happens.
- All sensitive items are to be secured, and the accident reported immediately.
- The first Marine to notice the vehicle is beginning to rollover should shout "ROLLOVER!"

### When rollover is imminent, the driver performs the following:

1. Release the accelerator.
2. Keep hands on the steering wheel with extended but not locked arms, tuck head and chin into chest and brace for an impact.
3. Yell "ROLLOVER!"

### When the rollover is imminent, the passenger(s) performs the following:

1. Tuck head and chin into chest and brace for impact.
2. Plant feet firmly on the floor while holding onto a stationary object.
3. Yell "ROLLOVER!"



### Post-Rollover Actions

Driver performs the following actions when the vehicle is stabilized:

- |   |  |
|---|--|
| 1. Shut down the engine                                 | 2. Check for injuries                        |
| 3. Identify an evacuation route                         | 4. Retrieve fire extinguisher                |
| 5. Exit the vehicle                                     | 6. Check for fire and fuel leaks or spills   |
| 7. Attempt to contain fire and or fuel leaks and spills | 8. Account for occupants and sensitive items |
| 9. Seek medical attention, as needed                    | 10. Radio for help                           |

Passenger(s) perform the following actions when the vehicle is stabilized:

1. Check for injuries
2. Exit the vehicle
3. Account for personnel and sensitive items
4. Seek medical attention, as required
5. Assist the driver

**WARNING:** Never attempt to leap from a rolling vehicle. It may rollover you. Ensure the vehicle has stopped its rolling before moving. Upon complete evacuation of all personnel, the vehicle should be inspected for fire hazards such as leaking oil, fuel, and hydraulic fluid. Use the portable fire extinguisher when inspecting vehicle for leaks in case of fire, which could cause injury or death. If hazardous/explosive materials are involved, driver should take actions according to the DD Form 836 accompanying load. Notify emergency response personnel and remain at evacuation distance while securing the accident site.





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## Water Egress HMMWV Uparmored Rollover Task and Performance Measures

Combat door locks on the M1114 uparmored HMMWV are designed to keep the enemy out. When they are locked, it is extremely difficult for rescuers to enter the vehicle! This problem may be compounded if damage occurs to the door as a result of an accident. Commanders should determine when combat locks should be used while conducting operations near bodies of water.

### Preventive Measures

Always wear your seat belt to survive water entry and maintain orientation during a rollover.

### When in the vicinity of water and tactical conditions permit:

1. Reduce speed and bring vehicle to a halt.
2. Inform vehicle crew that you are operating around water hazards.
3. Assess terrain and route for hazards and discuss risk mitigating measures with crew before proceeding.
4. Unlock combat door locks.



## Water Egress Drill Task Steps and Performance Measures When Water Entry is Imminent:

### A. Driver

- (1) Releases the accelerator and controls the entry by steering into the body of water.
- (2) Yells "WATER!"
- (3) Keep hands on the steering wheel with extended but not locked arms, tucks head and chin into chest and braces for impact.

### B. Gunner

- (1) Yells "WATER!"
- (2) Pushes / pulls self down into vehicle.
- (3) Tucks head and chin into chest and holding onto a stationary object, braces for impact.

### C. All other crew

- (1) Yells "WATER!"
- (2) Pulls the gunner into the cab.
- (3) Tucks head and chin into chest and braces for impact.
- (4) Plants feet firmly on the floor while holding onto a stationary object.



## Safety Tips

**Slow Down - Watch Sharp Curves and Steep Slopes -** Curves and slopes generate centrifugal forces that act sideways on the vehicle, increasing the chance of rollover.

**Avoid panic - don't jerk the steering wheel:** Many rollovers occur when the driver panics / jerks the steering wheel during an emergency. At highway speed, jerking the steering wheel can cause loss of control, and the vehicle may slide sideways and rollover.

**Know proper maneuvering:** If you drive off the roadway, gradually reduce speed. Ease your vehicle back onto the roadway at a safe speed.

**Use caution on rural roads/roads with soft or no shoulders:** When a vehicle goes off a road, the vehicle can overturn when it strikes a ditch or embankment, or is tripped by soft soil.

**Pay attention to vehicle condition, tire pressure and loading:** Pay particular attention to tire condition and air pressure during PMCS to reduce potential hazards. Worn / improperly inflated tires increase your risk of rollover. Don't overload the vehicle. The M1114 payload is 2300 lbs. This includes the passengers, winch, gunners protection kit, spare tire, weapons, and all cargo!

## Keep the Vehicle Center of Gravity Low

**Load heavier items low in the vehicle:** Increasing the height of the vehicle's center of gravity increases your risk of rollover.

**Secure the Load:** Improperly secured loads can shift and increase the chance of rollover - and become hazards inside the vehicle during a rollover.

**Trailer Towing:** Vehicles towing trailers are much more prone to rollover, especially in curves and during sudden steering maneuvers, as a result of the exaggerated motion of the trailer.



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"Being ready is not what matters. What matters is winning after you get there." Lt General Victor H. Krulak, USMC

### Navy and Marine Corps Non-Battle Fatalities to Date

